

# **Regional Water Study**

**Blackfalds – Lacombe – Ponoka –  
Montana – Samson – Ermineskin –  
Louis Bull**

Prepared for

**The Communities of Blackfalds, Lacombe, and Ponoka**

**The First Nations of Montana, Samson, Ermineskin, and  
Louis Bull**

Prepared by

**UMA Engineering Ltd.**

**17007 - 107 Avenue**

**Edmonton Alberta T5S 1G3**

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## 1.0 Executive Summary

- The community of Blackfalds, Lacombe, and Ponoka, as well as the First Nations of Montana, Samson, Ermineskin, and Louis Bull are experiencing or expect to be experiencing problems with the quantity and quality of the water available to them from their water supply systems. All of these communities currently rely on water wells.
- This study assesses the feasibility of a Regional Water System for the Towns of Blackfalds, Lacombe, and Ponoka and also considers the possible participation of the Hobbema First Nations in this Regional System.
- Other potential users may be interested in the future. An allowance of ten percent of the non-industrial water demand by Blackfalds, Lacombe, and Ponoka, has been included in the pipeline, for possible future other users.
- The report details forecasted population and water demand growths. The average day water demand for the three Towns increases over 50 years by a factor of 3.3. For the same period, the forecasted average day water demand for the First Nations increases by a factor of 6.5. This is due to the higher forecasted population growth for the First Nations but even more so due to their expected higher urbanization rate.
- The pipeline has been designed for flows equal to 1.5 times average day flows, and for a design horizon of 50 years. Higher than 1.5 peak day demands in the communities should be addressed by local reservoirs (in the communities).
- The source of the water would be the City of Red Deer water system, or a river intake upstream of the City of Red Deer's Wastewater Treatment Plant, with a water treatment plant.
- The water treatment plant should be designed for a design horizon of 20 years.

- Applying for and obtaining a licence to withdraw water from the Red Deer River is expected to be time consuming and complex, due to existing water commitments on the Red Deer River, the need to take into account (as yet undefined) “In-Stream Flow Needs”, and the fact that the proposed Regional System would entail inter-basin water transfer by withdrawing water from the Red Deer River and discharging most of the wastewater into the Battle River System.
- According to the City of Red Deer’s Water Treatment Master Plan (2001), there is a perceived deterioration in the Red Deer River water quality, particularly with respect to organics and waterborne pathogens.
- A water treatment plant is to meet or exceed the Alberta Environmental Standards and Guidelines (1996 Revision). A conventional plant would include rapid mixing of chemicals, hydraulic flocculators, horizontal flow type sedimentation, filtration and disinfection.
- Future predesign of a water treatment plant should also include sampling and analyzing of raw water, and confirm the levels of Cryptosporidium. Alternate technologies such as membrane filters, ozonation, or UV radiation might then have to be considered.
- Storage of raw river water is not thought to be required initially. However, the purchase of land for the possible future addition of such storage is recommended.
- Several pipeline alignments have been considered. Two pipeline alignments are recommended; one (green) connection to the City of Red Deer, the other (green/red) to an intake upstream of the City of Red Deer’s Wastewater Treatment Plant. These alignments follow adjacent to Highway 2A and offer the most flexibility for connection to the City of Red Deer and the regional customers.
- Recommended pipeline material is PVC pipe, mostly C905, of different DRs (Dimension Ratios). Alternate pipe materials for river crossings should be considered during predesign.
- Pipeline sizes are:
  - 300 mm, 500 mm, 600 mm in the case of the three Towns only; and

- 250 mm, 350 mm, 400 mm, 450 mm, 500 mm, 600 mm in the case of the three Towns and the First Nations.
- The pipeline will be equipped with a SCADA system, for operation and control (Supervisory Control and Data Acquisition System).
- Pipeline easements of the following widths will be required:
  - Permanent Easement: 10 m
  - Working Easement: 15 m
- Pipeline booster stations will not be required until after year 20, at the earliest.
- The Red Deer Regional Water Pipeline will be classified as a major pipeline and specific testing, reporting and approvals will be required in respect to topsoil handling, restoration, and inspections by Alberta Environment and Alberta Agriculture.
- Table 1-1 summarizes the capital costs as well as the operational and maintenance costs, and the cost of water per m<sup>3</sup> supplied to each community reservoir. Two alternates are being considered, i.e. the green alternate, connecting to the City of Red Deer and the green/red alternate, with a river intake upstream of the City of Red Deer's Wastewater Treatment Plant.

Various cost sharing possibilities are shown.

- Table 1-2 summarizes the “utility” or “rate base” method of cost calculations completed by Campbell Ryder Consulting Group Ltd. This method differs from the “cash” method since it addresses the gross and net values of utility assets and capitalization, service life of utility plant (up to 50 years for pipeline and structures) and sources of capital funding and capital structure.

The complete Campbell Ryder Consulting Group Ltd. Rate Review and Analysis is included in Appendix A.

**Table 1-1: Regional Water Study – Cost Summary**

	Alternate Green				Alternate Green/Red			
	Towns Only		Towns and First Nations		Towns Only		Towns and First Nations	
	Equal	Common Parts Sharing	Oversizing by INAC	Common Parts Sharing	Equal	Common Parts Sharing	Oversizing by INAC	Common Parts Sharing
Blackfalds								
Capital Cost	\$2,175,568	\$464,199	\$2,175,568	\$351,050	\$4,873,031	\$3,161,661	\$4,873,031	\$3,083,023
Capital Cost After Grant	\$1,292,287	\$275,734	\$1,292,287	\$207,400	\$2,894,580	\$1,878,026	\$2,894,580	\$1,831,316
Cost/m <sup>3</sup> (¢/m <sup>3</sup> )	Year 0: 85.6 Year 20: 70.1	Year 0: 63.8 Year 20: 60.5	Year 0: 85.6 Year 20: 70.1	Year 0: 63.4 Year 20: 61.1	Year 0: 93.6 Year 20: 45.3	Year 0: 69.0 Year 20: 38.0	Year 0: 89.6 Year 20: 44.5	Year 0: 64.7 Year 20: 37.1
Lacombe								
Capital Cost	\$7,999,193	\$6,056,925	\$7,999,193	\$4,976,389	\$17,917,301	\$15,975,034	\$17,917,301	\$14,618,983
Capital Cost After Grant	\$4,751,521	\$3,597,813	\$4,751,521	\$2,940,051	\$10,642,877	\$9,489,170	\$10,642,877	\$8,683,676
Cost/m <sup>3</sup> (¢/m <sup>3</sup> )	Year 0: 85.6 Year 20: 70.1	Year 0: 84.6 Year 20: 66.6	Year 0: 85.6 Year 20: 70.1	Year 0: 70.3 Year 20: 67.2	Year 0: 93.6 Year 20: 45.3	Year 0: 1.10 Year 20: 90.0	Year 0: 89.6 Year 20: 44.5	Year 0: 99.1 Year 20: 37.7
Ponoka								
Capital Cost	\$3,090,899	\$6,744,535	\$3,090,899	\$5,219,626	\$6,923,269	\$10,526,905	\$6,923,269	\$8,570,043
Capital Cost After Grant	\$1,835,994	\$4,006,254	\$1,835,994	\$3,083,755	\$4,112,422	\$6,282,682	\$4,112,422	\$5,090,606
Cost/m <sup>3</sup> (¢/m <sup>3</sup> )	Year 0: 85.6 Year 20: 70.1	Year 0: 97.6 Year 20: 87.1	Year 0: 85.6 Year 20: 70.1	Year 0: 88.6 Year 20: 80.4	Year 0: 93.6 Year 20: 45.3	Year 0: 85.0 Year 20: 65.0	Year 0: 89.6 Year 20: 44.5	Year 0: 70.1 Year 20: 55.7
First Nations								
Capital Cost	N/A	N/A	\$10,242,819	\$12,961,414	N/A	N/A	\$13,794,919	\$17,236,471
Cost/m <sup>3</sup> (¢/m <sup>3</sup> )	N/A	N/A	Year 0: 58.8 Year 20: 57.6	Year 0: 59.0 Year 20: 57.6	N/A	N/A	Year 0: 39.8 Year 20: 17.9	Year 0: 39.8 Year 20: 17.9
No Capital Debenture Costs								

- NOTE:
- 1) Capital costs after grant for Towns are based on an average 40.60% grants.
  - 2) No allowance is made for capital reserve funds or return on equity for the pipeline, water treatment plant and other major components of the system.

Regional Water Study  
 The Communities of Blackfalds, Lacombe, and Ponoka  
 The First Nations of Montana, Samson, Ermineskin, and Louis Bull

**Table 1-2: Summary of Costs – Utility/Rate Base Method**

	<b>Year 1</b> <b>\$/m<sup>3</sup></b>	<b>Year 2</b> <b>\$/m<sup>3</sup></b>	<b>Year 3</b> <b>\$/m<sup>3</sup></b>	<b>Year 4</b> <b>\$/m<sup>3</sup></b>	<b>Year 5</b> <b>\$/m<sup>3</sup></b>	<b>Year 6</b> <b>\$/m<sup>3</sup></b>	<b>Year 7</b> <b>\$/m<sup>3</sup></b>	<b>Year 8</b> <b>\$/m<sup>3</sup></b>	<b>Year 9</b> <b>\$/m<sup>3</sup></b>	<b>Year 10</b> <b>\$/m<sup>3</sup></b>
Option 1 – Base Case/Green Alternate/City of Red Deer Supply	0.788	0.758	0.734	0.728	0.723	0.717	0.713	0.708	0.702	0.696
Option 2 – Water Treatment Plant/Green/Red Alternate	0.813	0.726	0.657	0.641	0.626	0.612	0.600	0.589	0.572	0.558
Option 3 – Base Case + First Nations/Green Alternate/City of Red Deer Supply	0.754	0.732	0.714	0.707	0.701	0.696	0.690	0.686	0.681	0.676
Option 4 – Water Treatment Plant + First Nations/Green/Red Alternate	0.693	0.627	0.572	0.552	0.532	0.518	0.504	0.492	0.478	0.466

## 2.0 Introduction and Background

The Communities of Blackfalds, Lacombe, and Ponoka, and the First Nations of Montana, Samson, Ermineskin, and Louis Bull are reviewing the quantity and quality of the water available to them from their water supply systems. All of these communities currently rely on water wells and there are concerns about the long availability of water.

Blackfalds has three active wells. Two wells are high in H<sub>2</sub>S and fluoride. The other wells water is low in fluoride but harder. Currently, mixing of the water is carried out to attempt to meet Canadian Drinking Water Standards for fluoride.

**Blackfalds**

The Town's Master Plan indicates that *"no additional available wells have been identified that can be added economically to the supply system beyond 4,700 people"*.

Lacombe has seven active wells plus two wells at the college. A groundwater investigation and well drilling program is currently underway. It had been estimated that the aquifer in Lacombe is capable of supporting a population of 12,000. This does indicate that planning for new water sources is required. Recent developments, with the potential for food processing plants (with high water demands) being established in Lacombe in the very near future, make the need for new water sources all the more urgent.

**Lacombe**

Ponoka has eight active wells. Four wells serve the Central Treatment Plant, and the other four wells serve the Lucas Heights Treatment Plant. Treatments consist of aeration and manganese greensand filtration, as well as, in the case of the Lucas Heights Treatment Plant, lime softening and recarbonation. The water production rate from the water treatment plants does not satisfy current peak day consumption. There is an immediate need for either increased treated water storage or increased treatment capacity. There is also a need to review future water demands and water sources.

**Ponoka**

Ermineskin has been experiencing shortages of water due to biofouling of some wells. Hauling of water has been necessary. In addition, expected population increases as well as increasing water demands per capita make it necessary to look at other potential sources of water.

