# District of 100 Mile House

# WATER CONSERVATION PLAN

Prepared by: Philip Strain, Director of Engineering and Community Services, May 21, 2009

Revised June 12, 2012

## 1.0 INTRODUCTION

Bridge Creek is the District of 100 Mile House's main source of water. The water quality of Bridge Creek has been an issue dating back to 1968 when the Provincial Pollution Control Branch first showed initial concerns. Numerous studies have linked these water quality concerns to agriculture, which is abundant and essential for the economy in the area. In response to these concerns, a slow sand filtration system was built in 1985 to improve the water quality. Recently, due to low water levels in Bridge Creek during the winter months, a standby well (Well No. 4) has been used to supplement the primary Bridge Creek supply. However, there are concerns regarding surface water influence, hardness and manganese content of the well water. Changes to the water system and conservation measures are necessary in order to ensure the sustainability of 100 Mile House and to accommodate growth and development in the area.

### 1.1.1 Well Water Quantity

The maximum capacity of the well is 75 L/s. The well is capable of continually producing a flow rate of 53.7 L/s. The production well pump is rated for 50.5 L/s (800 USGPM).

### 1.1.2 Well Water Quality

Golder Associates collected well water samples from the production well during the well pumping tests in 2003 and 2004.

The water quality of the well water is very hard and very high in total dissolved solids (TDS). The hardness and TDS are in the range of 500 to 600 mg/L and 800 to 1000 mg/L, exceeding the aesthetic objectives (AOs) of the Guidelines for Canadian Drinking Water Quality (GCDWQ) of 200 mg/L and 500 mg/L respectively.

Manganese, which is also an aesthetic parameter, has a concentration in the range of 0.2 to 0.3 mg/L and also exceeds the AO of 0.05 mg/L. Iron results seem to be somewhat variable, and are likely relative to the solids content/turbidity of the water. In the 2003 sample, the turbidity was 1.8 NTU and the iron was 0.25 mg/L (i.e. less than the AO of 0.3 mg/L). However, in the 2006 sample, the turbidity was 130 NTU and the iron was extremely high at 11 mg/L.

A high lead result of 0.0157 mg/L seen in the 2003 samples raised concerns as it exceeded the maximum allowable concentration (MAC) of 0.01 mg/L. However, further testing has indicated that lead concentrations meet the MAC. Testing has also indicated that selenium levels may be somewhat elevated, and are in the range of 0.007 to 0.01. The MAC for selenium is 0.01 mg/L.

### 1.2 Bridge Creek

Bridge Creek is the primary source of water for the District. Two intakes on Bridge Creek supply the Water Treatment Plant. The water passes through a slow sand filtration system, an Ultra Violet disinfection process and is then chlorinated and sent to the distribution system. Information regarding Bridge Creek has been compiled from the reports on Water Quality and use in the Bridge Creek Basin (Hart, 1993) and the Horse Lake – Bridge Creek Water Quality Assessment (Zirnhelt, 1997).

The water flow rate of Bridge Creek is controlled by the Bridge Creek control structure at the west end of Horse Lake. The creek flows through 100 Mile House and outlets in Canim Lake.

### 1.2.1 Bridge Creek Water Quantity

The quantity of water that flows in Bridge Creek varies depending on rainfall, snow pack and the Bridge Creek structure, which controls the flow of water out of Horse Lake.
The District is licensed to use up to 2,000,000 Imperial gallons/day from Bridge Creek, or 9092 $m^3/d$ (0.105 $m^3/s$). They are also licensed to store 2,686 acre-feet or 3,313 ML in Horse Lake between October 1 and May 31.

### 1.3 Horse Lake

Information regarding Horse Lake has been compiled from the reports on Water Quality and Use in the Bridge Creek Basin (Zirnhelt, 1997) and the Horse Lake – Bridge Creek Water Quality Assessment (Hart, 1997).
Horse Lake is located within the Bridge Creek Basin. The tributaries for Horse Lake are Attwood, Evergreen, Fawn, Longbow, 93 Mile, and Bridge Creek. The lake outflows into Bridge Creek, eventually draining into the Fraser River.
Horse Lake is enjoyed by a wide range of water sport enthusiasts and is home to a wide range of fish and wildlife. There are seven water licenses allowing direct withdrawal from Horse Lake for domestic and irrigation purposes totaling 284,545 $m_3$ of water annually.

### 1.3.1 Horse Lake Quantity

Snow is the main form of precipitation during the winter and the resulting run-off leads to high water levels in May and June. The lake level is at a seasonal low level during October and November due to low precipitation and summer evaporation. Horse Lake has an average depth of 15.2 m and a maximum depth of 34.0 m. The approximate surface area and volume of Horse Lake is 11.2 $km_2$ and $174.6\times10_6$ $m_3$, respectively. The outflow volume of the lake is 49,953,024 $m_3$/year with a residence time of approximately 3.49 years.

### 1.3.2 Horse Lake Water Quality

Historical results indicate that the turbidity ranges between 0.2 and 0.6 NTU. It is unclear whether this information is reflective of the average conditions or provides the real range of turbidity.
The Horse Lake water is relatively hard at about 140 mg/L. It is also alkaline, with pH in the range of 8.0 to 8.5. Colour readings appear to be lower than the AO of 15 TCU.
All measured water criteria parameters meet the GCDWQ. Total and Dissolved Organic Carbon readings were not available for Horse Lake; therefore, no comparison can be made to the Bridge Creek results for these parameters. Disinfection by-product formation potential results were not available. UV Transmissivity results were not available.
No protozoa readings were found for Horse Lake; therefore an assessment cannot be made as to the level of protozoa present in the lake. However, protozoa are assumed to be present in all surface waters.

