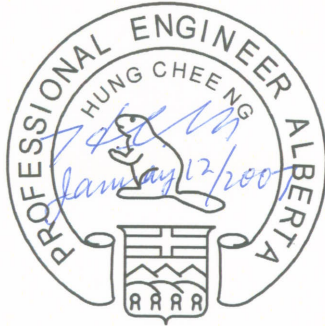


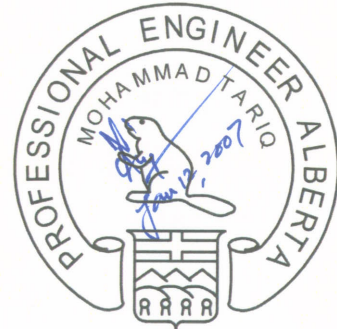
## Corporate Authorization

This document entitled "2005 Water System Master Plan - Grande Prairie-Clairmont Corridor Servicing Strategy" was prepared by ISL Engineering and Land Services Ltd.



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<i>ISL Engineering and Land Services Ltd.</i>	
Signature	<u></u>
Date	<u>Jan 12/07</u>
PERMIT NUMBER: P 4741	
<small>The Association of Professional Engineers, Geologists and Geophysicists of Alberta</small>	

## Acknowledgements

The project consultants gratefully acknowledge the following individuals for their valuable contribution to this study.

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## Executive Summary

The study area consists of approximately 18.5 sections of land extending from 132 Avenue northerly to Mercer Hill between Range Road 55 and Range Road 63 except Section 31-72-5-6 and Section 34-72-6-6. Out of the 18.5 sections of land, five quarter sections are located in the Grande Prairie City limit. The purpose of preparing a water system master plan for the Grande Prairie-Clairmont Corridor is to develop efficient and cost effective servicing strategies as a planning tool to accommodate the anticipated tremendous growth in an orderly manner.

Nine area structure plans were prepared in the study area and submitted to the County for review. These area structural plans are West Clairmont, Kehr Althen, Althen Corner Balisky Hodges, Crossroads South Phase 1 and 2, Crossroads North Phase 1 and Lakeside.

The projected growth include an ultimate industrial and commercial developments of approximately 2,121 hectares with a projected annual consumption rate of approximately 103 ha. Also, the population will grow from the current population of approximately 1,700 people to a projected ultimate population of 52,425 people. The population projection was calculated based on 45 persons/gross hectare for urban residential development and 27 persons/gross hectare for rural estates.

### **Design Criteria**

To prepare the master plan, a review was conducted on the current design criteria. The following new design criteria were recommended:

- Heavy industrial development water demand to be 20,000 L/ha/day
- General commercial development water demand to be 10,000 L/ha/day
- School water demand to be 15,000 L/ha/day
- Trickle water system water demand to be 4 L/min/unit
- Maximum day factor to be 1.4
- Population density to be RR 1 = 36, RR 2 = 45, RR 3 = 45, RR 4 = 51, RE = 27 and MHC = 51

Based on the design criteria and the projected growth, the existing Hamlet of Clairmont water distribution system is inadequate to accommodate the tremendous future growth in the study area. Improvements of the existing system are therefore required.

### **Water System Model**

To assist in the assessment of improvements, a water system model was developed using WaterCad Version 7.0 and water billing records. The model was calibrated with hydrant flow tests and the results are within acceptable accuracy.

### **Existing System Upgrading**

The assessment of the existing water distribution system identified that two areas have inadequate fire flow ranging from 65 L/s to 82 L/s. However, when a new reservoir is constructed, these areas will have sufficient fire flow.