**Ermineskin and  
Other First  
Nations**

### 3.0 Potential Regional Water System Users

Users of the Regional Water System will include:

- all the users within the Town Limits of Blackfalds, Lacombe, and Ponoka, including residential, commercial, and industrial users;
- all the users within the reserves of the First Nations of Montana, Samson, Ermineskin, and Louis Bull, including urban users and rural users. Urban users will obtain water through piped systems, rural users through trucking or via trickle feed systems;
- other potential users might be: interested parties in the Counties of Red Deer, Lacombe, and Ponoka. The Counties expressed some interest in a Regional Water System, the County of Red Deer more than others. Potential future users may include:
  - County of Red Deer
    - Burnt Lake Business Park
    - Central Park Area between Highways 2 and 2A (includes IPSCO)
    - Blindman Industrial Area and Norm Chiles Industrial Area east of Highway 2A
  - County of Lacombe
    - Morningside, residential, current population 109
    - Milton Residential Area northeast of Lacombe
    - County Residential: Greystones Subdivision northeast of Blackfalds and planned between C&E Trail and Highway 2A
    - County Residential: planned on east side of Lacombe Lake and on Johnson property between C&E Trail and Highway 2A
    - Burbank Area Residential
    - Burbank Area Industrial
  - County of Ponoka
    - Intensive livestock operations north of Ponoka
    - Morning Meadows Subdivision west of Highway 2

**Potential Future  
Users**

- NOTE: the County was interested in a Regional System in 1996, when Epcor (Aqualta) was looking at supplying water to the City and County of Wetaskiwin, Millet, Town and County of Ponoka, County of Leduc, and County of Camrose. At the time, Maple Leaf Meats were considering a possible plant in Ponoka County, with a water requirement larger than the whole flow of the Battle River.

For purposes of this study, the following users have been taken into account:

- Blackfalds,
- Lacombe,
- Ponoka,
- Other users:
  - an allowance of 10% of the total non-industrial water demand of Blackfalds, Lacombe, and Ponoka together, to represent other users,
- Montana,
- Samson,
- Ermineskin, and
- Louis Bull.

## 4.0 Population and Water Usage Projections

### 4.1 POPULATION PROJECTIONS

#### ***Blackfalds***

Population 2001: 3,300 people  
Growth 2001-2004: 4,300 people  
Assumed Growth thereafter: 2.35% (for 51 years). This growth rate is in accordance with Blackfalds' Master Plan (May 2000).

#### ***Lacombe***

Population 2001: 9,232 people  
Growth 2001-2004: 12,232 people  
Assumed Growth thereafter: 3% until 2010 and 1.5% (for 41 years)

#### ***Ponoka***

Population Fall 1996: 6,149  
Estimated Population Fall 2000: 6,703  
Assumed Growth thereafter: 1.5% (for 51 years)

#### ***Montana***

Population On-reserve 2001: 564, of which 102 urban and 462 rural  
Assumed Growth thereafter: 3% (for 50 years)

#### ***Samson***

Population On-reserve 2001: 4,845, of which an estimated 1,453 urban and 3,392 rural  
Assumed Growth thereafter: 3% (for 50 years)

***Ermineskin***

Population On-reserve 2001: 2,282, of which an estimated 500 urban and 1,782 rural  
 Assumed Growth thereafter: 3% (for 50 years)

***Louis Bull***

Population On-reserve 2001: 1,201, of which an estimated 673 urban and 528 rural  
 Assumed Growth thereafter: 3% (for 50 years)

NOTE: For the First Nations, it is assumed that 80% of all population growth will be located in an urban area, with the balance in a rural area. This is in accordance with the Samson First Nation official policy.

**First Nations 80%  
 of Population  
 Growth Assumed  
 in Urban Areas**

Table 4-1 below summarizes the population projections used in this study.

**Table 4-1: Population Projections**

	<b>Year 0 2001</b>		<b>Year 10 2011</b>		<b>Year 20 2021</b>		<b>Year 50 2051</b>	
	<b>Urban</b>	<b>Rural</b>	<b>Urban</b>	<b>Rural</b>	<b>Urban</b>	<b>Rural</b>	<b>Urban</b>	<b>Rural</b>
Blackfalds	3,300		5,059		6,382		12,811	
Lacombe	9,232		14,825		17,205		26,892	
Ponoka	6,703		7,779		9,028		14,110	
Montana	102	462	257	501	466	553	1,629	844
Samson	1,453	3,392	2,786	3,725	4,577	4,174	14,569	6,671
Ermineskin	500	1,782	1,128	1,939	1,972	2,150	6,678	3,326
Louis Bull	673	528	1,003	611	1,447	722	3,924	1,341
	21,963	6,164	32,837	6,776	41,077	7,599	80,613	12,182
	<b>28,127</b>		<b>39,613</b>		<b>48,676</b>		<b>92,795</b>	

**4.2 WATER DEMAND PROJECTIONS**

For the Towns of Blackfalds, Ponoka, and Lacombe, a total demand per capita per day of 370 Lpcpd has been used in this study.

As a correction to the above, an allowance for industrial water demand has been added for the Town of Lacombe.

For the First Nations of Montana, Samson, Ermineskin, and Louis Bull, a total demand per capita per day of 370 Lpcpd has been used for the urban part of the reserves; for the rural areas, a total demand per capita per day of 180 Lpcpd has been used. It is assumed that the rural areas will be served through trucking or through a trickle feed system from the central reservoir.

Based on the populations shown in Section 4.1, the average day water demand evolution is as shown in Table 4-2.

**Table 4-2: Evolution of Average Day Water Demands (L/s)**

	<b>Year 0 2001</b>	<b>Year 10 2011</b>	<b>Year 20 2021</b>	<b>Year 50 2051</b>
Blackfalds	14.1	21.7	27.3	54.9
Lacombe	39.5	63.5	73.7	115.2
Lacombe Industrial	0.0	40.0	40.0	40.0
Ponoka	28.7	33.3	38.7	60.4
Montana	0.9	2.1	3.2	7.4
Samson	9.6	19.7	28.3	65.2
Ermineskin	4.5	8.8	12.9	30.3
Louis Bull	3.5	5.6	7.7	16.9
<b>TOTAL</b>	<b>100.8</b>	<b>194.7</b>	<b>231.8</b>	<b>390.3</b>

Please note that, in Table 4-2, the water demands for the initial year 2001, for the First Nations, have been based on 370 Lpcpd for the urban population and 90 Lpcpd for the rural population. For later years, the rural water demand was increased to 180 Lpcpd.

Please also note the allowance of 40 L/s (or 3,456 m<sup>3</sup>/day) for Lacombe’s Industrial Area. This quantity is subject to further review and is based on a graduated demand, i.e. 15 L/s – 2004, 20 L/s – 2006, 40 L/s – 2011.

For the design of the pipeline, users other than the above are also taken into account; these are the other potential users discussed in Section 3.0. For this study, it has been assumed that their demand is spread along the pipeline and equals 10% of the demands of Blackfalds, Ponoka, and Lacombe, excluding the industrial demand in Lacombe.

Table 4-3 shows the evolution of the average day demand, including other demands.

**Table 4-3: Evolution of Average Day Demands, Including Other Demands (L/s)**

	<b>Year 0 2001</b>	<b>Year 10 2011</b>	<b>Year 20 2021</b>	<b>Year 50 2051</b>
Blackfalds	14.1	21.7	27.3	54.9
Lacombe	39.5	63.5	73.7	115.2
Lacombe Industrial	0.0	40.0	40.0	40.0
Ponoka	28.7	33.3	38.7	60.4
Allowance for Other Demands	8.2	11.9	14.0	23.1
Montana	0.9	2.1	3.2	7.4
Samson	9.6	19.7	28.3	65.2
Ermineskin	4.5	8.8	12.9	30.3
Louis Bull	3.5	5.6	7.7	16.9
<b>TOTAL</b>	<b>109.0</b>	<b>206.6</b>	<b>245.8</b>	<b>413.4</b>

It is further recommended that the pipeline be designed for flows equal to 1.5 times the average day demands.

Peak day demands in the various communities may well exceed 1.5 times the average demands (for example, in Lacombe, the peak day factor is approximately 1.6). It is the intent that sufficient storage be provided in each community to be able to supply the difference between the actual peak day demand and the amount supplied by the pipeline, i.e. 1.5 times average day.

It should be noted that the above does not apply to the industrial demand in Lacombe. The maximum day for this demand is estimated at 40.0 L/s and will be provided by the pipeline.

Table 4-4 shows the evolution of the design flows (based on 1.5 times average day demands) of the pipeline.

**Table 4-4: Pipeline Design Flows (L/s) (1.5 Times Average Day)**

	<b>Year 0 2001</b>	<b>Year 10 2011</b>	<b>Year 20 2021</b>	<b>Year 50 2051</b>
Blackfalds	21.2	32.6	41.0	82.4
Lacombe	59.3	95.3	110.6	172.8
Lacombe Industrial	0.0	40.0	40.0	40.0
Ponoka	43.1	50.0	58.1	90.6
Allowance for Other Demands	12.3	17.9	21.0	34.7
Montana	1.4	3.2	4.8	11.1
Samson	14.4	29.6	42.5	97.8
Ermineskin	6.8	13.2	19.4	45.5
Louis Bull	5.3	8.4	11.6	25.4
<b>TOTAL</b>	<b>163.8</b>	<b>290.2</b>	<b>349.0</b>	<b>600.3</b>

## 5.0 Philosophy for Sizing and Upgrading of Major System Components

### 5.1 SYSTEM COMPONENTS

The major system components are:

- Red Deer River Water Intake (if any),
- Low Lift Station (to pump from river intake to water treatment plant),
- Water Treatment Plant (if any),
- High Lift Station (if any),
- Pipeline, and
- Booster Stations.

### 5.2 PHILOSOPHY FOR SIZING AND UPGRADING OF COMPONENTS

For the river intake and low lift station structure, at the river, a design horizon of 50 years is selected. The reason for this is that a large proportion of the cost is fixed, and related to the difficult construction in the river and the deep excavation adjacent to the river for the low lift station.

**50 Year Design  
Horizon for River  
Intake and Low  
Lift Station  
Structure**

Pumps inside the low lift station would be sized for the 10 year horizon. To meet the 20 year horizon, impellers and motors would be changed. To meet the 50 year horizon, larger pumps and motors would be installed.

The water treatment plant would be sized for 20 years, on an area of land large enough to accommodate an expanded plant (for the 50 year horizon). The 50 year horizon would be met by expanding the plant.

**20 Year Design  
Horizon for WTP**

The high lift station, usually located inside the water treatment plant, would be designed such that it has adequate space for 20 years. The initial high lift pumps would be designed for the 10 year horizon, and upgraded through larger impellers and motors for the 20 year horizon. The 50 year horizon would be met through expansion of the high lift station.

For the pipeline, a design horizon of 50 years has been selected. It should be noted that the evolution over 50 years of the average day water demand is very different for the three Towns than for the four First Nations. The average day water demand for the three Towns (Table 4-2) increases from 82.3 L/s to 270.5 L/s, a factor of 3.3. Over the same period, the water demand for the First Nations is shown to increase from 18.5 L/s to 119.80 L/s, a factor of 6.5. To design a pipeline for an increase in flow as high as 6.5 is very unusual. Therefore, consideration could be given to designing the portion of the pipeline from Ponoka to Ermineskin for a 20 year design period only (during which period First Nation demand would increase from 18.5 L/s to 52.1 L/s, a factor of 2.8), and to turn this portion of the pipeline in the future, if and when the flows exceed the design flows. Such an approach would lead to lower initial pipeline costs for the First Nations.

For purposes of this study, however, a 50 year design horizon for the total length of the pipeline, for the 50 year pipeline design flows as shown in Table 4-4, has been adopted.

The system also contains a booster station to make the water move through the pipeline. As will be seen later, such a booster station would be required at Ponoka after year 20, to move the water to the First Nations.

Table 5-1 summarizes the sizing philosophy for the major system components.

**Table 5-1: Basis of Sizing of Major System Components**

<b>System Component</b>	<b>Design Horizon</b>
River Intake and Low Lift Station at River: Structures	50 years
Pumps in Low Lift Station	10 years
- to meet 20 Year Horizon: Larger Impellers and Motors	
- to meet 50 Year Horizon: Change Pumps and Motors	
Water Treatment Plant to meet 50 Year Horizon: Expand Plant	20 years
High Lift Pump Station	10 years
- to meet 20 Year Horizon: Larger Impellers and Motors	
- to meet 50 Year Horizon: Change Pumps and Motors	
Pipeline	50 years

## 6.0 Water Source Options

### 6.1 CONNECTION TO CITY OF RED DEER

A connection to the Water Distribution System of the City of Red Deer is possible, and is further shown in this study as the “green” alternative. The connection would be at the intersection of Gaetz Avenue (Highway 2A) and Highway 11A. Treated water from the City of Red Deer’s system would enter the pipeline under pressure. It should be noted that, in its rates, the City of Red Deer has assumed a dedicated line, within City Limits, to connect the regional pipeline to the Glendale Reservoir.

UMA had requested the City of Red Deer to advise at what pressures the water can be delivered. Although no official response has been received, for purposes of this study, it is assumed that the water can be supplied at a hydraulic grade of 914.0 m.