### 1.4 Implementation

District Council supports the efforts of staff in the development and implementation of a Water Conservation Plan and a Watershed Management Plan. District Engineering, Planning and Building Inspection staff will be working with consultants, Interior Health, CRD and stakeholders to develop strategies and educational tools to work towards meeting the Living Water Smart objectives.

## 2.0 Community Water System Profile

There are several uses in the watershed that could have an impact on the water quality of Horse Lake. These uses include agriculture, forestry, wastewater collection/disposal, commercial/industrial, recreation/boating, and other types of activities. These activities/impacts may be beyond the District's boundary and/or may be beyond their ability to control.
The District is committed to initiating a Watershed Management Plan as stated in Section 1.4

### 2.1 Population and Water Demands
Future water demands are based on population growth, current demand characteristics and designated land usage.

#### 2.1.1 Population Projections
Population estimates are summarized in the April 24, 2007 memo from Urban Systems entitled District of 100 Mile House – Population Forecast (Appendix A). It is difficult to forecast community growth with any degree of accuracy and the District has indicated that there are several new developments planned within the community. Therefore, instead of tying water distributions system improvements to population growth, improvements are recommended in terms of:
1. Existing Deficiencies;
2. Improvements required for specific developments and;
3. General improvements for increased water quality and operability
4. Development and implementation of a Water Conservation Program

#### 2.1.2 Water Demands
Using the 2008 population and water consumption records, the per capita annual average day demand (ADD) was calculated to be:

$$1{,}361{,}000L/d/1{,}933people=704\ L/cap/day$$

The 2008 maximum day demand (MDD), found to be on July 03, 2008, was calculated to be:

$$3{,}051{,}000L/d/1{,}933people=1{,}578L/cap/day$$

The MDD/ADD ratio is 2.24.
A comparison of the ADD and MDD from various BC communities has been provided below in Table 2-1. This table shows that the District's water consumption is consistent with other communities in BC.

**Table 2-1: ADD and MDD Comparison**

| | **ADD** | **MDD** |
|---|---|---|
| District of 100 Mile House | 704 | 1,578 |
| Village of Valemount (2004) | 645 | 1,980 |
| Quesnel (2003) | 630 | 1,250 |
| Logan Lake (2001) | 560 | 2,046 |

#### 2.1.3 Land Use
For the purpose of this study, land use areas are based on the District of 100 Mile House Official Community Plan Bylaw No. 990. The District of 100 Mile House land use consists of approximately 62 hectares of developed industrial land, 150 hectares of residential land including the two modular home parks and 134 hectares of commercial / institutional land.

## 2.2 WATER SYSTEM OVERVIEW

In general, the District of 100 Mile House water system consists of three main components:
1. water treatment;
2. water distribution; (Appendix C) and
3. water storage.

## 2.3 Water Treatment

The District of 100 Mile House largely relies on Bridge Creek to fulfill its water demands. The District water treatment plant utilizes a slow sand filter system, a UV disinfection process and chlorination to treat the water prior to delivery to the distribution system. The intake and water treatment plant (WTP) are located adjacent to Bridge Creek and the public works yard.
The District has a groundwater well which can be used to supplement the supply from the WTP.

The well is located north of Little Bridge Creek on the west side of Cariboo Highway. Although the well is finished in a relatively high yield aquifer, poor aesthetic water quality, including hardness and iron, prevent this well from being used on a regular basis. In addition, this well is situated within a fractured bedrock aquifer and is likely under the influence of surface water.

## 2.4 Water Distribution

The District water distribution system consists of two pressure zones, each with its own reservoir for balancing storage. Water from both the WTP and Well No. 4 pump water into the low pressure zone. The high pressure zone is fed via a booster station located near the low zone reservoir. A pressure reducing station located just north of Fifth Street on a side road east of the Cariboo Highway allows water from the high zone to be fed back to the low zone.

## 2.5 Water Storage

The District water system has two reservoirs which provide balancing storage for the distribution system. The low zone reservoir is located adjacent to the public works yard, and the high zone reservoir is located near the southwest District boundary. The total water storage provided by the district reservoirs is 1610 $m_3$.

## 2.6 Water Usage Data

See the 2007-2008 District of 100 Mile Annual Water Report Appendix B

# 3.0 Sewer System

The District of 100 Mile House upgraded their treatment works in 1992 through the addition of aerated lagoons and a winter storage cell (cell 3). All of the raw sewage from the District is pumped to the two aerated lagoons. Effluent then overflows into Cell 3. During the irrigation season effluent is pumped from Cell 3, and is spray irrigated on fields around the area.
In the summer of 2012 the District will be constructing Rapid Infiltration Basins on the west side of the Stephenson Lake facility. These RI Basins will be capable of receiving all of 100 Mile House's sewer effluent.

## 3.1 EXISTING SYSTEMS

Appendix D illustrates where the sewage collection systems are located. The transmission and treatment components include:

.1 Main Lift Station(2009): two 20 hp Flygt pumps and flow meter;
.2 Emergency Lift Station(1993): two 25 hp hydromatic pumps;
.3 Forcemain: 920 m at 250 mm diameter;
.4 Gravity sewer into Cell 1: 380 m at 350 mm diameter;

.5 Aerated Cell 1: 23,862 $m^3$, depth 5 m, 1 m freeboard, 24 diffusers;
.6 Aerated Cell 2: 30,548 $m^3$, depth 5 m, 1 m freeboard, 14 diffusers; and
.7 Two 50 hp Aerzen blowers, equates to 1.84 Hp/1000 $m^3$ of lagoon volume.

