DISTRICT OF LILLOOET

WATER CONSERVATION PLAN

TRUE
CONSULTING GROUP

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DISTRICT OF LILLOOET
WATER CONSERVATION PLAN

TABLE OF CONTENTS

Page

Executive Summary

1.0 Introduction....1

2.0 Existing Water Systems....2

2.1 General Description....2
2.2 Recorded Data and Inaccuracies....3

3.0 Current Water System Operational Data....5

3.1 General....5
3.2 Municipal System Water Consumption....5
3.2.1 Annual Average Water Consumption....5
3.2.2 Maximum Day Water Demands....8
3.2.3 Comparison to Other Southern Interior Municipalities....8
3.3 Municipal System Water Costs....11
3.4 Wastewater Treatment and Disposal Costs....13

4.0 Future Projections and Planning....14

4.1 Municipal System Capital Plan....14
4.2 Population and Water Demand Projections....15

5.0 Water Conservation Measures....18

5.1 General Objectives....18
5.2 Leak Detection and Repair....19
5.2.1 Description and Experience....19
5.2.2 Lillooet Assessment....19
5.2.3 Cost Benefit....20
5.3 Universal Water Metering....21
5.3.1 Description and Experience....21
5.3.2 Rate Structure....22
5.3.3 Cost Benefit Analysis....23
5.4 Public Education and Information....24
5.4.1 Description and Experience....24
5.4.2 Lillooet Assessment....25
5.4.3 Cost Benefit Analysis....26

DISTRICT OF LILLOOET
WATER CONSERVATION PLAN

TABLE OF CONTENTS
(continued)

Page

5.5 Low Flush Toilets 27
5.5.1 Description 27
5.5.2 Experience 27
5.5.3 Lillooet Assessment 30
5.5.4 Cost Benefit Analysis 31
5.6 Low Flow Fixtures 32
5.6.1 Description and Experience 32
5.6.2 Lillooet Assessment 32
5.6.3 Cost Benefit Analysis 33
5.7 Water Conserving Appliances 35
5.7.1 Description 35
5.7.2 Experience 35
5.7.3 Lillooet Assessment 36
5.8 Landscaping 37
5.8.1 Description 37
5.8.2 Experience 37
5.8.3 Lillooet Assessment 40
5.9 Rain Barrels 41
5.9.1 Description 41
5.9.2 Experience 41
5.9.3 Lillooet Assessment 42
5.10 Major User Audits 43
5.10.1 Description and Experience 43
5.11 Watering Restrictions 44
5.11.1 Description and Experience 44

6.0 Summary and Recommendations 47
6.1 Summary 47
6.2 Recommendations 52
6.3 Water Conservation Program 54

EXECUTIVE SUMMARY

Water consumption in Lillooet is extremely high in comparison to other BC interior communities. Lawn and garden irrigation is the largest component of residential water use, comprising 50% to 75% of all water consumed. Irrigation amounts are typically climate and lot size dependent; a high percentage of large rural lots, a hot/dry climate, and free-draining soils all contribute to increase Lillooet's water consumption.

As a result of its current water consumption, the District will be faced with significant financial challenges in the future, associated with compliance with the IHA Drinking Water Objectives. To ensure the sustainability of its water system, and increase the probability of infrastructure grant funding assistance from senior levels of government, the District must be proactive in trying to reduce its water consumption.

Existing maximum day per capita demands in Lillooet are currently 4225 L/capita/day. Average day demands are 1920 L/capita/day. These demand values currently include all water uses within the District (residential, commercial, institutional). The District should set goals to reduce these maximum and average day demands to 3000 L/capita/day and 1000 L/capita/day, respectively. The primary forms of demand management that will be needed to achieve these goals include:

- leak detection and repair (potential 20% reduction)
- universal water metering and metered rate structure (estimated 20% average day and 10% maximum day reductions)
- public education and information (estimated 2 – 5% reduction)

Additional demand management strategies should also be given consideration once a universal metering program is in place to form a well rounded water conservation program. The benefits of these additional strategies will be variable, and dependent on public participation rates. These complementary demand management strategies include:

- low flush toilets (maximum 2% demand reduction)
- low flow fixtures (maximum 0.5% reduction)
- water conserving appliances (maximum 1% reduction)
- landscaping incentives (uncertain results)
- rain barrels (maximum 1% reduction)
- watering restrictions (uncertain results)

Overall water conservation program costs will depend on the strategies implemented; the capital costs to implement a universal water metering and metered rate structure program are estimated at $1,000,000. It is recommended that the District apply for funding from senior levels of government to assist with the implementation of such a program. In addition, the water conservation program is not a “one time” cost. Implementation will require perseverance on behalf of the District over a number of years in order to successfully reduce its water consumption.

TRUE Consulting prepared a draft version of the "Master Water Plan" for the District of Lillooet in April 2008. The most fundamental conclusions of the water plan are:

- Water demands on a per capita basis for the District are extremely high relative to other municipalities in the interior of BC, as well as Canadian averages.
- Significant improvements to water supply and treatment infrastructure will be required in order to meet Interior Health Authority (IHA) Drinking Water Objectives.
- Reduction in water usage will be less costly than construction of water treatment plant capacity.

The combination of those factors means that, unless changes are made, Lillooet will face significant financial challenges associated with future water treatment compliance. It is likely that future funding assistance for major water treatment works would be conditional upon implementation of water conservation strategies. Therefore in 2007 application was made for funding assistance through the BC Infrastructure Planning Grant Program to prepare a Water Conservation Plan.

The purpose of this document is to assess current water usage within Lillooet, and review various conservation strategies in relation to probable outcomes (in terms of both volume/usage and financial change). Adaption of this document and implementation of recommended strategies will benefit both water customers and taxpayers within the District.

2.1 General Description

The District of Lillooet owns and operates water systems that service three separate service areas, summarized as follows:

- Central Lillooet
  - Supplied by means of Town Creek, and three drilled wells at Conway Park (two wells) and the Rec Centre (one well). The Rec Centre also has a second drilled well which has not been completed, but is available for future capacity.
  - Balancing storage provided by 1.0M Igal concrete tank (FWL=329m). and 250,000 Igal wood stave tank (FWL=373m).
  - Services approximately 750 connections (85% residential, 15% commercial).

- North Lillooet
  - Supplied by Dickey Creek.
  - Balancing storage provided by 310,000 Igal concrete tank (FWL=353m).
  - Services approximately 250 connections (primarily rural residential).