Advantages of connecting to the City of Red Deer are as follows:

**Advantages**

- results in a simpler Regional System:
  - no new river intake and low lift station required, and
  - no new water treatment plant and high lift station required;
- minimal staff required to operate Regional System;
- obtaining licence to withdraw water will likely be more straightforward, as City of Red Deer already has an existing licence; and
- existing experienced water treatment plant operators.

Other considerations will be:

- the cost per cubic metre of water to the Regional System.

### 6.2 RED DEER RIVER AND NEW WATER TREATMENT PLANT

The other possibility is building a new river intake on the Red Deer River, with a low lift station to pump the water to a water treatment plant, and to pump the treated water further from the water treatment plant to the regional pipeline.

Some issues related to this option are:

- availability of water in the Red Deer River;
- raw water quality; and
- potential use of existing intakes.

There are no intrinsic advantages to building a new river intake and water treatment plant, other than possibly the final cost per cubic metre of water. This will be reviewed further in Section 17.

### 6.2.1 Availability of Water in the Red Deer River

There is no moratorium on the Red Deer River, and thus the Regional Group can still apply for a licence to withdraw river water.

An application for such a licence will have to include a hydrological assessment of the water source (the Red Deer River) during low flow conditions.

Currently, a study group of Alberta Environment is working on minimum in-stream needs; this minimum is required for the purpose of maintaining water quality, fisheries, the aquatic environment, and recreation needs. No magnitude of the minimum in-stream needs is available at this time.

A report is expected later this year. A representative of Alberta Environment indicated that, on a preliminary basis, for in-stream water needs, a ballpark figure of 16 m<sup>3</sup>/s during winter months and 20-25 m<sup>3</sup>/s during the summer months could be used.

Alberta Environment also advised that the typical minimum flow in the Red Deer River since the Dickson Dam was put into operation is 16 m<sup>3</sup>/s but a few times the flow has dropped to 14 m<sup>3</sup>/s. The water licence for the Dickson Dam does not stipulate a minimum release so theoretically, the dam could turn off the flow completely at the Dickson Dam. Based on flow records at WCS 05CC002/Red Deer River at Red Deer), between 1985 (when the dam was in operation) and 1995 inclusive, the mean minimum flow was 12.8 m<sup>3</sup>/s, which is 20% lower than the 16 m<sup>3</sup>/s indicated by Alberta Environment.

**Related Issues**

**Minimum  
In-Stream Needs**

**Flows from the  
Dickson Dam**

When Alberta Environment reviews an application for a licence, they also look at the historical natural minimum flow. Again, based on the flow records at WSC 05CC002 (Red Deer River at Red Deer), the mean minimum flow was 5.44 m<sup>3</sup>/s between 1913 and 1982 inclusive, and can be taken to be the main minimum natural flow rate that is used by Alberta Environment when they review an application.

**Minimum Natural Flow**

Yearly withdrawals, in m<sup>3</sup>/s, for the Regional System are estimated to be as follows:

**Yearly Withdrawal by the Regional System**

	<b>Blackfalds – Lacombe – Ponoka</b>	<b>First Nations</b>	<b>Total</b>
Year 2001	0.08	0.02	0.10
Year 2011	0.16	0.03	0.19
Year 2021	0.17	0.06	0.23
Year 2051	0.27	0.12	0.39

- No magnitude of the in-stream flow need is available at this time but a report on this is expected sometime this year. In the absence of any better information, it has been suggested that the magnitude of the in-stream flow need is in the order of 16 m<sup>3</sup>/s during the winter months and 20-25 m<sup>3</sup>/s during the summer months. The applicability of the suggested winter in-stream flow need is questionable, as it is close to three times larger than the mean minimum flow (5.44 m<sup>3</sup>/s) before the construction of the Dickson Dam. As the intent with the in-stream flow need is to preserve the natural aquatic conditions, the mean minimum natural flow (5.44 m<sup>3</sup>/s) seems to be more appropriate than the 16 m<sup>3</sup>/s winter months flow suggested by Alberta Environment.
- A Regional Water System may have to consider sufficient raw water storage capacity to cover potential periods during which the release from the Dickson Dam is low.

**Conclusions**

## 6.2.2 Raw Water Quality

The predesign report of the Stettler Water Treatment Plant (1982) notes that:

*“Generally, the Red Deer River is a good quality water source. Water quality parameters affecting water treatment considerations include turbidity, suspended solids, colour, hardness and bacteria/viruses. . . . Conventional water treatment technology is adequate to ensure that the above parameters comply with the Guidelines for Canadian Drinking Water Quality, 1978. This is substantiated by extensive operating experience at three water treatment plants on the Red Deer River.”*

No water sampling was done on the river, but the following information was obtained from the City of Red Deer’s Water Treatment Master Plan (Associated Engineering, February 2001).

- *The raw water is subject to flashy turbidity during spring runoff. Turbidity varies from lows of 1 to 3 NTU in the winter months to 3 to 130 NTU during spring. Turbidity during spring breakup is generally low, with flashy spikes over 100 NTU.*
- *Pathogenic protozoa data are as follows:*

**City of Red Deer:  
Raw Water Quality**

<b>Pathogen</b>	<b>Units</b>	<b>Min. Value</b>	<b>Max. Value</b>	<b>Geometric Mean</b>
<i>Giardia</i>	<i>per 100 L</i>	<i>7</i>	<i>1,400</i>	<i>300</i>
<i>Cryptosporidium</i>	<i>per 100 L</i>	<i>0</i>	<i>4,700</i>	<i>80-180</i>

- *There is a perceived deterioration in the Red Deer River water quality, particularly with respect to organics and waterborne pathogens. Increased activity in the watershed – livestock farming, logging and municipal water discharges are all believed to be contributing to the deteriorating water quality. This situation is not unique to the Red Deer River, and the Alberta Government has a role to play in developing comprehensive watershed management programs that bring all issues to the table. It is important the City becomes more actively involved in watershed management to encourage initiatives that will improve the Red Deer River water quality.*

Any treatment plant will have to consider the levels of Giardia and Cryptosporidium in the raw water.

The current Alberta Environment standards address Giardia, and require a 5.5 log removal/inactivation for the Giardia levels in the raw water, noted above. A conventional treatment plant with chlorine disinfection will be able to achieve this.

The current Alberta Environment standards do not address Cryptosporidium, although the USEPA requires a minimum 2 log removal. Considering the levels of Cryptosporidium in the raw water however, a removal efficiency of 4 log to 6.5 log may be required. This level of removal can not normally be achieved by a conventional treatment plant with chlorine disinfection.

The future predesign of a water treatment plant should thus consider other technologies, such as membrane filters, ozonation or the addition of UV irradiation of filtered water, to achieve the required removal levels of Cryptosporidium.

The City of Red Deer, for its water treatment plant, is planning along these same lines.

### **6.2.3 Existing Intakes: Union Carbide (Dow)**

Consideration was given to the possibility of requesting the shared use of existing water intakes on the Red Deer River.

The only existing intake close enough to Blackfalds and Lacombe to warrant consideration is the one owned by Union Carbide (now a subsidiary of Dow Chemical Company).

Current information on the intake includes the following:

- The intake is located at NW 9-39-26-W4M.
- The licensed withdrawal rate is 3,632 acre feet per year, or 4,480,000 m<sup>3</sup> per year.
- From information obtained from Union Carbide, the capacity of the intake is estimated at some 750 m<sup>3</sup>/hr. (6,570,000 m<sup>3</sup> per year).
- Actual withdrawal in 1999 was 3,548,722 m<sup>3</sup>.

- Union Carbide also indicated that additional capacity may be required should an additional plant be constructed on the site.

Considering that the 10, 20, and 50 year withdrawals required for the Regional System alone, are 6,500,000 m<sup>3</sup>, 7,752,000 m<sup>3</sup>, and 13,037,000 m<sup>3</sup>, sharing the existing Union Carbide intake is not a possibility. This intake is too small.

## 7.0 Pipeline Alignment Options and Preferred Alignment

### 7.1 PIPELINE ALIGNMENT OPTIONS

Several pipeline alignments have been considered during the course of this study, four of which are shown on Figure 7.1. These four alignments can be described as follows:

- A “green” alignment connecting to the City of Red Deer’s distribution system at Highway 2A and Highway 11A, then north and across the Blindman River into Blackfalds, following the railway alignment through Blackfalds and further to the southern edges of Lacombe. Here the alignment turns east, and then north, to pass Lacombe on the east side, until it hits the railway alignment north of Lacombe again. From there the alignment follows the CPR alignment into Ponoka; the alignment is between the CPR and the Battle River going through Ponoka, and further follows the CPR to when it enters the Ermineskin Indian Reserve. **Green Alignment**
- A “blue” alignment starts from a river intake located on the Red Deer River about 1.5 km upstream of the City’s wastewater treatment plant. It then goes northeast through Red Deer County and then north, to cross the Red Deer River at a location about 1.5 km upstream of the Union Carbide water intake. From there, there is a branch-off westward towards Blackfalds, while the main line continues straight north, passing Lacombe just east of the existing lagoons, to meet the CPR north of Lacombe. From there the alignment is the same as for the “green” alignment (above) to the Ermineskin Indian Reserve. **Blue Alignment**
- A “pink” alignment starts from a river intake located about 18 km downstream of the City of Red Deer’s wastewater treatment plant, and about 4 km downstream of the mouth of the Blindman River into the Red Deer River. This alignment is otherwise the same as the “blue” alignment above. **Pink Alignment**

- A “cyan” alignment starts from a river intake located upstream of the City of Red Deer, then going north to the west of the City, through the Burnt Lake area, then following Highway 2 and across the Blindman River, to Highway 597. There the alignment turns east, entering Blackfalds, and, once it hits the CPR alignment, following the same route as the “green” alignment, all the way to the Ermineskin Indian Reserve.
- A “green/red” alignment starts from a river intake immediately upstream of the Red Deer Wastewater Treatment Plant and proceeds on the south side of the Treatment Plant to the Chiles Industrial Area. The alignment then connects to the “green” alignment at Highway 2A and Highway 11A. The alignment is approximately 2.4 km longer than the “green” alignment and would be utilized if the regional water group were to construct their own water treatment plant.

**Cyan Alignment**

**Green/Red Alignment**

Other alignments which had been considered in the study, but which were abandoned, include a river intake just upstream of the mouth of the Blindman River into the Red Deer River. Because of the difficult access to the riverbank in this area, the location close (13 km) to and downstream of the City of Red Deer’s wastewater treatment plant, and the difficulty of building a pipeline through the nearby Burbanks area, these alignments were abandoned.

## **7.2 PREFERRED ALIGNMENTS**

The “green” alignment is the only one directly connecting to the City of Red Deer’s water system. As such, it will need to be compared with the best of the three other alignments, each of which has its own intake and water treatment plant.

The advantages and disadvantages of the three alignments with river intake in this report, not considering cost, are shown in Table 7-1.

**Advantages and Disadvantages**

**Table 7-1: Advantages and Disadvantages of Pipeline Alignments - Pipeline Alignments with River Intake**

	<b>“Blue” Alignment</b>	<b>“Pink” Alignment</b>	<b>“Cyan” Alignment</b>	<b>“Green/Red” Alignment</b>
<b>Advantages</b>	Intake upstream of City’s WWTP	--	Intake upstream of City’s WWTP	Intake upstream of City’s WWTP
	Shorter than Cyan Alignment	Shortest	--	Alignment is close to Town of Blackfalds
	--	Relatively easy access to river	--	Allows option of either connection to City or new water treatment plant
<b>Disadvantages</b>	--	Intake downstream of City’s WWTP	--	
	--	--	Very long, longest Area near river marshy; difficult construction	Construction in industrial and WWTP area will be more difficult and likely higher land costs
	--	--	Burnt Lake area land expensive	

It should also be noted that, for the “pink” alignment, it was thought that the pipeline could be built inside the County’s road right-of-ways. The pipeline would be built inside, but to the side of the road right-of-ways, so as not to interfere with existing roads inside the right-of-ways or possible future widening of these roads. It was thought that land costs could be avoided this way. Lacombe County was approached. They have since advised that the County prefers that the pipeline be installed in a permanent easement; it would only be their “second preference” to allow it to be installed within the road right-of-ways. The County indicated that they typically have not allowed pipeline installations in their road right-of-ways; their concerns are about waterline breaks and washing out of roads.

For purposes of this study, it has been assumed that all the pipelines will be installed in permanent easements, and the related costs have been estimated. It is recommended that, during predesign of the pipeline, the possibility of installing the pipeline in County roads be further discussed with the County.