The disposal facilities include:
.1 Storage Cell 3: 286,620 $m^3$, depth 5 m and 7.3 m, 1 m freeboard;
.2 Effluent spray irrigation pumps (vertical turbines)
- Two at 20 Hp for areas closer to town served by an irrigation canon;
approximate pumping rate is (160 USgpm)
- One at 20 Hp for Hillside/Site 5 (± 250 USgpm);
.3 Forcemains to the irrigation areas; and
.4 Irrigation sites, complete with irrigation sprinklers/canon, as noted below and as shown on Figure 4.1.

| Site | Area (Ha) | Name | Land Owner |
|---|---|---|---|
| 1 | 4.92 | Barn South | 100 Mile Ranch |
| 2 | 9.94 | Barn North | 100 Mile Ranch |
| 3 | 4.71 | Old Lagoons | 100 Mile Ranch |
| 4 | 10.01 | Willowdale | 100 Mile Ranch |
| 5 | 52.8 | Site 5 | District of 100 Mile House |

**4.0 Targets for Sustainable Community Water**

The current demand on the water treatment plant and sewage disposal systems, in conjunction with the District's commitment to sustainable environmental policies has initiated the following parameters:

- To conserve the water thereby enhancing the natural environment
- Reduce the volume of waste water to the District's sewer system
- Education and awareness of the public with regards to water resources
- Implementation of a watershed management plan
- Minimizing greenhouse gas emissions by reducing energy consumption

The Districts OCP Natural Environment objectives also support these initiatives:

.1 Continue to strive to enhance Environmentally Sensitive Areas (ESA's) within the District boundaries;

.2 Exercise good stewardship of the Bridge Creek watershed;

.3 Provide a level of protection for both people and property from identifiable natural hazards in the District; and

.4 Maintain high water quality in surface water, ground water and aquifers.

The District's 2008 tax roll lists the following breakdown of eligible units:

- Residential 609
- Farm 5
- Strata (residential) 123
- Commercial 252
- Industrial 30
- The program will be structured to target residential users (737 total) first as this would potentially net the most reduction.

## 5.0 Conservation Methods

To date the District's conservation method has been seasonal sprinkler restrictions, commercial metering and limited public education.
The 2006 BC Building Code initiatives OE1 Energy Efficiency and OE2 Water Efficiency ensure new construction meets the Districts sustainability policies.

The District supports the implementation of the following initiatives subject to Council review and budget constraints.

- Continue sprinkler restrictions
- Enhance public education and awareness
- Implement residential plumbing fixture replacement program
- Implement commercial plumbing fixture replacement program
- Require installation of residential meters in new residential construction
- Meter existing residential units
- Initiate residential metering program

## 6.0 Implementation

The implementation process and dates are subject to budget and human resource allocation limitations. The program aims to set realistic target dates with cost estimates to be used in subsequent budget deliberations.

### 6.1 Public Education

The District's utility billing is mailed out quarterly in which the District can insert educational pamphlets. The District will work in conjunction with Interior Health to promote conservation and watershed stewardship. Informational brochures on efficient plumbing, xeriscaped landscaping, composting toilets ect. can be inserted. While data indicates educational promotions do not net large conservation results the costs are relatively low.

Implemented date March 2011 estimated cost $600 per year

### 6.2 Residential plumbing fixture replacement program

The District in 2011 had a residential roll count of 737 including strata units. With a well managed program the District hopes to generate a participation rate of 40% in the first five years. The District plan includes the replacement of 13L per flush toilets with high efficiency <6L per flush toilets in conjunction with water efficient shower heads and faucet aerators. The program will be developed as a multi-year initiative at a projected cost of $300 per household.

Similar programs in B.C. have shown an average decrease in household consumption of 24%.

- Planning and development including projected flow reductions- completion date October 2013
- Budget consideration for 2014 - November 2013
- Implementation of program March 2014 ( budget 60 units) $ 18,000 per year

**6.2 Commercial plumbing fixture replacement program**

Extension of the program to include commercial and institutional users would be initiated following analysis of the results of the residential program. Examples from the Sunshine Coast Regional District's commercial pilot program show and average of 34% reduction in consumption.

- Review residential program and develop commercial program March 2016
- Budget consideration for 2017 - November 2016
- Implementation of program March 2017 Costs to be determined in development stage

**6.2 Metering**

The Districts long term plan includes an initiative to meter residential users.

- Require installation of meters for new construction Bylaw update 2014
- Retrofit existing residences with meters program development 2016
- Implement global metering 2020

# REFERENCE DOCUMENTS


- Sewage Treatment and Disposal Study - Urban Systems Ltd. 2007
- Water Treatment Study – Urban Systems Ltd. 2007
- Population Forecast – Urban Systems 2007
- Water Supply Study – Urban Systems Ltd. 2008
- District of 100 Mile House Annual Water Report 2011

# APPENDIX A

Population Forecast

Suite 200 - 286 St. Paul Street, Kamloops, BC V2C 6G4
Telephone: 250-374-8311 Fax: 250-374-5334

URBANSYSTEMS.

## MEMORANDUM

| | |
|---|---|
| date: | April 24, 2007 |
| to: | Darrell Blades - District of 100 Mile House - Director of Community Services |
| cc: | |
| from: | Matthew Davis - Project Engineer |
| file #: | 0614.0031.01 - 0614.0034.01 |
| subject: | **DISTRICT OF 100 MILE HOUSE - POPULATION FORECAST** |

### Introduction

Urban Systems is assisting the District of 100 Mile House with reviews of its water and sanitary sewer systems. On the water side, we are examining opportunities for a reliable water supply in the long term and analyzing the existing water system for its capacity to service the existing population and proposed future development. On the sanitary sewer side, we are looking at long term treatment and disposal options and the capacity of the existing sewer collection system to service the existing population and future development within the District. An underlying consideration for this work is what the current population is and how that service population will change in the future.

Forecasting population growth is by no means an exact science. There are many influencing factors including local economy, regional economy, demographics, and environmental factors including the recent Pine Beetle infestation. As such, a more useful tool is to give a range of population growth scenarios and, based on those scenarios, identify population horizons that the District should plan its infrastructure work around.