- East Lillooet
  - Supplied by means of two drilled wells, one servicing the industrial park and one for the airport. In addition, the District has recently acquired two additional wells for future use; these wells are located near Bridgride Forest Products.
  - Balancing storage does not exist. Pressures in this system are maintained by pressure tanks at the wellheads.
  - Services approximately 10 industrial and commercial connections, as well as the airport.

Lillooet's water system infrastructure is depicted on Figure 2.1 As shown on this figure; the piped network that distributes water to these areas is comprised of:

- 1000m of 38mm and 50mm dia. watermain
- 5000m of 100mm dia. watermain
- 12,400m of 150mm dia. watermain
- 6000m of 200mm dia. watermain
- 2500m of 250mm dia. watermain
- 1000m of 300mm dia. watermain

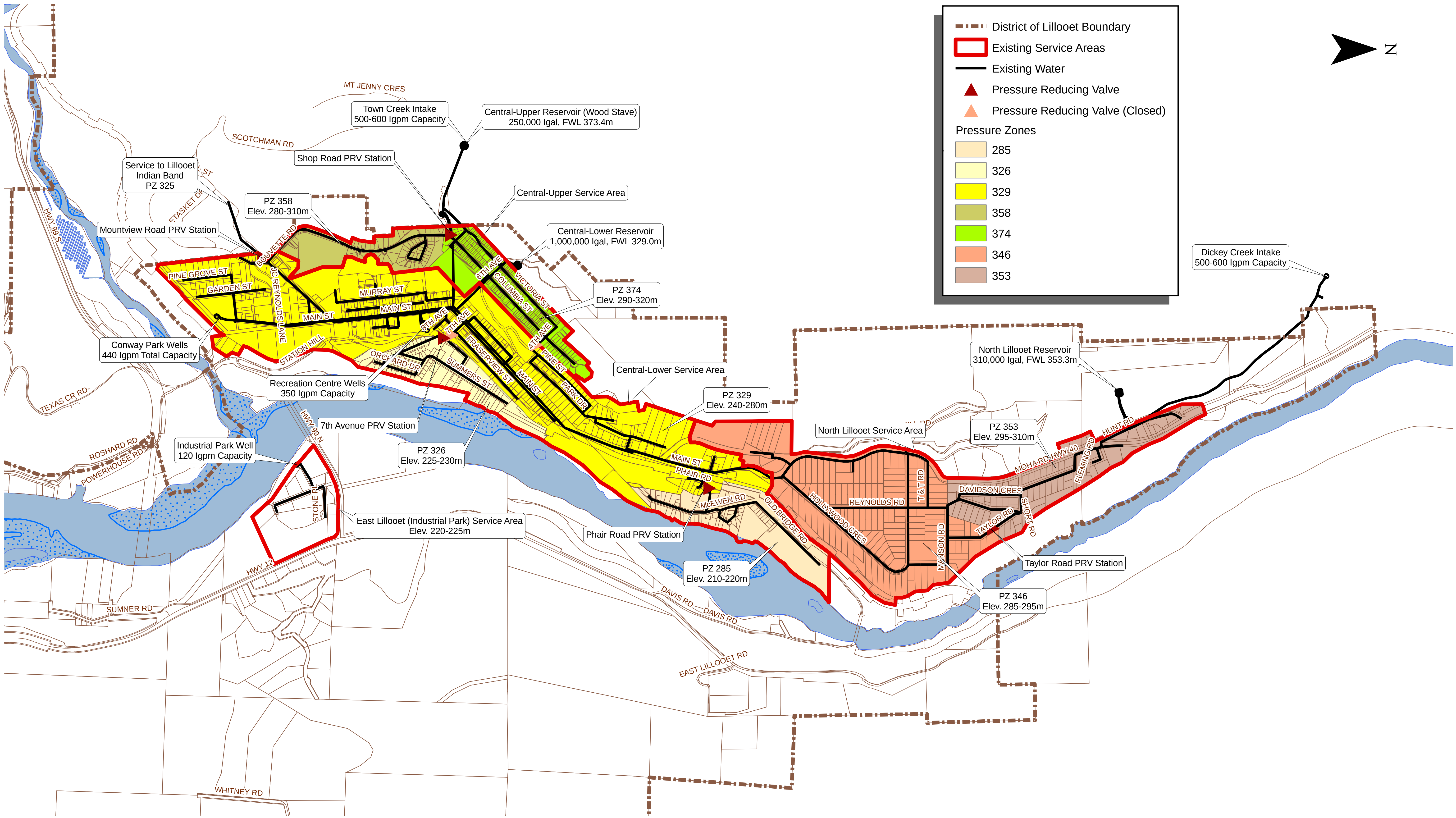
2.2 Recorded Data and Inaccuracies

The District's water demands have been recorded on a daily basis at all supply sources by public works for a number of years. This type of information is crucial for planning documents and, ultimately, design of upgrades.

The only known significant cause for inaccuracy in recorded water use data relates to Town Creek usage. This is a result of wood stave reservoir leakage. Flow is recorded before water enters the reservoir; therefore, recorded demand values for Town Creek are high, proportional to leakage. Actual leakage likely fluctuates throughout the seasons (and with reservoir age).

In the winter of 2006/2007, this reservoir was out of use temporarily due to collapse of the roof structure. During this period, leakage was measured and determined to be roughly 180m^3/day (40,000 Igal). Since we have no other recorded leakage values, 180m^3/day (66 ML/year) will be subtracted from all Town Creek recorded flow.

Other potential sources of inaccuracy are the flow measuring devices themselves. The Dickey Creek and Rec Well sources utilize fairly modern magmeters, and are expected to be accurate within a percent of actual. The Conway Park wells utilize turbine style meters – over time, this style of meter will impart some level of inaccuracy as its mechanical components wear. The Town Creek source utilizes a dated paddle-style meter; this style of meter (and its age) likely result in the largest amount of recording error of all the District's flow measuring devices.



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Existing Water System Layout

District of Lillooet
Water Conservation Plan

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3.1 General

Fundamental to estimating the benefits of a water conservation plan is defining the current situation from the perspective of both water consumption and costs.

Daily flow meter readings taken by District staff at each water source and the District's yearly water utility expense reports have been used, along with BC Stats population figures, to divide municipal water demands into per capita and unit cost figures. These per capita figures can then be used for consumption and cost reduction estimation, and comparison with other municipalities.

A strong and accurate understanding of the existing and future water demands is crucial in evaluating water conservation options and estimating corresponding reductions in demands, as well as estimating reductions in the cost to provide the water service.