The preferred alignment, costs not considered, appears to be the “green/red” alignment. The main reason being that its intake is upstream of the City of Red Deer’s wastewater treatment plant, and it is a shorter (and thus less expensive) alignment than the “cyan” alignment. The pipeline routing of the green/red

**Blue Alignment Preferred**

alignment is better than the blue alignment as it allows more flexibility of options and is closer to the Town of Blackfalds.

## 8.0 Pipeline Materials and Connection to Users

### 8.1 PIPELINE MATERIALS

Possible pipeline materials are:

- PVC,
- HDPE, and
- Steel.

**Possible  
Materials**

Calculations have shown that the maximum (50 year) flows that this pipeline will be designed for, PVC pipe is capable of withstanding the pressure, including transient pressures, if the proper pressure rating is selected, and if proper protection is provided against transient pressures and high pressures due to valve closures. The River Section Crossings however, will require special consideration during predesign.

PVC pipe has the advantage over HDPE and steel of being light weight, easy to install, and cost effective.

### 8.2 HYDRAULIC GRADE LINES AND PIPE PRESSURE RATINGS

For each pipeline alignment, the hydraulic grade lines were calculated. These were calculated for the following cases:

#### ***Case 1 – Base Case***

This is the case of the Towns of Blackfalds, Lacombe, and Ponoka alone, without the First Nations.

**Base Case**

#### ***Case 2***

This covers both the Towns and the First Nations. It considers a 50 year design flow to the Towns and a 20 year design flow to the First Nations.

### **Case 3**

This also covers both the Towns and the First Nations. It considers a 50 year design flow to the Towns and a 50 year design flow to the First Nations.

The following figures show the hydraulic grade lines for the four alignments and the three cases under consideration:

- Figure 8.1.1 – Green Alignment and Green/Red Alignment, Base Case
- Figure 8.1.2 – Green Alignment and Green/Red Alignment, Case 2
- Figure 8.1.3 – Green Alignment and Green/Red Alignment, Case 3
- Figure 8.2.1 – Blue Alignment, Base Case
- Figure 8.2.2 – Blue Alignment, Case 2
- Figure 8.2.3 – Blue Alignment, Case 3
- Figure 8.3.1 – Pink Alignment, Base Case
- Figure 8.3.2 – Pink Alignment, Case 2
- Figure 8.3.3 – Pink Alignment, Case 3
- Figure 8.4.1 – Cyan Alignment, Base Case
- Figure 8.4.2 – Cyan Alignment, Case 2
- Figure 8.4.3 – Cyan Alignment, Case 3

Please note that each figure indicates the selected pipe sizes and pressure ratings.

These have been selected to be always the same for Cases 2 and 3, so that the only difference between Cases 2 and 3 is the need for a booster station, at Ponoka, for Case 3, whereas this is not required in Case 2.

Finally, please also note that:

- All Base Case figures show:
  - the hydraulic grade line for the 50 year water demands; and
  - the hydraulic grade line for the 20 year water demands.

- All Case 2 figures show:
  - the hydraulic grade line for the “50 year Town and 20 year First Nations” water demand; and
  - the hydraulic grade line for the “20 year all over” water demand.

### **8.3 PROTECTION AGAINST OVERPRESSURIZING OF THE PIPELINES**

Protection against transient pressures is further discussed under Section 10.

The control philosophy for the pipeline is discussed in Section 18.

The pipeline also needs to be protected against potential overpressuring. This could occur, for example, when there is no demand at all (no filling of reservoirs) while the pumps at the booster station are on.

Considering, for example, Figure 8.1.3 – Green Alignment, Case 3: Under the 50 year water demands, there is a booster station at Blackfalds, and another one at Ponoka.

If there is no demand anywhere, and if the pumps at Blackfalds are on, then the hydraulic grade of about 960 m would exist in the pipeline. The pressure at Ponoka would be about  $960\text{ m} - 800\text{ m} = 160\text{ m}$  or 225 psi. This would overpressure the 450 diameter, PVC, C905 DR25 pipe proposed between Ponoka and Morningside.

**Pressure  
Reducing Valve  
at Morningside**

To protect this line, a pressure reducing valve is proposed at Morningside. The pressure at the downstream side of the valve would be set at “elevation at Morningside +7 m (10 psi)”. In addition, a pressure relief valve would be installed at the same location, to protect the line in case of failure of the pressure reducing valve. The setting of the pressure relief valve would be 5 psi higher than the setting of the pressure reducing valve.

### **8.4 CONNECTIONS TO USERS (RESERVOIRS)**

It has been agreed between parties that:

- The estimated cost of the Regional Water System would include one branch-off and connection from the pipeline to one selected reservoir in each Town.

- For Blackfalds, the selected reservoir is the existing one. It is recognized that Blackfalds’ long term plans include a proposed reservoir to the north of Town. The filling of this proposed future reservoir is not included in this study.
- For Lacombe, the selected reservoir is the new reservoir, planned for 2001 in the north of the Town. The filling of the existing 1 MIG reservoir on Woodland Drive is not considered in this study. The filling of the existing 0.5 MIG steel reservoir is also not considered in this study.
- For Ponoka, the selected reservoir is the new proposed reservoir at the southwest corner of the Town. The filling of the other, existing reservoirs (Lucas Heights and Central), is not considered in this study.
- For Montana, the selected reservoir is the one near Baptiste Lake.
- For Samson, the selected reservoir is the one on Louis Avenue and Yellowhead Drive.
- For Ermineskin, the selected reservoir is the one in SE 32-44-24-W4, not far from Highway 2A.
- For Louis Bull, it was agreed that, for purposes of this study, the required water flow would be brought to the Ermineskin reservoir only. INAC would then review later how the Louis Bull demand will be brought to the Louis Bull reservoir.

The required sizes for the reservoir connections (branch-offs) have been calculated for both the 20 year and 50 year requirements. Table 8-1 summarizes these requirements.

**Required Sizes of  
 the Reservoir  
 Connections  
 (Branch-Offs)**

**Table 8-1: Reservoir Connections (Branch-Offs) – Required Sizes**

	<b>Applies to Alignments</b>	<b>Size for 20 Year Flows</b>	<b>Size for 50 Year Flows</b>	<b>Length of Connection</b>
Blackfalds	Green & Cyan	100 mm	150 mm	25 m
Blackfalds	Blue & Pink	200 mm	250 mm	8,300 m
Lacombe	All	200 mm	300 mm	1,200 m
Ponoka	All	200 mm	250 mm	1,600 m
Montana	All	100 mm	150 mm	5,000 m
Samson	All	150 mm	200 mm	150 m
Ermineskin	All	150 mm	150 mm	10 m

Regional Water Study  
The Communities of Blackfalds, Lacombe, and Ponoka  
The First Nations of Montana, Samson, Ermineskin, and Louis Bull

Please note that the above connection sizes have been calculated assuming that the total flow for the particular user (Town or First Nation) is supplied to the one reservoir (selected above) through one single connection.

Future predesign can review these assumptions, e.g. Ponoka and Lacombe might want water delivered to more than one reservoir.

The cost estimates in this report include the costs for the 50 year connections only.

## 9.0 SCADA System

The Supervisory Control and Data Acquisition system is an important element of the pipeline, pump stations and reservoir fill points.

This system will allow the central operator to monitor and control pipeline flows, individual reservoir fill rates and pipeline pressures.

**Control Pipeline  
Operator**

In addition, monitoring of the fill rate and level of the local reservoir will also be available locally, at each community.

This SCADA system will allow the operator to ascertain that minimum pressures at key locations in the pipeline are maintained, and to check on the water levels in each water reservoir. If necessary, the central operator can override the automatic controls, to favour the filling of certain reservoirs over others. Normally, such overriding will not be required.

The system will consist of, at each local reservoir site:

- a pressure sustaining valve;
- a fill rate control valve;
- a magnetic flowmeter;
- an ultrasonic level transmitter;
- a pressure transmitter;
- a PLC/RTU;
- a site operator interface;
- a radio modem;
- an antenna;
- a lightning arrestor; and
- a UPS system.

In addition, at the upstream end of the pipeline at Morningside, there will also be:

- a pressure transmitter;
- a PLC/RTU;
- a generator interface;
- a radio modem;
- an antenna;
- a lightning arrestor; and
- a UPS system.

The central control room can be located at the proposed water treatment plant, in case of a water treatment plant. In case the pipeline is connected to the City of Red Deer's water system, the central control room can be located at the Public Works office of one of the communities, e.g. Lacombe.

**Central Control  
Room**

Local operators of the other communities can telephone the central operator in case of concerns; the central operator is the only one who can override automatic controls on the system.

## 10.0 Pipeline Transient Pressures

Transient pressures in a pipeline are deviations from the normal steady state pressures. Both positive pressure surges and negative pressures (vacuum) may occur.

Surge pressures are generated by changes in velocity of the water flowing in the pipeline. Causes of pressure surges include:

- opening and closing of pipeline valves;
- starting and stopping of pumps;
- liquid column separation; and
- entrapped air.

**Causes**

The maximum surge of pressure is related to the maximum velocity in a pipeline, and to the material and thickness of the pipeline wall. For example, in a 500 mm diameter PVC pipeline, with a wall thickness of 28 mm (DR18), where the velocity of the water is 1.5 m/sec., the maximum surge pressure can be 87 psi above the normal water pressure.

**Magnitude of Surges**

Preliminary calculations for this report have considered transient pressures, and preliminary pipe selections have been made accordingly. Still, it is recommended that, during predesign and design of the pipeline, a detailed analysis of transient pressures be made to include simulations of valve operations, pump start-up and shut-down operations, power failure, etc. Such an analysis will allow:

- choosing the type and proper location for protection devices; and
- making the optimum selection of pipe and wall thickness.

Typical surge protection devices include:

- slow closing valves which will control the minimum period of time over which a valve can close;
- time delays, for example to prevent pump start-up during a transient pressure event;
- surge tanks;
- standpipes; and
- pressure relief valves and bypass valves.

**Protection  
Devices**

## 11.0 Water Treatment Plant

### 11.1 CAPACITY CRITERIA

The new water treatment plant will be designed to provide a capacity to meet the 20 year pipeline design flows as shown in Table 4-4 above.

The plant will be sized to produce water at a rate equal to the 20 year pipeline design flow plus plant losses (due to backwashing, filter rinse to waste, water required for flushing, and other in-plant water requirements) over a 22 hour period.

This in-plant water requirement will be assumed to be 10% of the maximum day demand. The following, Table 11-1, depicts projected plant capacity requirements.

**Table 11-1: Plant Capacity Requirements**

	20 Year Pipeline Daily Demand (m <sup>3</sup> )	Plant Daily Losses (m <sup>3</sup> )	Maximum Plant Daily Production (m <sup>3</sup> )	Plant Capacity Required (L/s)
Blackfalds, Lacombe and Ponoka Only	23,388	2,339	25,727	298
Blackfalds, Lacombe, Ponoka and First Nations	30,154	3,015	33,169	384

### 11.2 WATER TREATMENT PROCESSES

All water treatment facilities are to be designed to meet or exceed the Alberta Environment Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems, 1996 Revision.

Conventional water treatment plant processes would typically consist of the following:

- rapid mixing of chemicals;
- flocculation (e.g. hydraulic flocculators);
- sedimentation (e.g. horizontal flow type; up-flow type);
- filtration (e.g. declining rate filtration, constant rate filtration); and

**Conventional Plant**

- disinfection (e.g. post-chlorination to ensure bacteriologically safe treated water; pre-chlorination might be considered to ensure individual unit processes are not affected by bacterial growths).

Chemicals typically used include:

- aluminum sulphate (liquid alum, dosage as liquid alum, primary coagulant);
- polyelectrolyte (praestol, powder bags of 20 kg, secondary coagulant);
- sodium hydroxide (caustic, for pH adjustment); and
- chlorine (as gas, 68 kg cylinders or ten containers, disinfection).

While this report and the cost estimates allow for hydraulic flocculators, horizontal flow type sedimentation, declining rate filtration using dual media anthracite and sand filters, the Predesign Report should compare alternate types of flocculation, sedimentation and filtration and recommend the most effective solution.

Under the present Alberta Environment Standards and Guidelines, a surface water treatment system shall ensure a minimum reduction in pathogen levels as follows:

#### Disinfection

- 3 log reduction in Giardia; and
- 4 log reduction in viruses.