### Historic Population

The British Columbia – BC Stats webpage has population information for the District of 100 Mile House for 1996 to present. The attached figure shows the variation in the population during this period. The overall trend for this period is a decrease in population of about 1.14% per anum. Since 2001 however, there has been a 0.22% annual growth rate. As illustrated by this range (and also depicted in the figure), relying strictly on past growth trends to predict community growth can result in a large range of future populations.

### Population Forecast

Although the past 10 year population trend has been negative, it does not make sense to plan for future infrastructure based on a negative growth rate. For example, infrastructure must be sized to meet the needs of the current population, and if population does decrease over time, the infrastructure will have additional capacity.

The short term forecast has been positive at approximately 0.22%. Therefore, estimating on the high side, it is proposed to use a 0.5% growth rate over the next 20 years. This provides a generous estimate of future population growth based on recent growth trends. A 0.5% growth rate will result in an increase of approximately 180 people over the next 20 years. This is an increase of approximately 10% over the current population in the District.

The District has indicated that approximately 170 new lots have been identified for development around the community. The 2006 census data has indicated that the average number of people per single family residence, which it is assumed these lots will be, is 2.3. Assuming these lots are developed and occupied over the next 20 years results in a population increase of 390 people which is approximately equivalent to a 1% annual population growth rate.

The forecasted population "envelope" therefore is between 0 and 390 people over the next 20 years. This range will be utilized to compare existing infrastructure capacity and the need for upgrades in the water and sewer studies that are currently being undertaken by Urban Systems Ltd.

**Conclusions**

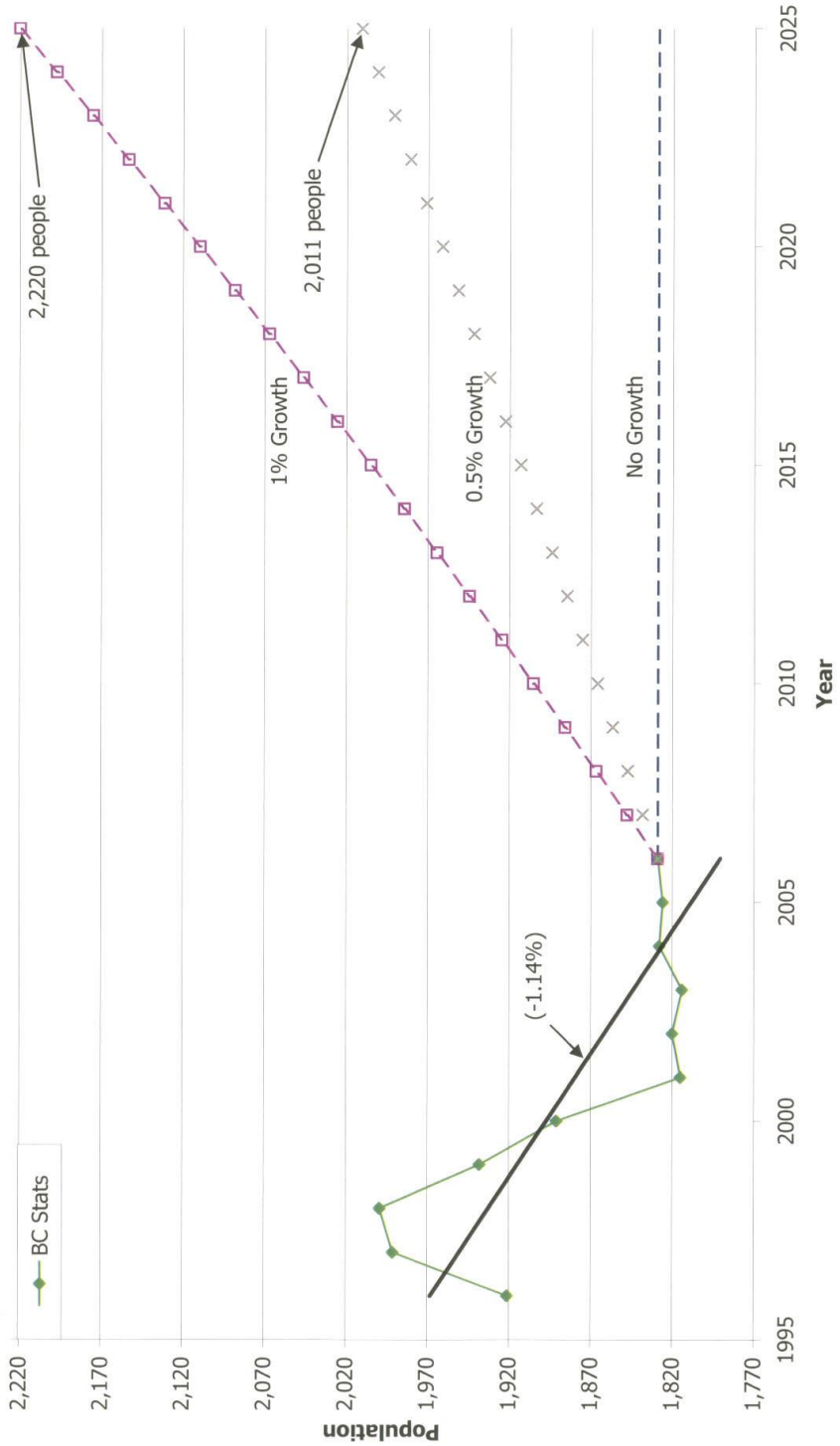
Population estimates should be referred to and updated frequently. Although largely inaccurate by definition, they are the primary tool a municipality has for estimating when expanded infrastructure capacity will be required. By comparing infrastructure population horizons with the current population and growth rate on a regular basis, the District will be more able to predict when infrastructure upgrades are required.