3.2 Municipal System Water Consumption

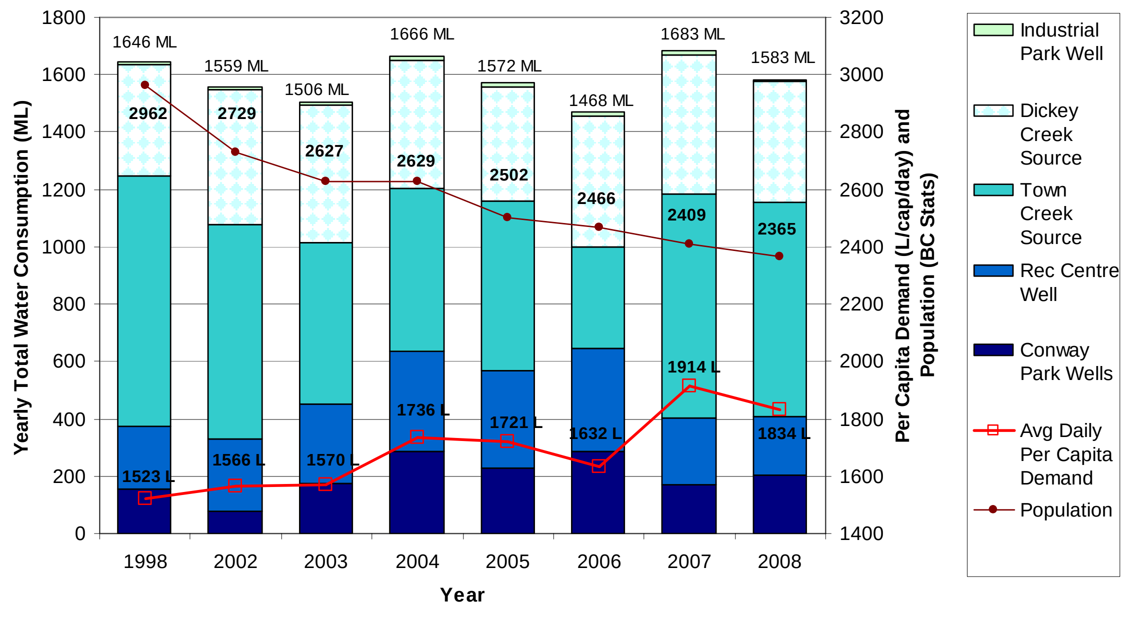
3.2.1 Annual Average Water Consumption

Water consumption data for the District's municipal water system has been reviewed and assessed for the period 2002 to 2008 to determine current annual average day and maximum day water usage on a per capita basis. The District's municipal water system supplies areas within the municipal boundaries as well as to the T'it'q'et Indian Band. The municipal water supply system can be broken down into three service areas (as shown in Figure 3.1):

- North Lillooet (supplied by Dickey Creek).
- Central Lillooet (supplied by Town Creek, and Conway Park and Rec Centre wells).
- East Lillooet (two service areas supplied by Industrial Park Well and the airport well).

Figure 3.1 depicts total annual water consumption data by source for the District's municipal system for the period 2002 to 2008.

Figure 3.1 Lillooet Water Consumption and Population



The following observations can be made with regards to the data depicted in Figure 3.1.

- since 1998, total population has decreased by 25%, averaging 2.3% reduction per year.
- since 1998, average daily per capita demands have increased by 20%, averaging 1.9% increase per year.
- total annual water consumption trended "downwards" in conjunction with population, with the following exceptions:
  - a 10% increase in total water consumption in the 2003 – 2004 period.
  - a 15% increase in total water consumption in the 2006 – 2007 period.

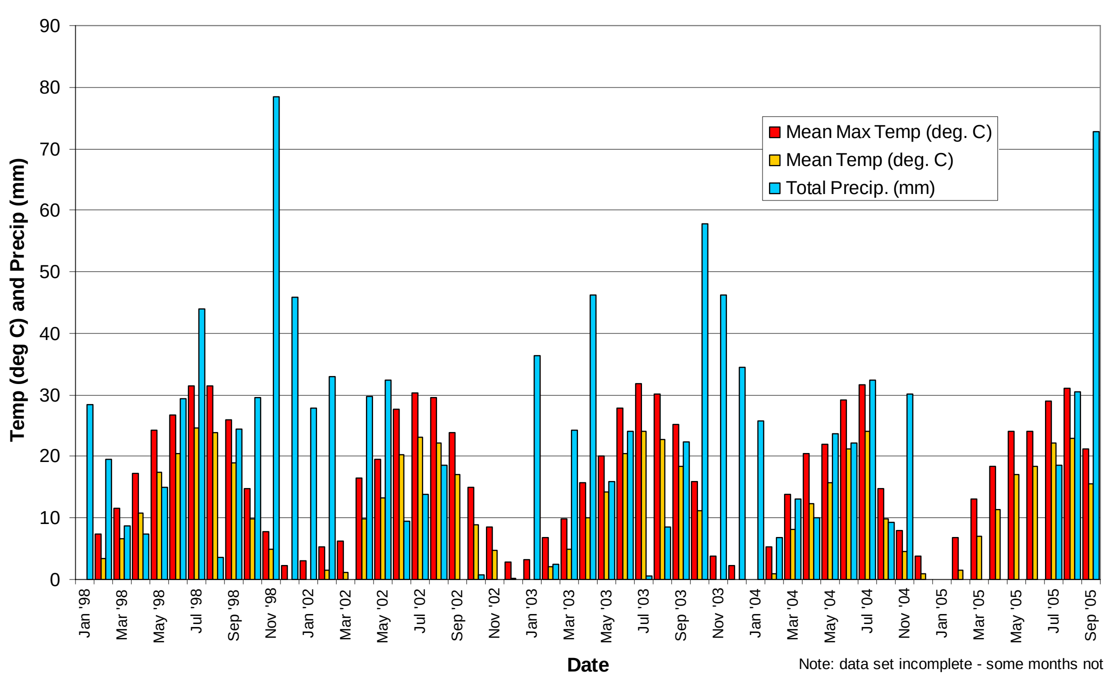
The apparent 20% increase in average per capita water demand over the past 10 years is unusual. Possible explanations for this "phenomenon" include:

- climate change. An increase in daily temperatures, and/or a reduction in precipitation through the irrigation season would likely result in increased irrigation usage – and therefore increased water demands. We reviewed climate data for the Lillooet area for this period (see Figure 3.2); no significant change in temperature or precipitation was noticed. As such, the effects of climate change on Lillooet's water demands are likely minimal.