These required reductions are achieved by removals/inactivation utilizing conventional filtration plus removals/inactivation due to disinfection. Conventional filtration methods provide a reduction credit as follows:

- Giardia Credit: 2.5 log
- Virus Credit: 2.0 log

The remainder of the log reduction has to be made up by disinfection. For disinfection to be effective in inactivation of Giardia and viruses, chlorine contact time is required. The required contact time is dependent upon the pH of the treated water, the chlorine residual concentration, and the temperature of the treated water. The Guidelines and Standards give the requirements for disinfection in terms of the CT requirement, where the CT requirement = Concentration (mg/L chlorine residual concentration) x Time (minutes chlorine contact time for inactivation at the

given chlorine residual concentration, pH level and temperature). If the pH of the treated water is maintained at 7.5, at a temperature of 0.5°C, the required CT to provide the additional 0.5 log reduction for Giardia is 40. The required CT to provide the additional 2.0 log reduction for viruses is 6. Therefore, if adequate CT is provided for the inactivation of Giardia, inactivation of viruses will be realized.

The predesign should further analyze how the CT of 40 will be achieved. The variables are: the chlorine residual level, the treatment of the flow patterns in the clearwell at the plant, and consideration of the length of the pipeline from the water treatment plant to the first user (possibly at Blackfalds).

### 11.3 CRYPTOSPORIDIUM

As indicated in Section 6.2.2, the current Alberta Environment Standards do not address Cryptosporidium (although the USEPA requires a minimum 2 log removal).

**Cryptosporidium  
Not Addressed in  
Standards**

A 2 log removal for Cryptosporidium can be achieved by a conventional treatment plant.

However, the City of Red Deer's Water Treatment Master Plan (Associated Engineering, February 2001) indicates high levels of Cryptosporidium in the raw water, which would require 4 log to 6.5 log removal efficiency. This level of removal can not normally be achieved by a conventional treatment plant with chlorine disinfection.

The future predesign of a water treatment plant should thus include sampling and analyzing of the raw water, and, if the high levels of Cryptosporidium are confirmed, consider alternate technologies such as membrane filters, ozonation or the addition of UV radiation of filtered water, to achieve the required removal levels of Cryptosporidium.

The effect on cost of such technologies has not been considered in this report.

#### 11.4 FLUORIDATION

Fluoridation has not been considered at this stage. The need for fluoridation should be considered in the predesign report.

#### 11.5 STORAGE OF RAW RIVER WATER

Storage of raw river water, for example for a period of 7 to 21 days, during periods of high turbidity in the river, is used in some locations on the Red Deer River, to reduce the turbidity of the raw water prior to it entering the plant. At the intake sites considered in this study, it is expected that the concentration and duration of high turbidity is much reduced in comparison with locations as for example Drumheller. Consequently, raw water storage for turbidity reasons is not considered at this time.

**Storage for  
Sedimentation  
Load**

Storage of raw river water might have to be considered to cover periods of time where the release of the Dickson Dam might be too low to accommodate all water users, as was verbally suggested by an Alberta Environment representative. However, in view of the fact that the 20 year withdrawal for this regional system, including the First Nations, is only 0.2 m<sup>3</sup>/s, when compared with the mean minimum flow of 12.8 m<sup>3</sup>/s of the Red Deer River at Red Deer (between 1985 and 1995 inclusive), we have not allowed for storage of raw water at this time. However, we have allowed for land for the possible future addition of such storage.

**Storage to Bridge  
Low Supply  
Periods**

## 12.0 Land Issues

Land is required for:

- the river intake and low lift station (if any);
- the water treatment plant and the high lift pump station; and
- pipeline permanent and working easements.

### 12.1 RIVER INTAKE, LOW LIFT STATION, WATER TREATMENT PLANT AND HIGH LIFT STATION

We have allowed for an area of 1.6 ha (4 acres) for the water treatment plant and low lift station, including for future expansions (50 year horizon) of these facilities.

We have also allowed for an area of 46 ha (115 acres) for the possible future installation of raw water storage (14 days) and sludge lagoons, even though these possible future components are not included in the proposed water treatment facilities.

### 12.2 PIPELINE

For the length of the pipeline, it has been assumed that the following easements will be required:

- permanent easement: 10 m wide, plus
- working easement, 15 m wide, for a total width of 25 m.

## 13.0 Regulatory Issues

### 13.1 RED DEER RIVER INTAKE

A Regional Water System with a new treatment plant will require a new intake and the associated licences and approvals for an intake in the Red Deer River.

The process and time requirements for new intake applications have greatly increased in recent years and, in particular, due to the existing water commitments on the Red Deer River, this will be an important and timely component in the implementation of a Regional Water System.

Approvals and licences are required through the following government agencies:

- Provincial:
  - Alberta Environment – Water Resources
  - Alberta Environment - Fisheries
- Federal
  - Department of Fisheries and Oceans
  - Department of Navigable Waters
  - National Coast Guard

**Approvals and  
Licences Required**

There is also a requirement from Alberta Environment to determine the “In Stream Flow Needs” of the Red Deer River at the intake location and an associated hydrological assessment of the low flow conditions.

This analysis looks at the minimum water requirements of all river users, including:

- fisheries;
- municipalities/industry;
- recreation users; and
- others.

Based on these minimum water requirements, a restriction on water withdrawal may occur during river low flow periods. Separate studies on the river hydraulics and fishery issues may be required for the approval process. It is suggested that a considerable time (1 to 2 years) be allowed for the study, advertising and approval process associated with a new intake.

### **13.2 WATER TREATMENT PLANT**

A new water treatment plant will require the approval of Alberta Environment, Standards and Approvals Division. The Alberta Environment “Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems” will apply to the water treatment plant.

It is suggested that ongoing meetings with Alberta Environment occur throughout the preliminary and design phases of the water treatment plant which will facilitate the final approval of the facility. In addition, any areas of the treatment plant that deviate from the standards or any new technologies will require close consultation and review by Alberta Environment before implementation.

### **13.3 PIPELINE AND LAND RECLAMATION ISSUES**

All pipelines in Alberta are classified into minor and major, based on their length and size. Major pipelines do require specific testing and reporting in respect to reclamation.

A major pipeline is determined by the following formula:

$$\text{Length of Pipeline (km) x Diameter of Pipe (mm)} > 2,690$$

**Formula for  
Determining a  
Major Pipeline**

The Red Deer Regional Water Pipeline will be classified as a major pipeline and specific testing, reporting and approvals will be required in respect to topsoil handling, restoration and inspections by Alberta Environment and Alberta Agriculture.

This will involve soils testing along the pipeline route by an Agrolgist, determination of topsoil and subsoil zones, recommendations of topsoil separation and replacement during construction and methods to minimize impacts during construction of the pipeline.

#### **13.4 OTHER ISSUES/INTER-BASIN TRANSFER**

The Red Deer Regional Water System will entail water withdrawal from the Red Deer River, however, wastewater discharge from the communities of Lacombe, Ponoka and the Hobbema First Nations will be to the Battle River System.

This will require separate approvals and possibly advertising and public hearings to approve this component. Sufficient time should be allowed for approval of this concept.

## 14.0 Capital Cost Estimates

The capital cost estimates have been developed for the assumptions and design horizons indicated above.

For the pipeline, they include a 10% spare capacity of the non-industrial consumption in Blackfalds, Lacombe and Ponoka.

The cost estimates include (when applicable):

- river intake;
- low lift station;
- water treatment plant;
- land for low lift station and for water treatment plant, and for possible future raw water storage ponds (14 days) and sludge lagoons;
- access road to low lift station;
- pipeline, PVC, mostly C905, 3 m bury;
- removal and replacement, in a controlled fashion, of topsoil, along the pipeline right-of-way;
- permanent and working easements;
- utility and pipeline crossing;
- river crossings (assumed HDPE, directional drilled);
- railway crossings;
- paved road crossings;
- all-weather road crossings;
- valves on the pipeline, at least every 8 km;
- pig launcher and retriever stations at each change of diameter;
- testing, cleaning and commissioning of the pipeline;
- one connection to one reservoir in each community, sized for the 50 year flow;  
and

- a SCADA system for this pipeline, including a pressure sustaining valve, a full control valve and a magnetic flowmeter on each fill line, as well as a pressure transmitter, or level transmitter in each reservoir, and a site PLC/RTU, radio modem, antenna, lightning arrestor and UPS. Pressure control equipment is also included at Morningside.

The cost estimate does not allow for:

**Not Included in  
Cost Estimate**

- raw water storage ponds at the water treatment plant;
- access road to water treatment plant. The plant is assumed to be located near an existing road;
- increased costs (if any) due to the possible application of non-conventional technologies such as membrane filters, ozonation or the addition of UV radiation of filtered water, to achieve higher than log 2 removals of Cryptosporidium; and
- booster stations along the pipeline. The only pumping stations allowed for are the low lift station near the river (in case of a river intake) and the high lift station at the water treatment plant. Calculations have shown that booster stations along the pipeline will only be required after 20 years.

Table 14-1 provides the capital cost estimates for the four pipeline alignments, for the Base Case, i.e. Blackfalds, Lacombe and Ponoka only.

Table 14-2 provides the capital cost estimates for the four pipeline alignments for the case where the Montana, Samson, Ermineskin and Louis Bull are included.

**Table 14-1: Regional Water System Capital Cost Estimates  
Base Case  
Blackfalds, Lacombe and Ponoka Only**

	<b>Green Alignment Connects to City of Red Deer</b>	<b>Blue Alignment Intake Upstream of WWTP</b>	<b>Pink Alignment Intake Downstream of WWTP</b>	<b>Cyan Alignment Intake Upstream of WWTP</b>	<b>Green/Red Alignment Connects Upstream of WWTP</b>
	L = 45 km	L = 45.5 km	L = 37.5 km	L = 52.5 km	L = 47.4
1. Water Transmission Main	\$7,270,000	\$7,277,500	\$5,312,500	\$9,692,500	\$7,658,000
2. Topsoil Removal/Replacement	\$486,000	\$491,400	\$405,000	\$567,000	\$512,000
3. Permanent and Working Easements	\$668,000	\$675,390	\$556,640	\$779,300	\$703,600
4. Utility and Pipeline Crossings	\$24,000	\$24,000	\$24,000	\$24,000	\$36,000
5. River, Railway, Highway, Paved Road and All-Weather Road Crossings	\$538,000	\$394,000	\$326,000	\$614,000	\$568,000
6. Valves, Pig Launcher and Retriever Stations	\$709,000	\$287,400	\$287,400	\$540,400	\$709,000
7. Testing, Cleaning and Commissioning	\$35,000	\$35,000	\$35,000	\$40,000	\$35,000
<b>Subtotal Pipeline</b>	<b>\$9,730,000</b>	<b>\$9,184,690</b>	<b>\$6,946,540</b>	<b>\$12,257,200</b>	<b>\$10,221,600</b>
8. River Intake and Low Lift Station	NIL	\$2,145,000	\$2,145,000	\$2,145,000	\$2,145,000
9. Water Treatment Plant	NIL	\$9,626,000	\$9,626,000	\$9,626,000	\$9,626,000
10. Land for LLS and WTP for Possible Future Ponds, etc.	NIL	\$312,500	\$312,500	\$312,500	\$312,500
11. Access Road to LLS	NIL	\$200,000	\$200,000	\$200,000	\$200,000
12. Pipeline SCADA System	\$159,000	\$159,000	\$159,000	\$159,000	\$159,000
13a. Connection to Blackfalds Reservoir	\$1,625	\$986,000	\$986,000	\$1,625	\$1,625
13b. Connection to Lacombe Reservoir	\$197,800	\$275,300	\$275,300	\$197,800	\$197,800
13c. Connection to Ponoka Reservoir	\$215,000	\$215,000	\$215,000	\$215,000	\$215,000
<b>Subtotal</b>	<b>\$10,303,425</b>	<b>\$23,103,490</b>	<b>\$20,865,340</b>	<b>\$25,114,125</b>	<b>\$23,078,525</b>
14. Engineering and Contingencies (25%)	\$2,575,856	\$5,775,873	\$5,216,335	\$6,278,531	\$5,769,631
<b>Subtotal</b>	<b>\$12,879,281</b>	<b>\$28,879,363</b>	<b>\$26,081,675</b>	<b>\$31,392,656</b>	<b>\$28,848,156</b>
15. Net GST (3%)	\$386,378	\$866,381	\$782,450	\$941,780	\$865,445
<b>TOTAL</b>	<b>\$13,265,660</b>	<b>\$29,745,743</b>	<b>\$26,864,125</b>	<b>\$32,334,436</b>	<b>\$29,713,601</b>