**URBAN SYSTEMS LTD.**

Matthew Davis, EIT
Project Engineer

*U:\Projects_KAM\0614\0031\01\X-Single-File\2007-04-24-Memo-Pop forecast.doc*

**Figure 1: District of 100 Mile House - Historic Population and Forecasted Population Growth**



# APPENDIX B

2011 District of 100 Mile House Annual Water Report

# DISTRICT OF 100 MILE HOUSE
# ANNUAL WATER REPORT
# 2011

In accordance with Interior Health Permit 14-091-00164 for the 100 Mile House Water System, the following is an annual report on the status of the 100 Mile House Water System for the period of January 1, 2011– December 31, 2011.

The report contains:

- An Overview of the Maintenance Program
- Average Daily Water Flows
- Peak Daily Water Flows
- Monthly Total Water Flows
- Bacteriological Testing Results
- Chemical Water Testing

Please forward any concerns or questions to the District of 100 Mile House Community Services Department.

Contact:
Kevin Dicken
Operations Supervisor
(250) 395-2123
kdicken@dist100milehouse.bc.ca

## Water Maintenance Schedule

## Daily

- Physical Inspection of all Water Stations
    - Water Treatment Plant
        - NTU in Clear Well
        - Free & Total Chlorine Residuals in Clear Well
        - Total Volume of Water Treated and Filtered
        - Chlorine Flow
        - Pump Hours
        - Filter Head Loss
        - pH of filtered water
        - UV system records
    - Low Zone Reservoir
        - Reservoir Level
    - High Zone Pumping Station
        - Pumping Hours
    - Well #4 Pump House
        - Pumping Hours
        - Total Volume of Water used
        - Hypochlorite Usage
        - Vandalism

## Weekly

- Horse Lake Control Structure Inspection
    - Record Level at Horse Lake
    - Record Level at Control Structure
    - Monitor Log Positions
    - Debris Removal
    - Vandalism
    - Rodent Control

- High Zone Reservoir
    - Reservoir Level
    - Vandalism
- Bacteriological Sampling @ three locations

## Bi–Weekly

- Clean Inside of All Buildings (as required)
- Cleaning of W.T.P. intake/ or as needed
- Main flushing Exeter Rd. Industrial area.

## Bi-Annually

- Flush Water Distribution System
- Maintain Fire Hydrants and Standpipes

## General (Ongoing)

- Inspect Water Mains and Services for Leaks
- Test and Inspect New Services
- Respond to Requests for Water Service Turn-on and Shut-off
- Inspect Filter Beds and Pump Houses for Freezing
- Attend Emergency Water Calls and Repairs
- Ensure Access to Fire Hydrants
- Valve exercising
- Service card updates (and locates)
- New service cards

## Maintenance Project Overview

- New rota meter in W.T.P.
- Install second turbidity meter
- Relocation of chlorine analyzer to HZ Pump house
- Raw Water Augmentation
- Completion of UV Disinfection Project

## Future Development Upgrades (proposed):

- Further development of Cross Connection Control program
- Eliminate services on 2" main on Alder Avenue and connect to new main
- Connect main from 8$^{th}$ to Spruce Avenue to complete loop
- W.T.P. media replacement and cleaning
- Decommission water wells #2 & #3
- PRV Replacement
- Conversion from chlorine gas to sodium hypochlorite.

Maintenance concerns or questions please contact:

Kevin Dicken
Operations Supervisor
(250) 395-2123

## Average Daily Water Flows

| Month | Cubic Meters |
|---|---|
| January 2011 | 1290 |
| February 2011 | 1292 |
| March 2011 | 1376 |
| April 2011 | 1411 |
| May 2011 | 1553 |
| June 2011 | 1665 |
| July 2011 | 1718 |
| August 2011 | 2254 |
| September 2011 | 2011 |
| October 2011 | 1471 |
| November 2011 | 1530 |
| December 2011 | 1572 |

## Peak Daily Water Flows

| Day | Cubic Meters |
|---|---|
| January 19, 2011 | 1665 |
| February 14, 2011 | 1861 |
| March 15, 2011 | 1609 |
| April 27, 2011 | 1680 |
| May 10, 2011 | 2175 |
| June 30, 2011 | 2554 |
| July 6, 2011 | 2530 |
| August 17, 2011 | 3334 |
| September 10, 2011 | 2784 |
| October 5, 2011 | 2104 |
| November 23, 2011 | 1902 |
| December 27, 2011 | 2152 |

## Total Monthly Water Flows (m3)

| Month | WTP | Well #4 | Total |
|---|---|---|---|
| January 2011 | 39,981 | 0 | 39,981 |
| February 2011 | 36,189 | 0 | 36,189 |
| March 2011 | 42,597 | 50 | 42,647 |
| April 2011 | 42,237 | 100 | 42,337 |
| May 2011 | 45,494 | 2652 | 48,146 |
| June 2011 | 49,673 | 276 | 49,949 |
| July 2011 | 52,886 | 383 | 53,269 |
| August 2011 | 66,166 | 3694 | 69,860 |
| September 2011 | 58,317 | 1998 | 60,315 |
| October 2011 | 45,273 | 336 | 45,609 |
| November 2011 | 44,690 | 1201 | 45,891 |
| December 2011 | 48,233 | 503 | 48,736 |