- an increase in water system leakage; i.e. buried pipes leaking to coarse grained soils, and not surfacing where the leak could be detected and repaired.
- general increase in water usage on a household basis. This could potentially be a result in a decreasing population, with the percentage of population decrease leaving smaller dwellings with smaller outdoor irrigation usage. Similarly, the population decrease could be tied to the younger generation moving out of their parents' home, and moving away from Lillooet. As a result of a decrease in these population demographics, the District would be left with a smaller number of citizens living in larger dwellings with continued large irrigation demands, and corresponding larger per capita water consumption numbers.
- inaccuracies in the flow measuring equipment, as mentioned in Section 2.2.

Based on the sudden "jumps" in consumption seen in the 2003 – 2004 and 2006 – 2007 periods, it is most likely that the 20% increase in per capita demands seen in Figure 3.1 is a result of water system leakage.

Figure 3.2 - Historical Monthly Weather Data - Lillooet (1998, 2002-2005)



Note: data set incomplete - some months not available from Enviro Canada

Accurate and complete water consumption data is essential for the design of water supply system improvements and assessments of benefits achieved by water consumption programs. Calculation of domestic water consumption from historical supply data is complicated by unknown and possibly significant leakage from an aging reservoir and distribution system. The District is in the process of replacing the Town Creek reservoir and flow meter which will help improve the accuracy of any future water system assessments.

For the purposes of the current review, the current average day demand is calculated based on the 2007 – 2008 data, as follows:

- Total recorded flow (Jan.1/07 – Dec. 31/08) = 719,383,000 Igal
- Average Daily Demand (ADD) = 719,383,000/2/365 = 985,456 Igal

Say 1,000,000 Igal/day (4.5 ML/day)

3.2.2 Maximum Day Water Demands

The maximum day water demand is the most important demand criteria for the purposes of assessing the adequacy of supply capacity and determining when additional source capacity has to be constructed.

To reduce the effect of daily anomalies such as differences in time of day when flows are recorded, maximum day demands are calculated based on the maximum demands week (five consecutive days) in recent years, as follows:

- Total flow, maximum week 2005 (August 6-10) = 10,860,000 Igal
- Maximum Day Demand 2005 (MDD) = 10,860,000/5 = 2,172,000 Igal

- Total flow, maximum week 2008 (August 14-18) = 10,802,600 Igal
- Maximum Day Demand 2008 (MDD) = 10,860,000/5 = 2,160,520 Igal

Say 2,200,000 Igal/day (10.0ML/day)

3.2.3 Comparison to Other Southern Interior Municipalities

Comparison of derived annual average and maximum day water consumption values for Lillooet may include some level of inaccuracy. Factors which complicate comparison include:

- lawn and garden irrigation is the largest component of residential water use in the BC Interior area, comprising 50% to 75% of all water consumed. Lawn and garden irrigation amounts are climate and lot size dependent therefore strict comparison between municipalities is difficult. Single family lot sizes in North Lillooet are significantly larger than typical urban density averages, resulting in increased "per capita" usage.
- where universal metering is provided, non residential uses, i.e. industrial, commercial, and institutional uses can be separated and residential usage rates accurately calculated. Water consumption on a per capita basis calculated for Lillooet includes all non residential land uses.

Average Day Demands (ADD) and Maximum Day Demands (MDD) as calculated in the previous sections are:

- ADD = 1,000,000 Igpd (4.5 ML/day)
- MDD = 2,200,000 Igpd (10.0 ML/day)

Water usage on a per capita basis is then derived as follows:

- Existing District Population (BC Stats, 2008) = 2365
- Per capita ADD = 1,000,000 ÷ 2365 = 420 Igpd (1920 litres/day)
- Per capita MDD = 2,200,000 ÷ 2365 = 930 Igpd (4225 litres/day)

Table 3.1: Average Annual and Maximum Day Water Demands Comparisons

Municipality	*Average Daily Water Consumption (L/capita)*	*Maximum Day Water Demand (L/capita)*
Lillooet (non metered) (2)	1920	4225
Oliver (non metered) (1)	1400	4300
Osoyoos (non metered) (1)	1380	3900
Penticton (metered)	670	2500
Vernon (metered)	600	1300
Princeton (non metered) (2)	1900	3300
Kamloops (non metered)	800	1700
Pemberton (non metered)	740	1780
Salmon Arm (non metered)	900	2000
Sicamous (non metered)	750	2000
Summerland (non metered) (3)	800	3000

Notes: (1) includes commercial irrigation.

(2) high demands likely caused in part by undetected system leakage into coarse grained free draining soils.

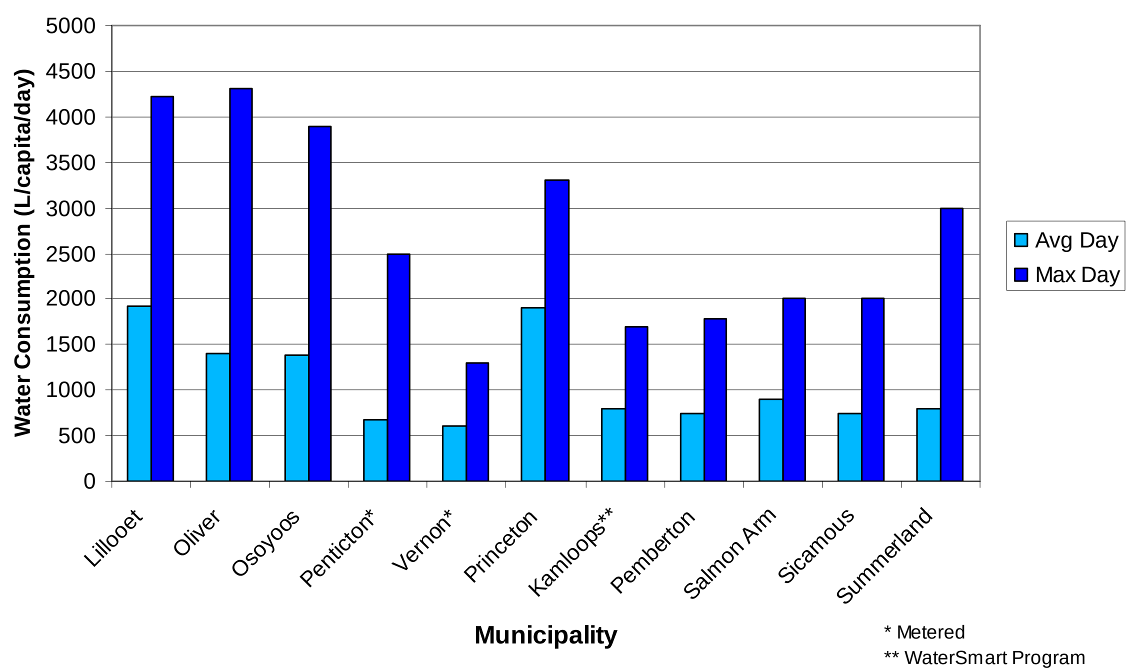
(3) Summerland values are Design Criteria used in the Water Master Plan (2002). We understand that Summerland's large commercial services are metered (irrigation usage).