### **Ultimate Servicing Options**

The following four servicing options were investigated to accommodate future developments:

- Option 1A: Service the entire study area from a new pump house and reservoir at the northwest corner of NW ¼ Sec 36-72-6-6 in the Clairmont Heights subdivision
- Option 1B: Service the entire study area from a new pump house and reservoir in the reserve site in the SE ¼ Sec 23-72-6-6 in the West Clairmont subdivision
- Option 2A: Service the study area north of Highway 43 from a new pump house and reservoir at the northwest corner of NW ¼ Sec 36-72-6-6 in the Clairmont Heights subdivision and the study area south of Highway 43 from the Zone 3 reservoir
- Option 2B: Service the study area north of Highway 43 from a new pump house and reservoir in the reserve site in the SE ¼ Sec 23-72-6-6 in the West Clairmont subdivision and the study area south of Highway 43 from the Zone 3 reservoir

Among these four options, Option 2B has the lowest implementation cost and is therefore the preferred option. The estimated implementation cost is \$42.2 million. It appears that Option 2A may be able to provide service beyond the study area. Further investigation will be required to confirm the feasibility. Since Option 2A is only approximately \$2.3 million less than Option 2B, the implementation of either Option 2A or 2B is at the discretion of Aquatera/County of Grande Prairie No. 1.

Since a reservoir is also an important component of a water distribution system, the adequacy of the existing reservoirs in the Hamlet and the Zone 3 reservoir to accommodate the projected growth were evaluated. The evaluation was carried out using a reduced water demand for the study area because the water demand that was calculated based on the projected full build-out condition of the study area and the design criteria was extremely high. The reduced demands used for evaluations are as follows:

- One sixth of the projected water demands
- One third of the projected water demand for all other growth scenarios

The reason for using one sixth of the projected water demand for the first five years is that the reduced water demand would be quite similar to the current water demand. The advantage of using the reduced water demand is that it will not only provide the expected level of service but also prevent an unwise investment on an oversized reservoir which can be expanded cost effectively in stages.

### **Regional System Improvements**

Since the study area relies on the water supply from the regional water supply system, the implementation and adequacy of the regional water supply system was also investigated. The investigation consists of the following components:

- Interim water supply to the Zone 3 reservoir  
The regional water system will obtain water from the Zone 3 reservoir to service the Clairmont and Sexsmith area. The Grande Prairie Water Distribution System Master Plan recommended constructing a dedicated transmission line to supply water from the Zone 1 reservoir to the Zone 3 reservoir. Due to the high construction cost associated with constructing this dedicated transmission line, an interim servicing option was investigated. The interim option is to construct a

450 mm diameter transmission line from the Zone 2 reservoir to the Zone 3 reservoir. Based on the reduced water demand, this interim transmission line can supply adequate water to Zone 3 reservoir as required till 2014.

- Regional water transmission line improvements  
The regional water transmission line is 450 mm in diameter and was recently constructed from the Zone 3 reservoir to the Clairmont reservoir. Since the majority of the study area was not included to determine the size of the transmission line, an assessment of the transmission line with respect to the capability of service was carried out. The assessment revealed that based on the reduced water demand and the pumping capacity of 243 L/s as stated in the Grande Prairie to Sexsmith Water Supply System Design Brief, this transmission line would be adequate till 2016.

### **Staged Implementation Plan**

The staged implementation costs for the cost sharing components for various growth scenarios are shown in the table below:

<b>Components</b>	<b>2006 (\$)M</b>	<b>2025 (\$)M</b>	<b>Ultimate (\$) M</b>	<b>Total (\$) M</b>
<b>Transmission Lines</b>	\$4.64	\$0	\$14.37	\$19.01
<b>Reservoir and Pumphouse</b>	\$11.95	\$11.23	\$0	\$23.18
<b>Total</b>	<b>\$16.59</b>	<b>\$11.23</b>	<b>\$14.37</b>	<b>\$42.19</b>

### **Conclusions**

The study has the following conclusions:

- Design criteria for three new types of land use including heavy industrial, general commercial and school were proposed. These new design criteria will enhance the design of the water distribution system and facilities. Other proposed new design criteria are for a trickle water system and population density.
- The water model developed for the study area was calibrated with hydrant flow tests and the results are within acceptable accuracy.
- The water demand calculated based on the design criteria is very high and unrealistic for the short term. The reduced water demand calculated using the assumptions as stated in Section 7.3.1 appears to be quite similar to the current water demand in the study area. Using the reduced water demand to determine the required volume of the reservoir and pumping facilities is therefore a more realistic approach for the short term.
- The existing water system will require improvements to accommodate future developments in the study area. Option 2B has the lowest construction cost. This option is to service the area north of Highway 43 from a new reservoir to be constructed in the reserve site in the West Clairmont subdivision and the area south of Highway 43 from the Zone 3 reservoir. The estimated implementation cost is \$45.8 million.
- The proposed improvements for the five year growth scenario for Option 2B consist of the following components:

- Protect the right-of-way to allow construction of the transmission line from the regional waterline to the new reservoir in West Clairmont.
  - Construct a 4.5 ML reservoir in West Clairmont for the 10 year growth scenario.
  - Construct a 450 mm diameter water transmission line from the regional water transmission line to the new reservoir.
  - Install a new distribution pump with a capacity of 38 L/s and a head of 55 m in the new reservoir to service the Clairmont Heights subdivision through a 350 mm diameter water main.
  - Install a new distribution pump with a capacity of 376 L/s and a head of 33 m at the new reservoir to service the study area through a 400 mm diameter trunk water main.
  - Install water distribution mains as shown in Figure 10.2.1.
  - Install a new standby pump with a capacity of 95 L/s and a head of 55 m at the new reservoir
  - Expand the existing Zone 3 reservoir with an additional capacity of 3.5 ML for the 10 year growth scenario
  - Install 2,200 m of 450 mm diameter transmission line from the tee intersection of the regional transmission line to the new reservoir.
  - Install 400 m of 400 mm diameter water transmission line out from each of the Zone 3 and the new reservoir.
- Option 2A is only \$2.3 million higher than Option 2B and therefore Option 2A is also a viable option. The implementation of either option is at the discretion of Aquatera/County of Grande Prairie No. 1.
- Protect land and right-of-way for future infrastructure via the development process.
- The proposed system will provide a longer service to the study area if the actual demand is less than the projected demand. If the projected water demand is larger than the actual demand, upgrading of the proposed system will be required sooner. Monitoring of the water demand in the study area should be carried out to assess the schedule for future upgrading of the proposed water system.
- The construction of a 450 mm diameter transmission line from the Zone 2 reservoir to the Zone 3 reservoir is a viable interim servicing option. The transmission line can meet the water demand till 2014 based on the reduced water demand calculated on the assumptions stated in Section 7.3.1.
- The recently constructed 450 mm diameter regional water transmission line from the Zone 3 reservoir to the Hamlet of Clairmont reservoir can meet the water demand until 2016 based on the proposed pumping capacity of 243 L/s and the reduced water demand calculated on the assumptions stated in Section 7.3.1.
- The estimated implementation costs in the report were estimated based on normal ground condition and profiles obtained from a contour plan derived from aerial photographs. These cost estimates should be considered for budgeting

purposes only. If a more accurate cost estimate is required, a preliminary design for the improvements should be carried out.

- The Master Plan is conceptual in nature and based on the best information available at the time of the study in 2005. As a result, a more detailed study may be required prior to the implementation of the recommendations.
- This master plan should be updated every 5 years in accordance with the new information and growth potential.

### **Recommendations**

The study has the following recommendations:

- Incorporate the recommended design criteria in the County's design standards
- Determine the capacities of reservoirs for the next five years based on a reduced water demand calculated on the assumption as stated in Section 7.3.1.
- Carry out further investigation on the feasibility of Option 2A to provide service beyond the study area prior to implementing either Option 2A or 2B.
- Construct a 450 mm diameter transmission line from the Zone 2 reservoir to the Zone 3 reservoir as an interim water supply measure
- Monitor the water demand for the study area to determine the schedule for upgrading of the proposed water system
- Carry out a preliminary design for the proposed improvements to refine the cost estimates.