## Bacteriological Testing Results

| JAN 11 | Location | E.Coli | Total Coliform |
|---|---|---|---|
| 5 | 100M N&U | <1 | <1 |
| 5 | VIC | <1 | <1 |
| 5 | Red Coach | <1 | <1 |
| 12 | District Off | <1 | <1 |
| 12 | High Lift St. | <1 | <1 |
| 12 | Super 8 | <1 | <1 |
| 19 | 100M N&U | <1 | <1 |
| 19 | Red Coach | <1 | <1 |
| 19 | VIC | <1 | <1 |
| 26 | District Off | <1 | <1 |
| 26 | WTP sink | <1 | <1 |
| 26 | Super 8 | <1 | <1 |

| MAR 11 | Location | E.Coli | Total Coliform |
|---|---|---|---|
| 2 | Petro can | <1 | <1 |
| 2 | Ramada | <1 | <1 |
| 2 | VIC | <1 | <1 |
| 9 | WTP Sink | <1 | <1 |
| 9 | Petro Can | <1 | <1 |
| 9 | Super 8 | <1 | <1 |
| 9 | District Off | <1 | <1 |
| 17 | 100M N&U | <1 | <1 |
| 17 | Petro Can | <1 | <1 |
| 17 | VIC | <1 | <1 |
| 17 | Red Coach | <1 | <1 |
| 23 | WTP Sink | <1 | <1 |
| 23 | District Off | <1 | <1 |
| 23 | Super 8 | <1 | <1 |
| 30 | 100M N&U | <1 | <1 |
| 30 | Petro Can | <1 | <1 |
| 30 | Red Coach | <1 | <1 |
| 30 | VIC | <1 | <1 |

| FEB 11 | Location | E.Coli | Total Coliform |
|---|---|---|---|
| 2 | 100M N&U | <1 | <1 |
| 2 | Petro Can | <1 | <1 |
| 2 | Red Coach | <1 | <1 |
| 2 | VIC | <1 | <1 |
| 9 | WTP Sink | <1 | <1 |
| 9 | District Off | <1 | <1 |
| 9 | Super 8 | <1 | <1 |
| 17 | Petro Can | <1 | <1 |
| 17 | Red Coach | <1 | <1 |
| 17 | VIC | <1 | <1 |
| 17 | 100M N&U | <1 | <1 |
| 24 | WTP Sink | <1 | <1 |
| 24 | Red Coach | <1 | <1 |
| 24 | District Off | <1 | <1 |

| APRIL 11 | Location | E.Coli | Total Coliform |
|---|---|---|---|
| 6 | Petro Can | <1 | <1 |
| 6 | District Off | <1 | <1 |
| 6 | Super 8 | <1 | <1 |
| 6 | WTP Sink | <1 | <1 |
| 13 | Red Coach | <1 | <1 |
| 13 | 100M N&U | <1 | <1 |
| 13 | Petro Can | <1 | <1 |
| 13 | VIC | <1 | <1 |
| 20 | WTP Sink | <1 | <1 |
| 20 | District Off | <1 | <1 |
| 20 | Ramada | <1 | <1 |
| 20 | Cedars #303 | <1 | <1 |
| 28 | District Off | <1 | <1 |
| 28 | Petro Can | <1 | <1 |
| 28 | VIC | <1 | <1 |
| 28 | 100M N&U | <1 | <1 |

| MAY 11 | Location | E.Coli | Total Coliform |
|---|---|---|---|
| 4 | WTP Sink | <1 | <1 |
| 4 | Red Coach | <1 | <1 |
| 4 | Ramada | <1 | <1 |
| 11 | 100M N&U | <1 | <1 |
| 11 | Petro Can | <1 | <1 |
| 11 | VIC | <1 | <1 |
| 19 | Petro Can | <1 | <1 |
| 19 | Red Coach | <1 | <1 |
| 19 | Ramada | <1 | <1 |
| 19 | WTP Sink | <1 | <1 |
| 26 | 100M N&U | <1 | <1 |
| 26 | District Off | <1 | <1 |
| 26 | VIC | <1 | <1 |

| JUNE 11 | Location | E.Coli | Total Coliform |
|---|---|---|---|
| 1 | Petro Can | <1 | <1 |
| 1 | Ramada | <1 | <1 |
| 1 | Red Coach | <1 | <1 |
| 8 | Petro Can | <1 | <1 |
| 8 | VIC | <1 | <1 |
| 8 | District Off | <1 | <1 |
| 23 | Petro Can | <1 | <1 |
| 23 | District Off | <1 | <1 |
| 23 | VIC | <1 | <1 |
| 29 | Red Coach | <1 | <1 |
| 29 | Ramada | <1 | <1 |
| 29 | Petro Can | <1 | <1 |

| JULY 11 | Location | E.Coli | Total Coliform |
|---|---|---|---|
| 6 | 100M N&U | <1 | <1 |
| 6 | D. Office | <1 | <1 |
| 6 | VIC | <1 | <1 |
| 13 | Red Coach | <1 | <1 |
| 13 | Petro Can | <1 | <1 |
| 13 | Ramada | <1 | <1 |
| 20 | 100M N&U | <1 | <1 |
| 20 | D. Office | <1 | <1 |
| 20 | VIC | <1 | <1 |
| 27 | Red Coach | <1 | <1 |
| 27 | Petro Can | <1 | <1 |
| 27 | Ramada | <1 | <1 |

| AUG 11 | Location | E.Coli | Total Coliform |
|---|---|---|---|
| 3 | District Off | <1 | <1 |
| 3 | VIC | <1 | <1 |
| 3 | Petro Can | <1 | <1 |
| 10 | Red Coach | <1 | <1 |
| 10 | Petro Can | <1 | <1 |
| 10 | Ramada | <1 | <1 |
| 17 | 100M N&U | <1 | <1 |
| 17 | District Off | <1 | <1 |
| 17 | VIC | <1 | <1 |
| 24 | Red Coach | <1 | <1 |
| 24 | Petro Can | <1 | <1 |
| 24 | Ramada | <1 | <1 |
| 31 | District Off | <1 | <1 |
| 31 | VIC | <1 | <1 |
| 31 | Petro Can | <1 | <1 |

| SEP 11 | Location | E.Coli | Total Coliform |
|---|---|---|---|
| 8 | Red Coach | <1 | <1 |
| 8 | Ramada | <1 | <1 |
| 8 | WTP Sink | <1 | <1 |
| 14 | District Off | <1 | <1 |
| 14 | VIC | <1 | <1 |
| 14 | 100M N&U | <1 | <1 |
| 21 | WTP Sink | <1 | <1 |
| 21 | Petro Can | <1 | <1 |
| 21 | Red Coach | <1 | <1 |
| 28 | District Off | <1 | <1 |
| 28 | VIC | <1 | <1 |
| 28 | Ramada | <1 | <1 |