**Table 14-2: Regional Water System Capital Cost Estimates  
Blackfalds, Lacombe, Ponoka,  
Montana, Samson, Ermineskin and Louis Bull**

	<b>Green Alignment Connects to City of Red Deer</b>	<b>Blue Alignment Intake Upstream of WWTP</b>	<b>Pink Alignment Intake Downstream of WWTP</b>	<b>Cyan Alignment Intake Upstream of WWTP</b>	<b>Green/Red Alignment Intake Upstream of WWTP</b>
	L = 66 km	L = 66.5 km	L = 58.5 km	L = 73.8 km	L = 68.4
1. Water Transmission Main	\$13,597,500	\$13,685,000	\$11,003,500	\$17,468,500	\$14,092,000
2. Topsoil Removal/Replacement	\$712,800	\$718,200	\$631,800	\$797,000	\$738,700
3. Permanent and Working Easements	\$979,688	\$987,100	\$868,400	\$1,095,500	\$1,015,300
4. Utility and Pipeline Crossings	\$35,200	\$35,200	\$32,000	\$39,400	\$47,200
5. River, Railway, Highway, Paved Road and All-Weather Road Crossings	\$727,400	\$837,400	\$759,400	\$845,300	\$757,400
6. Valves, Pig Launcher and Retriever Stations	\$1,062,000	\$872,000	\$872,000	\$1,183,500	\$1,062,000
7. Testing, Cleaning and Commissioning	\$50,000	\$50,000	\$50,000	\$55,000	\$50,000
<b>Subtotal Pipeline</b>	<b>\$17,164,588</b>	<b>\$17,184,900</b>	<b>\$14,217,100</b>	<b>\$21,484,200</b>	<b>\$17,762,600</b>
8. River Intake and Low Lift Station	NIL	\$2,750,000	\$2,750,000	\$2,750,000	\$2,750,000
9. Water Treatment Plant	NIL	\$11,580,000	\$11,580,000	\$11,580,000	\$11,580,000
10. Land for LLS and WTP for Possible Future Ponds, etc.	NIL	\$406,000	\$406,000	\$406,000	\$406,000
11. Access Road to LLS	NIL	\$200,000	\$200,000	\$200,000	\$200,000
12. Pipeline SCADA System	\$254,000	\$254,000	\$254,000	\$254,000	\$254,000
13a. Connection to Blackfalds Reservoir	\$1,625	\$986,000	\$986,000	\$1,625	\$1,625
13b. Connection to Lacombe Reservoir	\$197,800	\$275,300	\$275,300	\$197,800	\$197,800
13c. Connection to Ponoka Reservoir	\$215,000	\$215,000	\$215,000	\$215,000	\$215,000
14. Connections to Montana, Samson, Ermineskin and Louis Bull	\$426,000	\$426,000	\$426,000	\$426,000	\$426,000
<b>Subtotal</b>	<b>\$18,259,013</b>	<b>\$34,277,200</b>	<b>\$31,309,400</b>	<b>\$37,514,625</b>	<b>\$33,793,025</b>
15. Engineering and Contingencies (25%)	\$4,564,753	\$8,569,300	\$7,827,350	\$9,378,656	\$8,448,256
<b>Subtotal</b>	<b>\$22,823,766</b>	<b>\$42,846,500</b>	<b>\$39,136,750</b>	<b>\$46,893,281</b>	<b>\$42,241,281</b>
16. Net GST (3%)	\$684,713	\$1,285,395	\$1,174,103	\$1,406,798	\$1,267,238
<b>TOTAL</b>	<b>\$23,508,479</b>	<b>\$44,131,895</b>	<b>\$40,310,853</b>	<b>\$48,300,080</b>	<b>\$43,508,520</b>

## 15.0 Operation and Maintenance Costs

Operations and Maintenance (O&M) costs are yearly recurring costs, necessary to operate the Regional System and to maintain it.

This includes:

- maintenance costs;
- salaries and benefits for operators;
- electrical power costs;
- water treatment plant heating costs; and
- water treatment plant chemical costs.

**O&M Costs  
Include**

### 15.1 MAINTENANCE COSTS

Yearly maintenance costs are estimated at 2% of the capital cost of:

- water treatment plant;
- SCADA system; and
- pipeline valves, pig launcher and retriever stations.

### 15.2 SALARIES AND BENEFITS FOR SYSTEM OPERATORS

#### 15.2.1 In Alternatives with a Water Treatment Plant

It is estimated that there would be three operators covering 24 hours a day, each having an 8 hour shift.

**24 Hour Plant  
Operation**

#### 15.2.2 In Alternatives with Connection to the City of Red Deer's Water System

In this case, only the central control system needs regular attention. This monitors the fill valves and pressure controls along the pipeline.

The central control room can be in the Public Works office of one of the Towns. It is estimated that 2 hours a day of an operator's time is sufficient for this operation.

### **15.3 ELECTRICAL POWER COSTS**

Power costs consist essentially of pumping costs. In the case of alternatives with a water treatment plant, this concerns the pumping of the low lift and of the high lift stations.

In the case of the alternative with a connection to the City of Red Deer's water system, there are no electrical power costs as the City of Red Deer supplies the water under pressure.

Booster stations on the pipeline, for all alternatives, become only necessary after year 20; the electrical for these has not been considered.

A cost of 8.5 dollar cents per kwh has been assumed.

### **15.4 WATER TREATMENT PLANT HEATING AND VENTILATION COSTS**

These include the cost of ventilation. The ventilation load is based on six air changes per hour. This was selected in view of the wet atmosphere in the building.

During the design stage, the number of air changes per hour could be reviewed with the aim of lowering it and thus lowering the ventilation cost. Any lowering of the number of air changes requires a check of the resistance building materials in a humid environment.

The energy cost is assumed at \$6.00 per GJ.

### **15.5 PLANT CHEMICAL COSTS**

Plant chemicals include:

- Aluminum Sulphate (Liquid Alum) (Dosages as liquid alum ((50% alum)): 20 mg/L
- Polyelectrolyte (Praestol): 1.0 mg/L
- Sodium Hydroxide (caustic-pH control) (as 48% NaOH): 40 mg/L
- Chlorine (as gas): 8.0 mg/L

Assumed costs are:

**Assumed Costs**

- Aluminum Sulphate: \$0.16/kg
- Praestol: \$10.00/kg
- Caustic: \$0.48/kg
- Chlorine: \$1.95/kg

Chemical consumption, per 1,000 m<sup>3</sup>, is estimated at:

- Aluminum Sulphate (200 kg): \$32.00
- Praestol (1 kg): \$10.00
- Caustic (40 kg): \$19.20
- Chlorine (8 kg): \$15.60
- Total cost per 1,000 m<sup>3</sup>: \$76.80

Table 15-1 summarizes the yearly O&M cost estimates for the five pipeline alignments, for the Base Case, i.e. Blackfalds, Lacombe and Ponoka only.

Table 15-2 summarizes the yearly O&M cost estimates for the five pipeline alignments, for the case where Montana, Samson, Ermineskin and Louis Bull are included.

**Table 15-1: Regional Water System Yearly O&M Cost Estimates  
 Base Case  
 Blackfalds, Lacombe and Ponoka Only**

	<b>Maintenance</b>	<b>Operators</b>	<b>Power</b>	<b>Heating</b>	<b>Chemicals</b>	<b>Total</b>
<b>Year 0</b>						
Green	\$18,575	\$15,000	NIL	NIL	NIL	\$33,575
Blue	\$189,313	\$180,000	\$151,139	\$77,682	\$278,327	\$876,461
Pink	\$189,313	\$180,000	\$118,693	\$77,682	\$278,327	\$844,015
Cyan	\$194,740	\$180,000	\$123,262	\$77,682	\$278,327	\$854,011
Green/Red	\$189,313	\$180,000	\$118,693	\$77,682	\$278,327	\$844,015
<b>Year 10</b>						
Green	\$18,575	\$15,000	NIL	NIL	NIL	\$33,575
Blue	\$189,313	\$180,000	\$177,638	\$77,682	\$327,565	\$952,198
Pink	\$189,313	\$180,000	\$139,499	\$77,682	\$327,565	\$914,059
Cyan	\$194,740	\$180,000	\$144,883	\$77,682	\$327,565	\$924,870
Green/Red	\$189,313	\$180,000	\$139,499	\$77,682	\$327,565	\$914,059
<b>Year 20</b>						
Green	\$18,575	\$15,000	NIL	NIL	NIL	\$33,575
Blue	\$189,313	\$180,000	\$202,844	\$77,682	\$373,435	\$1,023,274
Pink	\$189,313	\$180,000	\$159,306	\$77,682	\$373,435	\$979,736
Cyan	\$194,740	\$180,000	\$165,438	\$77,682	\$373,435	\$991,295
Green/Red	\$189,313	\$180,000	\$159,306	\$77,682	\$373,435	\$979,736

**Table 15-2: Regional Water System Yearly O&M Cost Estimates  
 Blackfalds, Lacombe, Ponoka,  
 Montana, Samson, Ermineskin and Louis Bull**

	<b>Maintenance</b>	<b>Operators</b>	<b>Power</b>	<b>Heating</b>	<b>Chemicals</b>	<b>Total</b>
<b>Year 0</b>						
Green	\$28,162	\$15,000	NIL	NIL	NIL	\$43,162
Blue	\$242,376	\$180,000	\$175,536	\$91,806	\$326,270	\$1,015,988
Pink	\$242,376	\$180,000	\$131,623	\$91,806	\$326,270	\$972,075
Cyan	\$249,043	\$180,000	\$147,018	\$91,806	\$326,270	\$994,137
Green/Red	\$242,376	\$180,000	\$131,623	\$91,806	\$326,270	\$972,075
<b>Year 10</b>						
Green	\$28,162	\$15,000	NIL	NIL	NIL	\$43,162
Blue	\$242,376	\$180,000	\$211,873	\$91,806	\$421,378	\$1,147,433
Pink	\$242,376	\$180,000	\$158,870	\$91,806	\$421,378	\$1,094,430
Cyan	\$249,043	\$180,000	\$177,452	\$91,806	\$421,378	\$1,119,679
Green/Red	\$242,376	\$180,000	\$158,870	\$91,806	\$421,378	\$1,094,430
<b>Year 20</b>						
Green	\$28,162	\$15,000	NIL	NIL	NIL	\$43,162
Blue	\$242,376	\$180,000	\$273,550	\$91,806	\$508,452	\$1,296,184
Pink	\$242,376	\$180,000	\$205,118	\$91,806	\$508,452	\$1,227,752
Cyan	\$249,043	\$180,000	\$229,109	\$91,806	\$508,452	\$1,258,410
Green/Red	\$242,376	\$180,000	\$205,118	\$91,806	\$508,452	\$1,227,752

## 16.0 Grants

Under the Alberta Municipal Water/Wastewater Partnership, the part of the study for the Regional Water Supply System, relative to the Towns of Blackfalds, Lacombe and Ponoka, was eligible for a grant of 40.92%. This percentage was based on the 2000 populations of 9,128 for Lacombe, 6,149 for Ponoka and 2,001 for Blackfalds. (Letter of November 21, 2000 to Town of Lacombe.)

Updated population figures taken in July 2001 indicated the following populations: Lacombe = 9,232, Ponoka = 6,703, and Blackfalds = 3,300. Based on these populations, the overall grant would be 40.60%. A combined grant of 40.60% was used for the cost calculations.

## 17.0 Cost Sharing, Yearly Costs to Communities and Cost Per m<sup>3</sup> of Water

### 17.1 BASE CASE: BLACKFALDS, LACOMBE AND PONOKA ONLY

Two methods of sharing the costs have been considered:

- Equal sharing of capital and yearly O&M costs, based on the relative water demand of each community. The 20 year horizon has been used to determine the portions of the total costs.

**Equal Sharing**

These are:

- Blackfalds: 16.4%
- Lacombe: 60.3%
- Ponoka: 23.3%

- Sharing of the capital costs of the common system components, based on relative water demand of the communities using the common component. Non-sharing of the capital costs of the system components that serve one community only. Sharing of the yearly O&M costs based on the relative water demand of each community. The 20 year horizon has been used to determine the portions of the total costs.

**Sharing of  
Common  
Components  
Only**

These are where all three communities share:

- Blackfalds: 16.4%
- Lacombe: 60.3%
- Ponoka: 23.3%

Where only Lacombe and Ponoka share:

- Lacombe: 72.2%
- Ponoka: 27.8%

Table 17-1 shows the yearly cost to the Towns and the cost per m<sup>3</sup> of water, in the initial year 0 and at year 20, under the “Equal Sharing” method.

