

## Executive Summary

The last update of the Water Distribution System Master Plan was prepared in 1995. Since then the city of Grande Prairie has experienced tremendous growth. An update of the Master Plan is warranted for the determination of upgrading requirements to accommodate future growth within the City and the needs of potable water for the surrounding communities. The purpose of the Master Plan is to determine cost effective upgrading requirements for the existing system and future developments. The new Master Plan will be used as a planning tool for Aquatera.

Water demand is one of the crucial factors for the assessment of a water distribution system. Available records were used in the assessment of current water demand for various types of land use. It was found that the residential and industrial water demand are very close to the current recognized standards. With respect to water demand for other types of land use that cannot be assessed on the basis of available records, they were determined on the basis of an assessment of the water demand and wastewater flow standards of other municipalities. The assessment concluded that the majority of the current design standards are still applicable. The exceptions are new water demand standards for highway and general commercial developments, light and heavy industrial developments, school and hospital, and a new fire flow standard for institutional developments as well as new spacing standard for fire hydrants.

To facilitate the assessment of a water distribution system, a computerized modelling technique was used. Among the six softwares investigated, the WaterCAD software was considered most suitable for the City of Grande Prairie's water distribution system. The main reasons are that the WaterCAD model has a better support and training program and graphical capability as well as a lower price.

Just like water demand, population is another crucial factor in the assessment of a water distribution system. The projected population for the City of Grande Prairie in 2008 and 2013 is 46,125 and 52,210 respectively. The projection was based on an annual growth

rate of 3.5% for the next three years and a reduced annual growth rate of 2.5% from 2007 through 2013.

The model for the existing system was developed on all available data. The model has a total of 1295 pipes which is 631 pipes more than the original model. A portion of the previous model data has not been validated. Nine fire flow tests were used to calibrate the model. The roughness coefficients for pipes constructed after 1975 were adjusted slightly higher than the 1995 model so that a better calibration could be achieved. The model can be refined by carrying out tests to determine the roughness coefficients for various pipe materials and validation of pipes that have not been validated.

The study identified a number of locations in the existing water distribution that has inadequate fire flow based on the new design standards. These areas are:

- Zone 1
  - West Industrial area: the estimated improvement cost is \$ 1,586,000
  - 96 Avenue between 106 and 104 Streets, the estimated improvement cost is \$ 344,000
  - Schools at 91A Avenue and 96 A Street  
88 Avenue and 97 Street  
Total estimated improvement cost is \$ 229,000
  - School site at 112 Avenue and 105 Street, the estimated improvement cost is \$140,000
  - 116 Avenue and 100 Street, the estimated improvement cost is \$340,000
  - 106 Avenue and 92 Street, the estimated improvement cost is \$ 33,000
  
- Zone 2
  - North Industrial Area, 97B Street and 128 Avenue, the estimated improvement cost is \$ 631,000
  
- Zone 3
  - North Industrial Area, the estimated improvement cost is \$1,026,000
  - 116 to 124 Avenue between 99 and 101 Street, the estimated improvement cost is \$191,000
  - 104 to 108 Avenue between 93 and 96 Street, the estimated improvement cost is \$190,000

- School site at 90 Street – 110 Avenue and 88C Street – 109 Avenue, the estimated improvement cost is \$293,000

To accommodate future developments within the City boundary, the North Industrial area, the regional water supply system and the area located to the south and east of the City in the country, the following upgrading will be required:

- Upgrading the existing water treatment plant in the near future. However, the pumphouse will be adequate for at least 10 years and the reservoir is sufficient to accommodate ultimate developments or a design population of 72,000 people.
- Install an additional distribution pump at the Zone 2 pumphouse by 2008. To accommodate the development in 2003, the capacity of the additional pump will be 110 L/s.
- The options for the construction of the dedicated supply line along the east edge of the current City boundary are as follows:
  - Construct 12 km of 750 mm trunk main to accommodate the ultimate requirements at an estimated cost of \$9.4 million
  - Construct a 500 mm main initially at a cost of approximately \$7.0 million and then a second 500 mm main approximately 15 – 20 years later.
- Expand the existing Zone 3 reservoir when the development in the North Industrial area exceeds 40 ha of RM-4 or 100 ha of RM-2 and when the required water system is to be developed.
- Construct 300 mm watermains through undeveloped areas in Zone 1, 2, and 3 as discussed in Section 8.2. The exceptions are the watermain connecting to the partially existing Flyingshot Lake area through Pinnacle Ridge area in Zone 2 is 350 mm and the watermain in the east central area in Zone 3 is 250 mm.

- Upgrade the Airport pumphouse and reservoir and construction of 300 mm watermain to the existing distribution system to accommodate the developments in the west end area of the City. The construction cost will be \$2.25 Million.