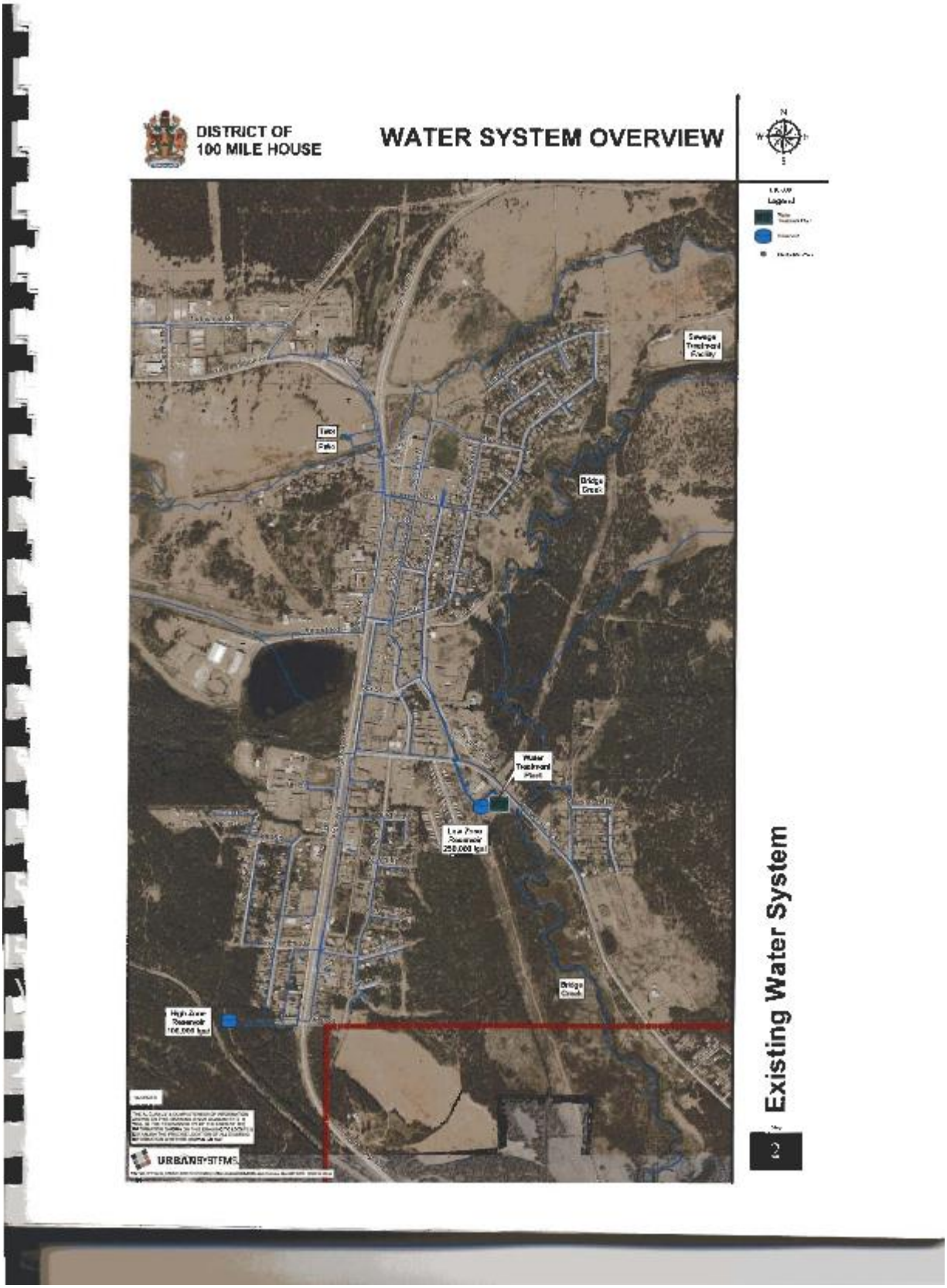
| OCT 11 | Location | E.Coli | Total Coliform |
|---|---|---|---|
| 6 | WTP Sink | <1 | <1 |
| 6 | Petro Can | <1 | <1 |
| 6 | Red Coach | <1 | <1 |
| 13 | District Off | <1 | <1 |
| 13 | VIC | <1 | <1 |
| 13 | Ramada | <1 | <1 |
| 19 | WTP Sink | <1 | <1 |
| 19 | 100M N&U | <1 | <1 |
| 19 | Red Coach | <1 | <1 |
| 27 | District Off | <1 | <1 |
| 27 | Ramada | <1 | <1 |
| 27 | VIC | <1 | <1 |

| NOV 11 | Location | E.Coli | Total Coliform |
|---|---|---|---|
| 2 | WTP Sink | <1 | <1 |
| 2 | Petro Can | <1 | <1 |
| 2 | Red Coach | <1 | <1 |
| 9 | District Off | <1 | <1 |
| 9 | Ramada | <1 | <1 |
| 9 | VIC | <1 | <1 |
| 16 | 100M N&U | <1 | <1 |
| 16 | Petro Can | <1 | <1 |
| 16 | Red Coach | <1 | <1 |
| 23 | WTP Sink | <1 | <1 |
| 23 | Petro Can | <1 | <1 |
| 23 | VIC | <1 | <1 |
| 30 | District Off | <1 | <1 |
| 30 | Ramada | <1 | <1 |
| 30 | Red Coach | <1 | <1 |