General Note: Many of the municipalities marked as "non metered" have water metering programs and metered water rates in place but have not yet achieved universal metering across their whole system.

Comparative data for annual average and maximum day water demands are presented in Table 3.1 and depicted on Figure 3.3. Average annual water consumption on a per capita basis for Lillooet and Princeton are comparable at about 1900L/capita per day and significantly greater than all other municipalities listed in Table 3.2. Maximum day water consumption within the service area of the District's municipal water system is 4225L/capita per day.

Water consumption in Lillooet is significantly higher than most other municipalities in the BC interior, including Oliver and Osoyoos who both have significant commercial irrigation demands during the summer season, while Lillooet does not.

Figure 3.3: BC Municipal Water Demands



The comparisons presented in Table 3.1 and Figure 3.3 would appear to suggest that there are significant opportunities in Lillooet to reduce water usage through a water conservation program. It is also worth noting the fact that the two municipalities with the lowest average water demands both have metering programs in place.

3.3 Municipal System Water Costs

Operating costs for the District's municipal system were broken down into two categories:

- Fixed costs – costs (such as administration costs) that are independent of the amount of water supplied.
- Variable (volume based) costs – costs which are dependent upon the amount of water supplied.

Variable costs were then further broken down into three sub-categories

- Supply – includes costs associated with pumping (or collecting) and storing water.
- Treatment – includes cost associated with water treatment such as chlorine costs and associated labour.
- Distribution – includes costs associated with operating and maintaining the municipal distribution network.

On the basis of the above total municipal system operating costs excluding debt retirement for the period 2002 to 2008 are summarized in Table 3.3.

Table 3.3: Summary of Municipal Water System Operating Costs

Water Budget	***2002***	***2003***	***2004***	***2005***	***2006***	***2007***	***2008***
Supply	$39,074.00	$57,029.22	$112,683.27	$70,305.14	$68,773.92	$53,119.28	$58,755.57
Treatment	$6,068.00	$5,697.29	$4,762.39	$8,712.59	$13,465.62	$16,075.90	$18,148.68
Distribution	$74,880.00	$18,316.68	$26,831.80	$40,050.40	$48,088.01	$27,674.02	$28,787.74
Total Variable	$120,022.00	$81,043.19	$144,277.46	$119,068.13	$130,327.55	$96,869.20	$105,691.99
Total Fixed (admin, etc.)	$71,203.00	$79,377.84	$57,011.27	$70,780.42	$89,099.44	$101,302.21	$109,158.52
Total	$191,225.00	$160,421.03	$201,288.73	$189,848.55	$219,426.99	$198,171.41	$214,850.51
% Fixed	37.2%	49.5%	28.3%	37.3%	40.6%	51.1%	50.8%

Unit costs for each category are calculated by dividing the annual costs for each operating cost category by the total water consumption for that year. Unit costs for the District's municipal water system are presented in Table 3.4. It is important to note that water conservation will result in savings to the District of variable (volume related) operating costs only.

Tables 3.3 and 3.4 also provide percentages of the total that represent fixed operating costs.

Table 3.4: Municipal Water System Unit Costs

Cost per m3	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*
Supply	$0.025	$0.038	$0.068	$0.045	$0.047	$0.032	$0.037
Treatment	$0.004	$0.004	$0.003	$0.006	$0.009	$0.010	$0.011
Distribution	$0.048	$0.012	$0.016	$0.025	$0.033	$0.016	$0.018
Total Variable	$0.077	$0.054	$0.087	$0.076	$0.089	$0.058	$0.067
Total Fixed (admin, etc.)	$0.046	$0.053	$0.034	$0.045	$0.061	$0.060	$0.069
Total	$0.123	$0.107	$0.121	$0.121	$0.149	$0.118	$0.136
% Fixed	37.2%	49.5%	28.3%	37.3%	40.6%	51.1%	50.8%

The following should be noted from Tables 3.3 and 3.4:

- beginning in fall 2007, the District hired a full-time Public Works Director whose salary is partially included in the water system costs. This explains the marked increase in fixed costs which went from representing approximately 40% of total operational costs to about 50% in 2007 and 2008.
- in 2007 and 2008 on an overall basis, the cost to provide one (1) cubic meter of water from the municipal water system averaged $0.127 per cubic meter of which about 50% or $0.063 per cubic meter represents variable or volume dependent costs.
- during the 2002 to 2008 period, the variable (volume dependent) costs to provide water have averaged $0.07 per cubic meter.
- the 2002 – 2008 average cost to supply and treat water was approximately $75,000 per year, or $0.05 per cubic meter. The Master Water Plan provides estimates for future supply and treatment costs based on IHA 43210 compliance of $200,000 per year (with 10% less water being consumed), which equates to $0.13 per cubic meter.

Cost information presented in Table 3.4 forms the basis for assessing water conservation strategies on a cost benefit basis. ***Also, based on the above, we expect the variable cost to supply and treat water in the future to be at least double existing costs.***

3.4 Wastewater Treatment and Disposal Costs

Several water conservation strategies, i.e. low flush toilet replacement incentives and water efficient appliance rebates, represent the potential of reducing both domestic water consumed and wastewater quantities generated. To enable a cost benefit analysis of these strategies, cost savings associated with reduced wastewater generation have to be considered.

Using sanitary sewer flow and operating budget data provided by the District, unit costs for wastewater collection and treatment have been calculated. As with water supply costs, wastewater treatment and disposal costs have been separated into variable and fixed costs by the total sewage volume treated at the sewage treatment plant.

The District's sewage treatment plant was constructed in 2004 and the only available flow data is from 2007 so this is the only year that unit costs were derived, as shown in Table 3.5. The total wastewater volume treated in 2007 was 347,441 m^3.