Research on fire flow policy has been conducted. A draft fire flow policy was presented for consideration by Aquatera for the development of a fire flow policy as described in Section 11. With respect to existing areas where fire flow is insufficient, it is suggested that the City prepare a local improvement plan for the construction of required system upgrading that can be carried out in a cost effective fashion. The cost of the upgrading will be imposed on the land owners within the benefiting area through the levy of a local improvement tax or a connection charge. When a local improvement plan has been prepared, the City must send a notice to residents who will be liable to pay the local improvement tax or connection charge. The improvement can proceed only when the petition is insufficient.

A literature review of the best practices for a water system was also carried out. A summary of the review was documented in Section 12 to assist Aquatera in the formation of the policy for the water system. A review of Aquatera's current practice is beyond the scope of work for this assignment. The review includes the following topics:

- Good Governance in water utilities
- Reducing the impact of variations in financial plans
- Adoption of Strategic planning framework
- Best practices in minimizing water loss
- Creating a water smart community
- Lessons learned from Walkerton
- Strategies for competitive advantage
- Best practices for maintenance work orders

The study has the following conclusions:

- The assessment concluded that the majority of the current design standards are still applicable. The new design standards are:
  - Water Demand
    - Highway commercial developments = 26,000 L/ha/day

- General commercial developments = 20,000 L/ha/day
  - - Light industrial developments = 10,000 L/ha/day
  - Heavy industrial developments = 20,000L/ha/day
  - School = 20,000 L/ha/day
  - Hospital = 30,000 L/ha/day
  - Fire Flow
    - Institutional = 250 L/s
  - Hydrant spacing
    - Residential = 150 m (measured radially)
    - All other land use = 90 m
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- The WaterCAD software is the most suitable model for Aquatera because it has a better support and training program and a lower cost.
  - The population projection for the water demand calculation was based on an annual growth rate of 3.5% for the next three years because it is anticipated that the City will carry on the same annual growth rate for a period of time. From 2007, the annual growth rate will be reduced to 2.5%.
  - The model for the existing system was calibrated with nine fire flow tests and provide reasonably good results. The model can be refined by conducting tests to determine the roughness coefficient of the existing watermains and validate the database.
  - The study identified there are seven areas in Zone 1 and one area in Zone 2 as well as from areas in Zone 3 that have insufficient fire flows in accordance with the new fire flow standards. The deficiency in these areas can be rectified by replacing undersized watermains and construction of new watermains as well as pressure reducing valve stations.
  - To accommodate future developments, improvements for the water distribution system will be required.

The improvements required in the immediate future would consist of the following components.

- Expand the capacity of the water treatment plant.
- Expand the capacity of the Airport reservoir by the construction of a 2.5ML capacity reservoir and construct a 300 mm Ø watermain to connect the reservoir to the existing water distribution system as discussed in the EXH report.
- Expand the Zone 3 reservoir as required to accommodate growth for the regional supply system. An additional 5.0 ML storage will be required for the development of the County North Industrial area.
- The 250 mm watermains from the Crystal Lake subdivision to the intersection of 132 Avenue and 97B Street.

The improvements required by 2008 would consist of the following components:

- Construct a 500 mm Ø dedicated trunk watermain to supply water from the Zone 1 reservoir to the Zone 3 reservoir.

The improvements required sometime after 2018 would consists of the following components:

- Expand Zone 1 pumphouse to have a pumping capacity to be defined at that time.
- In accordance with the Municipal Government Act, the City will not be required to upgrade the existing water distribution system in areas where there is insufficient fire flow. However, the City should advise the residents in those areas about the condition so that the City can be protected from being negligent.

For areas of the City that can be upgraded in a cost effective fashion, the City will initiate a local improvement proposal to fund the construction of required fire flow infrastructure. The cost of the fire flow network improvements will be passed onto land owners within the benefiting area through a local improvement levy.

For areas of the City where the fire flow network cannot be brought up to desired standards in a cost effective fashion, the City will maintain an inventory of deficient areas and periodically assess improvement opportunities.

- The service connection rates for water (\$644.88 single family) and sewer (\$869.06 single family) will fully recover water and sewer new growth area infrastructure investments in 60 to 80 years which is unreasonable.

The study has the following recommendations:

- Adopt the recommended design standards as new design standards for the water distribution system.
- Refine the WaterCAD model by carrying out tests to determine the roughness coefficient of the existing watermains and validate the size of the watermain and node elevation in the database.
- Carry out improvements to rectify deficient fire flow in areas where improvements can be carried out cost effectively.
- Carry out improvements to accommodate future developments in stages as recommended.
- Maintain an inventory of deficient areas where they cannot be upgraded cost effectively and periodically assess improvement opportunities.
- Aquatera should consider service connection fees that closer to the minimum (\$2,300.00) and maximum (\$3,000.00).