The total cost per m<sup>3</sup> of water in year 0 varies from 85¢/m<sup>3</sup> to 99¢/m<sup>3</sup>. In year 20, due to higher water usage, these costs range from 42¢/m<sup>3</sup> to 70¢/m<sup>3</sup>.

The calculation took into account: a 40.60% grant on the overall capital cost, and, a 20 year debenture on the portion of the capital to be financed, at 6<sup>3</sup>/<sub>8</sub>%.

A supply cost of 57¢/m<sup>3</sup> for purchase of the City of Red Deer's water has been assumed. This rate is the average of two rates suggested on a very preliminary basis only, by the City of Red Deer. The first rate is 61.5¢/m<sup>3</sup> and assumes no provincial contribution for the required plant upgrades and the dedicated water main in the City, connecting the Glendale Reservoir. The second rate is 53.0¢/m<sup>3</sup> and assumes a grant of 50% for these items. The reality will likely be smaller than a 50% grant which is why we assumed a rate of 57¢/m<sup>3</sup>. This supply cost is a guideline only at this time, as the City of Red Deer is further reviewing its costs. The City of Red Deer will also want to review the latest water demands for the Towns (and First Nations) that we are using in this report. This cost per m<sup>3</sup> is also subject to negotiation.

Water distribution costs and operational costs within each community have not been included in these water rates. Typical costs for these areas range from 25¢ to 40¢/m<sup>3</sup>.

Table 17-2 shows the yearly cost to the Towns, and the cost per m<sup>3</sup> of water for each Town, under the "Equal Sharing of Common Components Only" method. It can be seen that under this method, Lacombe's water is some 1¢ to 4¢ less per m<sup>3</sup>; Ponoka's is 12¢ to 17¢ more expensive; and Blackfalds' can be some 10¢ less or more, depending on the alignment.

**Table 17-1: Regional Water System  
 Yearly Cost to Towns – Cost per m<sup>3</sup>  
 Blackfalds, Lacombe and Ponoka Only  
 Equal Sharing**

	Green Alignment		Blue Alignment		Pink Alignment		Cyan Alignment		Green Red Alignment	
Total Capital Cost	\$13,265,660		\$29,745,743		\$26,864,125		\$32,334,436		\$29,713,601	
Grant 40.60%	\$5,385,858		\$12,076,772		\$10,906,835		\$13,127,781		\$12,063,722	
Debenture Net Amount	\$7,879,802		\$17,668,971		\$15,957,290		\$19,206,655		\$17,649,879	
Yearly Debenture Cost (20 yrs. 6 <sup>3</sup> / <sub>8</sub> %)	\$708,062		\$1,587,695		\$1,433,887		\$1,725,868		\$1,585,979	
	Year 0	Year 20	Year 0	Year 20	Year 0	Year 20	Year 0	Year 20	Year 0	Year 20
O&M Costs/Year	\$33,575	\$33,575	\$876,461	\$1,023,274	\$843,815	\$979,736	\$854,011	\$991,295	\$844,015	\$979,736
Total Cost/Year	\$741,637	\$741,637	\$2,464,156	\$2,610,969	\$2,277,702	\$2,413,623	\$2,579,879	\$2,717,163	\$2,429,994	\$2,565,715
Water Consumption/Year: m <sup>3</sup>	2,595,413	5,667,019	2,595,413	5,667,019	2,595,413	5,667,019	2,595,413	5,667,019	2,595,413	5,667,019
Total Cost/Year										
- Blackfalds	\$121,628	\$121,628	\$404,122	\$428,199	\$373,543	\$395,834	\$423,100	\$445,615	\$398,519	\$420,777
- Lacombe	\$447,207	\$447,207	\$1,485,886	\$1,574,414	\$1,373,454	\$1,455,415	\$1,555,667	\$1,638,449	\$1,465,287	\$1,547,126
- Ponoka	\$172,801	\$172,801	\$574,148	\$608,356	\$530,705	\$562,374	\$601,112	\$633,099	\$566,189	\$597,812
Regional System Cost/m <sup>3</sup>	28.6	13.1	94.9	46.1	87.8	42.6	99.4	47.9	93.6	45.3
Water Purchase Cost/m <sup>3</sup>	57.0	57.0	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
Total Cost/m <sup>3</sup>	85.6	70.1	94.9	46.1	87.8	42.6	99.4	47.9	93.6	45.3

NOTE: In-Town costs for distribution of water have not been included.

**Table 17-2: Regional Water System  
 Yearly Cost to Towns – Cost per m<sup>3</sup>  
 Sharing of Common Components Only**

	<b>Green Alignment</b>		<b>Blue Alignment</b>		<b>Pink Alignment</b>		<b>Cyan Alignment</b>		<b>Green/Red Alignment</b>	
Total Capital Cost	\$13,265,660		\$29,745,743		\$26,864,125		\$32,334,436		\$29,713,601	
Capital Cost Blackfalds	\$464,199								\$3,161,661	
Capital Cost Lacombe	\$6,056,925								\$15,975,034	
Capital Cost Ponoka	\$6,744,535								\$10,576,905	
Yearly Debenture Costs after 40.60% Grant:										
- Blackfalds	\$24,782								\$170,443	
- Lacombe	\$323,584								\$861,203	
- Ponoka	\$359,696								\$570,194	
<b>O&amp;M Costs/Year</b>	<b>Year 0</b>	<b>Year 20</b>	<b>Year 0</b>	<b>Year 20</b>	<b>Year 0</b>	<b>Year 20</b>	<b>Year 0</b>	<b>Year 20</b>	<b>Year 0</b>	<b>Year 20</b>
- Blackfalds	\$5,506	\$5,506							\$138,419	\$160,677
- Lacombe	\$20,246	\$20,246							\$508,941	\$590,781
- Ponoka	\$7,823	\$7,823							\$196,655	\$228,278
<b>Total Cost/Year</b>										
- Blackfalds	\$30,288	\$30,288							\$308,862	\$331,120
- Lacombe	\$343,830	\$343,830							\$1,370,144	\$1,451,984
- Ponoka	\$367,519	\$367,519							\$766,849	\$798,472
<b>Blackfalds Cost/m<sup>3</sup></b>										
- Regional System Cost	6.8¢/m <sup>3</sup>	3.5¢/m <sup>3</sup>							0.69¢/m <sup>3</sup>	0.38¢/m <sup>3</sup>
- Supply Cost/m <sup>3</sup>	57.0¢/m <sup>3</sup>	57.0¢/m <sup>3</sup>							NIL	NIL
- Total Cost/m <sup>3</sup>	63.8¢/m <sup>3</sup>	60.5¢/m <sup>3</sup>							0.69¢/m <sup>3</sup>	0.38¢/m <sup>3</sup>
<b>Lacombe Cost/m<sup>3</sup></b>										
- Regional System Cost	27.6¢/m <sup>3</sup>	9.6¢/m <sup>3</sup>							1.10¢/m <sup>3</sup>	0.40¢/m <sup>3</sup>
- Supply Cost/m <sup>3</sup>	57.0¢/m <sup>3</sup>	57.0¢/m <sup>3</sup>							NIL	NIL
- Total Cost/m <sup>3</sup>	84.6¢/m <sup>3</sup>	66.6¢/m <sup>3</sup>							1.10¢/m <sup>3</sup>	0.40¢/m <sup>3</sup>
<b>Ponoka Cost/m<sup>3</sup></b>										
- Regional System Cost	40.6¢/m <sup>3</sup>	30.1¢/m <sup>3</sup>							0.85¢/m <sup>3</sup>	0.65¢/m <sup>3</sup>
- Supply Cost/m <sup>3</sup>	57.0¢/m <sup>3</sup>	57.0¢/m <sup>3</sup>							NIL	NIL
- Total Cost/m <sup>3</sup>	97.6¢/m <sup>3</sup>	87.1¢/m <sup>3</sup>							0.85¢/m <sup>3</sup>	0.65¢/m <sup>3</sup>

NOTE: 1. In-Town costs for distribution of water have not been included.  
 2. Escalation/inflation rates were not included in future operating/maintenance costs or in the water rate from the City of Red Deer.

## 17.2 CASE WHICH ALSO INCLUDES THE FIRST NATIONS OF MONTANA, SAMSON, ERMINESKIN AND LOUIS BULL

Three methods of sharing the costs have been considered:

- Oversize of pipeline and extra pipeline length payable by INAC. Balance of capital cost equally shared between Towns. Yearly O&M share by relative water demand of all communities. The communities considered are: Blackfalds, Lacombe, Ponoka and First Nations (as a whole).
- Sharing of the capital costs of the common system components only, based on the relative water demand of the communities. Non-sharing of the capital costs of the system components that serve one community only. Sharing of the yearly O&M costs based on the relative water demand of each community. The 20 year horizon has been used to determine the portions of the total costs.

**Oversize and  
Extra Length for  
INAC**

**Sharing of  
Common  
Components  
Only**

These are where all four communities share:

- Blackfalds: 12.5%
- Lacombe: 45.9%
- Ponoka: 17.7%
- First Nations: 23.9%

Components where only Lacombe, Ponoka and First Nations share:

- Lacombe: 52.5%
- Ponoka: 20.2%
- First Nations: 27.3%

Where only Ponoka and First Nations share:

- Ponoka: 42.6%
- First Nations: 57.4%

Tables 17-3 and 17-4 show the yearly cost to each community and the cost per m<sup>3</sup> of water for each community for these two cost sharing methods.

**Table 17-3: Regional Water System  
 Blackfalds, Lacombe, Ponoka and First Nations  
 Yearly Cost to Communities; Cost Per m<sup>3</sup>  
 Oversizing and Extra Pipeline Length by INAC  
 Equal Sharing of Balance by Towns**

	Green Alignment		Blue Alignment		Pink Alignment		Cyan Alignment		Green Red Alignment	
Total Capital Cost	\$23,508,479		\$44,131,895		\$40,310,853		\$48,300,080		\$43,508,520	
Capital Cost Base Case	\$13,265,660		\$29,745,743		\$26,864,125		\$32,334,436		\$29,713,601	
INAC's Capital Cost	\$10,242,819		\$14,386,152		\$13,446,728		\$15,965,644		\$13,794,919	
Towns' Grant 40.60%	\$5,385,858		\$12,076,992		\$10,906,835		\$13,127,781		\$12,063,722	
Towns' Debenture Net Amount	\$7,879,802		\$17,668,971		\$15,957,290		\$19,206,655		\$17,649,879	
Yearly Debenture Cost (20 yrs. 6 <sup>3</sup> / <sub>8</sub> %)	\$708,061		\$1,587,694		\$1,433,886		\$1,725,867		\$1,585,979	
	<b>Year 0</b>	<b>Year 20</b>	<b>Year 0</b>	<b>Year 20</b>	<b>Year 0</b>	<b>Year 20</b>	<b>Year 0</b>	<b>Year 20</b>	<b>Year 0</b>	<b>Year 20</b>
O&M Towns/Year	\$32,846	\$32,896	\$773,167	\$986,396	\$739,749	\$934,319	\$756,538	\$957,650	\$739,749	\$934,319
O&M INAC/Year	\$10,316	\$10,316	\$232,821	\$309,788	\$232,326	\$293,433	\$237,599	\$300,760	\$232,326	\$293,433
<b>Total Cost/Year</b>										
- Blackfalds	\$121,509	\$121,517	\$387,181	\$422,151	\$356,476	\$388,386	\$407,114	\$440,097	\$381,419	\$413,329
- Lacombe	\$446,767	\$446,797	\$1,423,599	\$1,552,176	\$1,310,702	\$1,428,028	\$1,496,890	\$1,618,161	\$1,402,414	\$1,519,740
- Ponoka	\$329,956	\$172,643	\$739,865	\$599,763	\$668,191	\$551,792	\$804,254	\$625,259	\$739,066	\$587,229
First Nations	\$10,316	\$10,316	\$232,821	\$309,788	\$232,326	\$293,433	\$237,599	\$300,760	\$232,326	\$293,433
<b>Town's Cost per m<sup>3</sup> (m<sup>3</sup>/year)</b>	2,595,413	5,667,019	2,595,413	5,667,019	2,595,413	5,667,019	2,595,413	5,667,019	2,595,413	5,667,019
- Regional System Cost/m <sup>3</sup>	28.5	13.1	91.0	45.4	83.7	41.8	95.6	47.4	89.6	44.5
-Supply Cost/m <sup>3</sup>	57.0	57.0	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
- Total Cost/m <sup>3</sup>	85.5	70.1	91.0	45.4	83.7	41.8	95.6	47.4	89.6	44.5
<b>First Nations' Cost per m<sup>3</sup> (m<sup>3</sup>/year)</b>	583,416	1,643,026	583,416	1,643,026	583,416	1,643,026	583,416	1,643,026	583,416	1,643,026
- Regional System Cost (No Capital Debenture Costs)	1.8	0.6	39.9	18.9	39.8	17.9	40.7	18.3	39.8	17.9
-Supply Cost/m <sup>3</sup>	57.0	57.0	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
- Total Cost/m <sup>3</sup>	58.8	57.6	39.9	18.9	39.8	17.9	40.7	18.3	39.8	17.9

NOTE: 1. In-Town and On-Reserve costs for distribution of water have not been included.  
 2. Escalation/inflation rates were not included in the future operating/maintenance costs.