Table 3.5: Wastewater Treatment and Disposal Costs (2007)

	Fixed Costs	*Variable Costs*	*Total Costs*	*% Fixed Costs*
Annual Cost	$22,662.97	$120,090.61	$142,753.58	15.9%
Cost per m^3	$0.065	$0.346	$0.411	

The costs to treat wastewater for the single year (2007) in Lillooet appear reasonable; other interior BC communities which operate secondary treatment facilities generally fall in the range of $0.30 to $0.60 per cubic meter treated.

4.1 Municipal System Capital Plan

The District of Lillooet does not have a formal five year water capital plan. Generally, the District is working towards implementation of the "short term" recommendations in the Master Water Plan, including:

- replace the failing wood stave tank (Town Creek reservoir)
  Cost Estimate = $675,000
- construct a booster pumping station and supply watermain on Victoria Street to the central-upper service area
  Cost Estimate = $525,000
- construct the North Lillooet interconnect including Main Street watermain upgrade and Hollywood Cres. booster pumping station
  Cost Estimate = $570,000
- install chlorination equipment on all municipal wells (Conway Park and Rec Centre)
  Cost Estimate = $10,000
- compile additional well quality and creek quantity data to allow accurate decision making for future sourcing options
  Cost Estimate = $25,000
- complete a District-wide water conservation strategy
  Cost Estimate = $13,000
- implementation of water conservation strategy
  Cost Estimate = to be determined

Lillooet, like the majority of small and mid sized municipalities in the Province, will be faced with significant capital costs for treatment works to comply with the Interior Health 43210 drinking water quality objectives. Lillooet, also like the majority of other small and midsize municipalities, is likely to make application for grants under infrastructure assistance programs of senior governments to assist with the construction of treatment works necessary for 43210 compliance. Beyond the capital waterworks listed above, the District compliance with the IHA objectives is likely to be obtained through:

- constructing a filtration plant for one creek source
- conversion of the second creek source to an emergency/back-up supply

- completing Rec Well #2
- conversion of the Conway Park wells to an emergency/back-up supply
- constructing a dedicated watermain from the Rec Wells to allow “blending”

Cost Estimate = $5,500,000

4.2 Population and Water Demand Projections

The District of Lillooet is currently adopting an Official Community Plan update; this OCP describes both incentive and deterrent factors related to population growth in the community.

Incentive factors include:

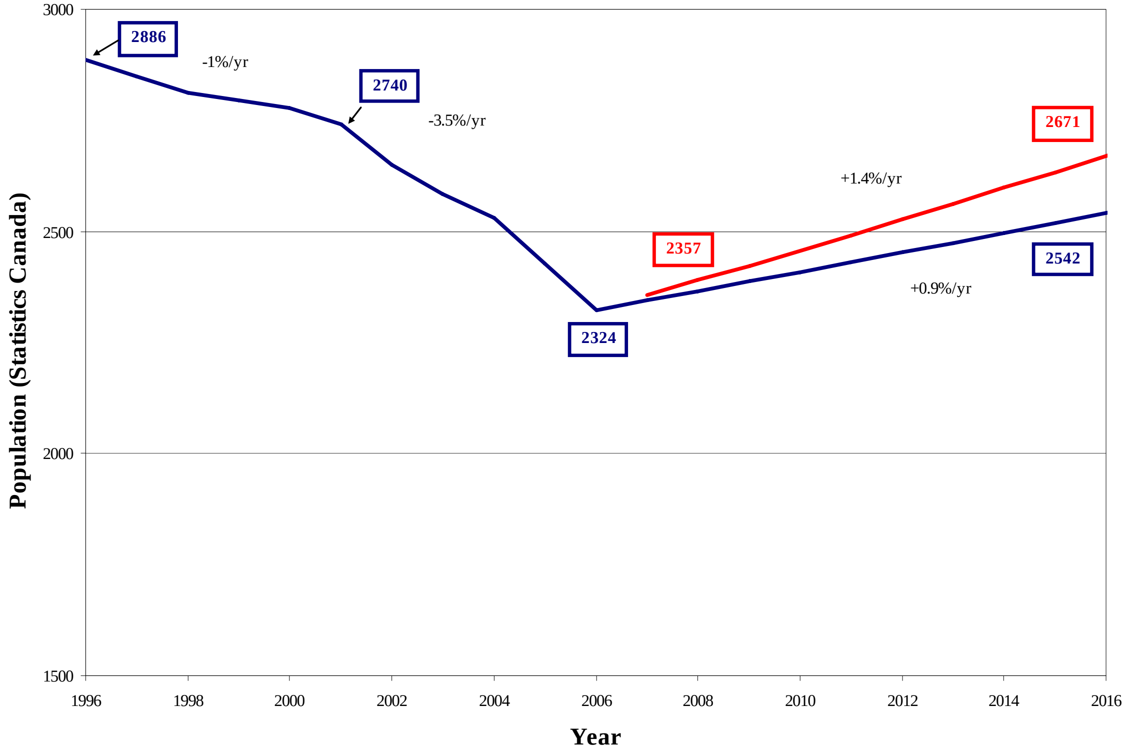
- a young growing First Nations population
- expanding regional tourism focus with the 2010 Olympics
- an aging provincial population for affordable housing in small towns
- continued availability of affordable housing
- a spectacular, scenic local setting

Factors presented as deterring growth include:

- general trend toward smaller household sizes
- an aging of the overall population
- provincial policies to centralize regional government jobs and services
- diminishing job market in the resources sectors, particularly forestry