| DEC 11 | Location | E.Coli | Total Coliform |
|---|---|---|---|
| 7 | 100M N&U | <1 | <1 |
| 7 | Petro Can | <1 | <1 |
| 7 | VIC | <1 | <1 |
| 14 | Red Coach | <1 | <1 |
| 14 | District Off | <1 | <1 |
| 15 | WTP Sink | <1 | <1 |
| 20 | Petro Can | <1 | <1 |
| 20 | VIC | <1 | <1 |
| 20 | Ramada | <1 | <1 |
| 29 | Red Coach | <1 | <1 |
| 29 | District Off | <1 | <1 |
| 29 | Sunrise Ford | <1 | <1 |

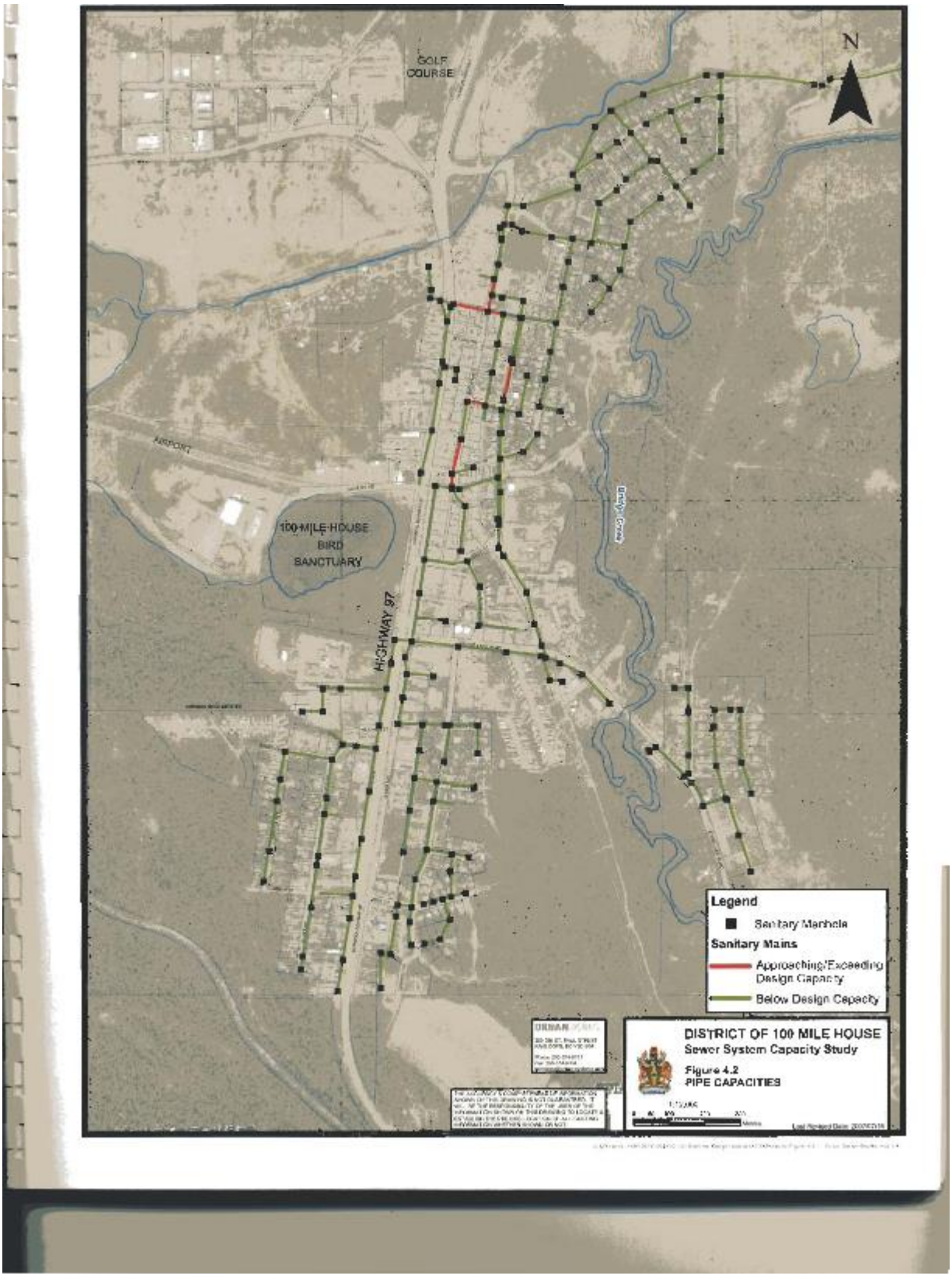
# APPENDIX C

## Water System Map


DISTRICT OF
100 MILE HOUSE
WATER SYSTEM OVERVIEW
Sewage Treatment Facility
Bridge Creek
Water Treatment Plant
Low Zone Reservoir 250,000 Igal
Bridge Creek
High Zone Reservoir
URBANSYSTEMS
Existing Water System
2

# APPENDIX D

## Sanitary Sewer Collection System Map


GOLF COURSE
N
AIRPORT
100 MILE HOUSE BIRD SANCTUARY
HIGHWAY 97
Legend
Sanitary Manhole
Sanitary Mains
Approaching/Exceeding Design Capacity
Below Design Capacity
DISTRICT OF 100 MILE HOUSE
Sewer System Capacity Study
Figure 4.2
PIPE CAPACITIES