**Table 17-4: Regional Water System  
 Blackfalds, Lacombe, Ponoka and First Nations  
 Yearly Cost to Communities; Cost Per m<sup>3</sup>  
 Sharing of Common Components Only**

	<b>Green Alignment</b>		<b>Blue Alignment</b>		<b>Pink Alignment</b>		<b>Cyan Alignment</b>		<b>Green/ Red Alignment</b>	
Total Capital Cost	\$23,508,479		\$44,131,895		\$40,310,853		\$48,300,080		\$43,508,520	
Capital Cost Blackfalds	\$517,187		\$3,300,171						\$3,083,023	
Capital Cost Lacombe	\$5,289,408		\$13,150,170						\$14,618,983	
Capital Cost Ponoka	\$5,054,323		\$9,039,899						\$8,570,043	
Capital Cost INAC	\$12,647,560		\$18,036,530						\$17,236,471	
Yearly Debenture Costs After 40.60% Grants										
- Blackfalds	\$27,881								\$166,204	
- Lacombe	\$285,148								\$788,100	
- Ponoka	\$272,475								\$462,005	
<b>O&amp;M Costs/Year</b>	<b>Year 0</b>	<b>Year 20</b>	<b>Year 0</b>	<b>Year 20</b>	<b>Year 0</b>	<b>Year 20</b>	<b>Year 0</b>	<b>Year 20</b>	<b>Year 0</b>	<b>Year 20</b>
- Blackfalds	\$5,395	\$5,395							\$121,509	\$153,469
- Lacombe	\$19,812	\$19,812							\$446,183	\$563,538
- Ponoka	\$7,640	\$7,640							\$172,057	\$217,312
- First Nations	\$10,316	\$10,316							\$232,326	\$293,433
<b>Total Cost/Year</b>										
- Blackfalds	\$33,276	\$33,276							\$287,713	\$319,673
- Lacombe	\$304,960	\$304,960							\$1,234,283	\$1,351,638
- Ponoka	\$280,115	\$280,115							\$634,062	\$679,317
- First Nations	\$10,316	\$10,316							\$232,326	\$293,433
<b>Blackfalds Cost/m<sup>3</sup> /year)</b>	444,658	860,933							444,658	860,933
- Regional System Cost	7.5¢/m <sup>3</sup>	3.9¢/m <sup>3</sup>							64.7	37.1
- Supply Cost/m <sup>3</sup>	57.0¢/m <sup>3</sup>	57.0¢/m <sup>3</sup>							NIL	NIL
- Total Cost/m <sup>3</sup>	64.5¢/m <sup>3</sup>	60.9¢/m <sup>3</sup>							64.7¢/m <sup>3</sup>	37.1¢/m <sup>3</sup>
<b>Lacombe Cost/m<sup>3</sup></b>	1,245,672	3,585,643							1,245,672	3,585,643
- Regional System Cost	24.5¢/m <sup>3</sup>	8.5¢/m <sup>3</sup>							99.1	37.7
- Supply Cost/m <sup>3</sup>	57.0¢/m <sup>3</sup>	57.0¢/m <sup>3</sup>							NIL	NIL
- Total Cost/m <sup>3</sup>	81.5¢/m <sup>3</sup>	65.5¢/m <sup>3</sup>							99.1	37.7
<b>Ponoka Cost/m<sup>3</sup></b>	905,083	1,220,443							905,083	1,220,443
- Regional System Cost	30.9¢/m <sup>3</sup>	23.0¢/m <sup>3</sup>							70.1	55.7
- Supply Cost/m <sup>3</sup>	57.0¢/m <sup>3</sup>	57.0¢/m <sup>3</sup>							NIL	NIL
- Total Cost/m <sup>3</sup>	87.9¢/m <sup>3</sup>	80.0¢/m <sup>3</sup>							70.1	55.7

Regional Water Study  
 The Communities of Blackfalds, Lacombe, and Ponoka  
 The First Nations of Montana, Samson, Ermineskin, and Louis Bull

	<b>Green Alignment</b>		<b>Blue Alignment</b>		<b>Pink Alignment</b>		<b>Cyan Alignment</b>		<b>Green/Red Alignment</b>	
NOTE: In-Town and On-Reserve costs for distribution of water have not been included.										
<b>O&amp;M Costs/Year</b>	<b>Year 0</b>	<b>Year 20</b>	<b>Year 0</b>	<b>Year 20</b>	<b>Year 0</b>	<b>Year 20</b>	<b>Year 0</b>	<b>Year 20</b>	<b>Year 0</b>	<b>Year 20</b>
<b>First Nations Cost (m<sup>3</sup>/year)</b>	583,416 m <sup>3</sup>	1,643,026 m <sup>3</sup>							583,416	1,643,026
- Regional System Cost (No Capital Debenture Costs)	2.0¢/m <sup>3</sup>	0.6¢/m <sup>3</sup>							39.8¢/m <sup>3</sup>	17.9¢/m <sup>3</sup>
- Supply Cost/m <sup>3</sup>	57.0¢/m <sup>3</sup>	57.0¢/m <sup>3</sup>							NIL	NIL
- Total Cost/m <sup>3</sup>	59.0¢/m <sup>3</sup>	57.6¢/m <sup>3</sup>							39.8¢/m <sup>3</sup>	17.9¢/m <sup>3</sup>

NOTE: In-Town and On-Reserve costs for distribution of water have not been included.

## 18.0 Control Philosophy

The control philosophy that is described is a general control philosophy.

### 18.1 CASE WITH A NEW WATER TREATMENT PLANT AND HIGH LIFT STATION

A minimum pressure of 10 psi should always be maintained at the Morningside point near the Samson connection (please refer to ground profiles and hydraulic grade lines in Section 8.0). A pressure sustaining valve can be installed at this location. In addition, a pressure transmitter at this location will control the pumps at the high lift station, to ensure that this pressure is maintained. Pressure transmitters will also be located at each reservoir location. When a reservoir calls for water (based on a drop in the reservoir level), the reservoir fill valve will only open after a minimum pressure is established in the pipeline. This minimum pressure will be predetermined for each reservoir. The pressure transmitter on each fill line will sense the pressure; if it is below the determined setting, then it will cause the high lift pumps to increase in speed, until the set pressure is reached. Then the fill valve will gradually open to a position corresponding with a predetermined fill rate. A flowmeter will control the fill valve. When the reservoir is full, the fill valve will close, and the pressure transmitter on the reservoir will no longer control the high lift pumps.

In addition to the above, pressure sustaining valves on the fill lines to Ponoka, Montana, Samson, and Ermineskin should be set such that a minimum pressure of 10 psi is always maintained at the high lift point near the Samson connection.

Similarly, the pressure sustaining valve on the fill line to the Lacombe reservoir should be set such that the pressure in the branch to the reservoir does not drop below a level equal to 10 psi above the high point at Morningside.

## **18.2 CASE OF DIRECT CONNECTION TO THE CITY OF RED DEER'S WATER DISTRIBUTION SYSTEM**

It is likely that, possibly for 20 years, no separate pump station is required. Pressure would be maintained by the City of Red Deer. We have assumed that the minimum grade line at the City of Red Deer is at 914 m.

In this case, no special controls are required other than the pressure sustaining valves at each reservoir, as indicated above. When a reservoir calls for water (based on a drop in the reservoir level), the reservoir fill valve will open, to a position corresponding with a predetermined fill rate. A flowmeter will control the fill valve. When the reservoir is full, the fill valve will close.

## **19.0 System Ownership, Operational and Cost Sharing Options**

There are a number of options available to the member municipalities in the ownership and operation of the Red Deer Regional Water System.

The types of regional water systems currently operating in Alberta are varied and there are advantages and disadvantages associated with each system. The size of regional systems vary from small two community systems to large regional water commissions involving numerous communities and complex infrastructure.

The main ownership and operational scenarios that would apply to the Red Deer Regional Water System are discussed in the following section.

### **19.1 COMMUNITY OWNED AND OPERATED SYSTEM**

This system is detailed as follows:

- Each community would own a specific percentage of the system (pipeline, treatment plant, etc.) based on the projected demand requirements.
- Each community would provide the capital funding and finance their share of the capital costs of the system.
- One community would take the lead role in the operation and financial management of the system.
- Costs of operations and administration would be documented and reported yearly and shared by all municipalities based on percentage of system ownership.
- Ownership percentages of the system could be adjusted at later dates based on changes of demand or possible new customers.
- Detailed legal agreements would be required between all members of the system.

## **19.2 WATER COMMISSION**

- A water commission could be formed for the region in accordance with the “Alberta Water Commissions Act”.
- The water commission would own, finance and operate the water system and incorporate all costs into a yearly water rate.
- Each community would have representation on the commission and any changes, upgrades, and rate adjustments would be determined by the commission.
- Water rates could be equal for all members or could vary depending on location and length of pipeline.

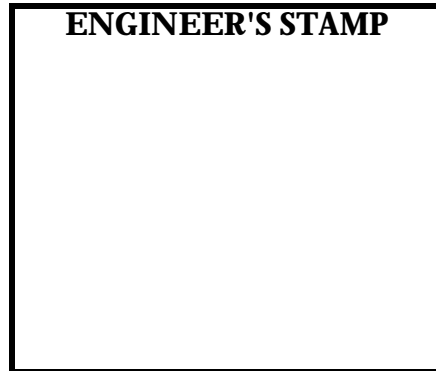
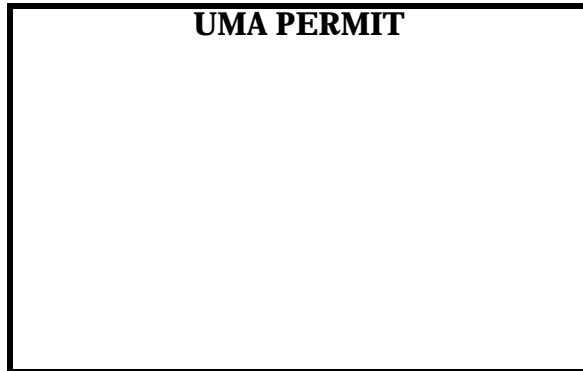
## **19.3 PRIVATE OWNERSHIP**

- Municipalities could contract with a private company or authority to build, finance and operate a regional water system.
- Water rates could vary yearly and would be subject to adjustment by the private owner/operator and subject to review by the Public Utilities Board.
- Precedence has been established where grants available to municipalities could be transferred to a private water operator.

All ownership and operation scenarios should be reviewed in detail by the municipalities and the long term implications considered. Examples of all systems available in Alberta and detailed discussions and review of current systems would be advisable before finalizing the ownership system.

## 20.0 Report Submittal

This report has been prepared and submitted by UMA Engineering Ltd., as documented below:



**UMA ENGINEERING LTD.**  
**THIRD PARTY DISCLAIMER**

This report has been prepared by UMA Engineering Ltd. ("UMA") for the benefit of the client to whom it is addressed. The information and data contained herein represent UMA's best professional judgement in light of the knowledge and information available to UMA at the time of preparation. Except as required by law, this report and the information and data contained herein are to be treated as confidential and may be used and relied upon only by the client, its officers and employees. UMA denies any liability whatsoever to other parties who may obtain access to this report for any injury, loss or damage suffered by such parties arising from their use of, or reliance upon, this report or any of its contents without the express written consent of UMA and the client.

Regional Water Study  
The Communities of Blackfalds, Lacombe, and Ponoka  
The First Nations of Montana, Samson, Ermineskin, and Louis Bull

**Appendix A -  
Rate Review and Analysis  
Campbell Ryder Consulting Group Ltd.**