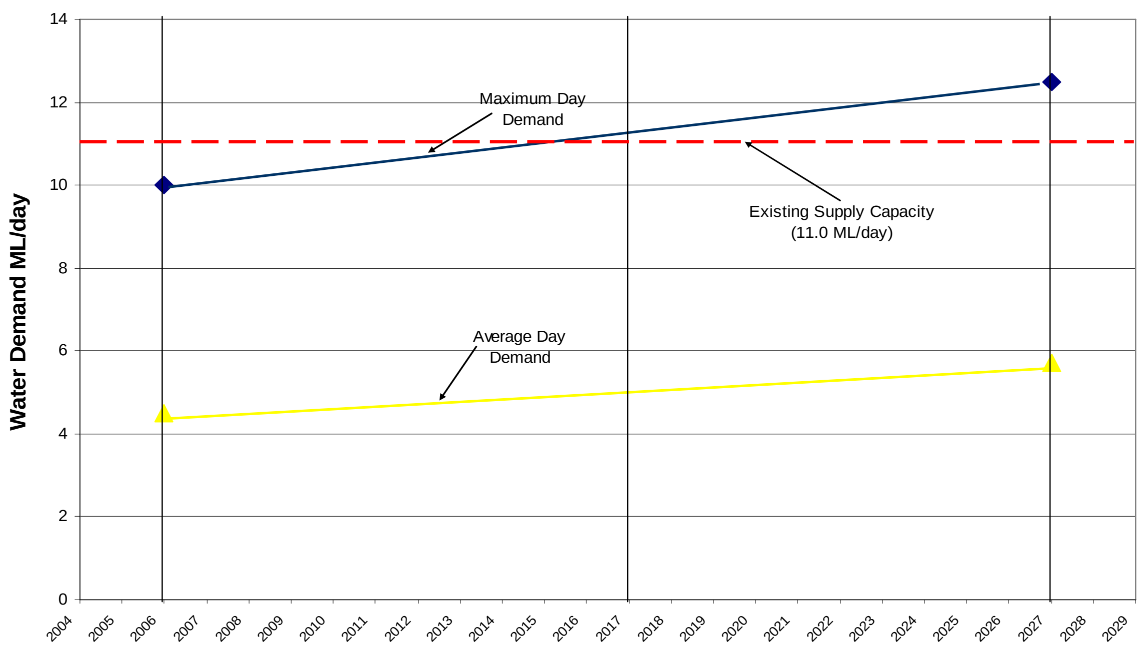
All factors considered the OCP anticipates future growth in Lillooet to average between 0.9 and 1.4%. Figure 4.1 below was taken from the Draft OCP, and illustrates that the population of the District has declined from 2886 in 1996 to 2324 in 2006 (based on Statistics Canada census data). Population projections anticipate a population of between 2542 (0.9% growth rate) and 2671 (1.4% growth rate) by year 2016. Extending the population projections to year 2027 (20 year projection) results in a District population in the range of 2800 to 3050. From a water supply planning perspective, a 20 year demand projection would likely be conservatively based on a population increase of about 600.

Figure 4.1: Lillooet Population Projections



Average and maximum day water demand projections for Lillooet are then presented in Figure 4.2. In year 2027 the maximum day water demand is projected to be 12.5 ML/day. In the same period, the average day demand could increase to 5.7 ML/day. These estimates assume the current per capita water demands remain unchanged.

Figure 4.2: Lillooet Water Demand (Consumption) Projections



As derived in Section 3.2.3, per capita average day and maximum day water demands are currently 1920 L/capita and 4225 L/capita respectively. Also, as described in Section 3.2.3 these per capita average and maximum day demands are high in comparison to other municipalities in the southern interior area of the province. There is some uncertainty as to whether the current average and maximum day per capita demands of the District of Lillooet are sustainable recognizing:

- Compliance with IHA for 43210 treatment objectives is likely to require treatment of either groundwater sources (arsenic removal) or surface water sources (filtration), or potentially both of the above.
- The District's water source capacity (all sources combined) is about 11 ML/day. If demands increase as shown in Figure 4.2, the District will require new source capacity with treatment by the year 2015. As determined in the Master Water Plan, the costs to treat Lillooet's existing water sources will be in the range of 60% to 210% more costly than the costs to implement a demand management strategy such as universal water metering.

5.1 General Objectives

The sections following describe water conservation measures that have been assessed and implemented by other local governments, in Canada and the United States. Where information is available, experience of local governments in British Columbia is described.

The following demand management strategies are described in this section:

- leak detection and repair
- universal water metering and metered rate structure
- public education and information
- low flush toilets
- low flow fixtures
- water conserving appliances
- landscaping incentives
- rain barrels
- major user audits

These measures represent the potential to reduce water use. Of particular importance to the District of Lillooet are water conservation measures which represent the potential of significant reductions in the District's maximum day water demand. Any reduction in maximum day water demand will mean that future treatment systems required to meet IHA 43210 objectives can be sized smaller, thus reducing capital and operating costs.

The District of Lillooet should aim to reduce its maximum day demand to 3000 L/capita/day (a 30% reduction overall), and average day demand to 1000 L/capita/day (a 50% reduction overall). These may appear to be lofty goals; however, as described in the following sections, with the right combination of demand management strategies, we believe they are achievable.

5.2 Leak Detection and Repair

5.2.1 Description and Experience

Leak detection and repair is the only water conservation strategy which requires no input from the general public. This strategy has been implemented by municipalities through the province with varying degrees of success. Factors which affect the overall results of the strategy include:

- size of leaks. Typically, larger leaks are more easily detected than small leaks.
- location of leaks. It is expected that numerous leaks would be discovered on private property (i.e. leaking service pipes). Generally, the ability of municipalities to implement leak repair on private property is limited.
- watermain material. Watermain leak detection is undertaken by means of electronic acoustical listening equipment. This equipment's ability to "hear" leaks is improved with "stiffer" pipe materials, such as ductile iron and steel.
- financial commitment to repairs. Locating leakage is only a portion of the strategy. Once located, repairing leaks can be costly – repairs could include a combination of:
  - isolated watermain repair of individual leak locations (i.e. band clamp repairs, or replacement of a few meters of watermain).
  - Wholesale watermain replacements of failed sections of watermain (i.e. installation of new watermain to replace a "city block" of leaking watermain).

Isolated repairs would typically be expected at joint and bend location where watermain in not properly restrained, or where "pinhole" leaks have developed in older steel and asbestos-cement watermain. Wholesale repair could be expected on severely corroded and failing watermain, most likely older, smaller diameter galvanized iron piping.

5.2.2 Lillooet Assessment

As shown in Section 3, it is estimated that up to 20% of current demands are attributable to system leakage. In terms of actual water volumes, this is calculated as:

Existing ADD	= 1,000,000 Igal (4.5 ML)
ADD Leakage	= 20% of 1,000,000 Igal
	= 200,000 Igal (0.9 ML)

This estimated leakage is assumed to be constant; maximum day demand leakage is expected to be 200,000 Igal (0.9 ML) as well.

All other water conservation strategies and anticipated reduction values are then made from the "non-leakage" demands, as follows:

Non Leakage ADD	= 1,000,000 – 200,000 Igal
	= 800,000 Igal (3.6 ML)
Non Leakage MDD	= 2,200,000 – 200,000 Igal
	= 2,000,000 Igal (9.1 ML)

Probable leakage locations include:

- galvanized iron watermains and services
- older sections of the water system (downtown core)
- asbestos cement and steel watermains (Central Lillooet)
- poorly constructed sections of watermain (i.e. bad "joints", inadequate thrust restraint on fittings)
- areas of Town containing corrosive soils and/or where former land use may impact current watermain conditions, such as former woodchip storage areas, whose soils are inherently more acidic/corrosive in nature.

5.2.3 Cost Benefit

The cost benefit assessment of leak detection and repair must be considered against both the existing and potential future costs to supply and treat water, as described in Section 3.3. Potential benefit by means of reduction in supply costs are calculated as follows:

ADD Leakage = 200,000 Igal (0.9 ML)
Annual savings (existing) = \$0.07 x 900 x 365 = \$22,995
(future, 43210 treatment) = \$0.13 x 900 x365 = \$42,705

We recently contacted one of the primary leak detection companies in Western Canada (Hetek Solutions Inc.). Hetek quoted completion of a leak detection program for the entire District water system at approximately \$15,000. We have also discussed leak detection with Neptune Technology Group (water meter supplier). Neptune supplies a leak detection system that can be purchased for use by the District in perpetuity. The system contains sounding devices installed on existing watermain valves, which correlate with surrounding water meters to determine leakage areas. The benefit of such a system is mobility; the District could move it around Town as needed, thereby running its own leak detection program.

Therefore, after initial capital costs of the leak detection program (allow $25,000), the District could budget $20,000 per year for leak repair, in anticipation of realizing equivalent savings through supply reduction.

5.3 Universal Water Metering

5.3.1 Description and Experience

The experience in British Columbia is that a universal water metering program to replace a flat rate water usage and rate structure will result in significant water use reduction both on an annual average and maximum day demand basis. A water metering program must however be combined with an appropriate volume based rate structure to take full advantage of the opportunities available through a metering program. Some examples:

- per capita water usage in the City of Vernon during the period 1993 to 1998 (after metering) was 19 percent lower than the period 1985 to 1991 (before metering).
- since the introduction of universal metering and volume based rates between 1996 and 1998, residential average day water usage in the City of Kelowna has reduced by more than 20 percent compared to consumption prior to metering.
- the maximum day demand in the City of Vernon has decreased from about 2000 Lpcd in 1975 to about 1200 Lpcd in 1999. This decrease likely reflects the combined effects of densification of new development and water metering.
- a “Summary Report on Residential Watermetering” prepared by Kerr Wood Leidal Gore and Storie Inc. in 1996 for the Greater Vancouver Regional District estimates that universal metering complimented by a user pay pricing system, reinforced by public education, can be expected to result in a 20% reduction in total annual residential water use. Even greater peak day demand reductions would be expected to occur.

On the basis of the above, it is conservatively assumed that universal metering will achieve a 20% reduction in the District's average day demand and a 10% reduction in the District's maximum day water demand. As noted in the previous section, these estimated reduction values would be applied to the "non leakage" portion of the current demands.

5.3.2 Rate Structure

Coupled with the universal metering program, the District of Lillooet should implement a water rate structure which provides further encouragement to conserve water. Table 5.1 provides a summary of metered rate structure for other central interior municipalities. All comparisons provided in Table 5.1 are for a 20mm dia. residential water service.

Table 5.1: Residential Metered Water Rates for Southern Interior Municipalities

Municipality	*Basic Charge (per year)*	*Consumptive Charge (per cu.m.)*	*Increasing Block*
Salmon Arm (2004)	$90.00	$0.38 for up to 180m^3/mon	Yes (1)
Vernon (2005)	$207.00	$0.70	No
Kelowna (2006)	$72.00	$0.25 for up to 30m^3/mon	Yes (2)
Summerland (2006)	$288.00 (3)	$0.40	No
Penticton (2006)	$128.40	$0.32	No
Kamloops (2006)	$244.00	$0.51	No
Sicamous (2006)	$144.00	$0.332	No
Oliver (2005)	$121.25	$0.112	No
Lillooet (2008)	$204.00		No

(1) Salmon Arm consumptive change increases an average of 10% for each additional 180m^3/mon consumption.

(2) Kelowna consumptive rates: $0.25/m^3 up to 30m^3/mon, $0.33/m^3 for next 50m^3/mon, $0.36/m^3 for next 45m^3/mon and $0.50/m^3 for consumption in excess of 125m^3/mon.

(3) Summerland metered rate for 20mm dia. commercial service. All Summerland residential on flat rate basis. Base rate includes first 20m^3 of consumption.

From Table 5.1:

- base rates (excluding those that include a consumption allowance) generally fall between $130.00 to $250.00 per year and consumptive charges vary between $0.30 and $0.70 per cubic meter.
- all of the municipalities with water metering and metered water rates have average day demands less than half that of Lillooet (see Table 3.2).
- the noted exception to the above is the Town of Oliver whose average day demands of 1400L/capita are significantly higher than all the other municipalities examined. The Town of Oliver also has the lowest basic charge and consumptive charge rate which suggests that a metered rate structure closer to the average is more effective.

The District of Lillooet should implement a metered water rate structure comparable to the other municipalities in Table 5.1 as part of any universal metering project.

5.3.3 Cost Benefit Analysis

Universal water metering is anticipated to result in a 20% reduction of the District's annual municipal system water consumption. In the first several years following implementation, reductions may be significantly higher than 20%; however there is a 'rebound' effect as water customers adjust to the metered cost of water. The direct benefit of a 20% reduction in overall consumption is reduced system operating costs, principally electrical energy, pump maintenance, etc. The cost savings can be estimated based on an average variable cost per cubic meter of $0.070 derived from the costs summarized in Table 3.4. The potential cost savings are also reviewed in the context of future IHA 43210 compliance, at an estimated cost per cubic meter of $0.13 (per Table 3.4 summary).

Anticipated operating cost savings to be realized by universal metering are:

- Existing Average Day Consumption = 4.5 ML/day
- Total "non-leakage" Consumption = 3.6 ML/day x 365 x 1000 = 1,314,000 m^3/yr
- Estimated Water Conserved @ 20% =262,800 m^3/yr
- Annual Cost Savings, existing = 262,800 m^3/y x $0.070/$m^3$ = $18,400/year
  future (43210 treatment) =
  262,800 m^3/y x $0.13/$m^3$ = $34,160/year

It is recommended that the District proceed with applications for grants from senior governments should the decision be made to implement a universal water metering program. With and without grants the annual costs of the universal metering program are derived as follows (costs to implement universal metering were reviewed in the District's Master Water Plan):

	No Grants	*Canada-BC Infrastructure*
Estimated Cost (2008)	$970,000	$970,000
Grant	$0	$646,667
Net Cost to District	$970,000	$323,333
Annual Cost ± (6% for 20 years)	$82,114.35	$27,371.42

Direct annual cost savings ($18,400 per year) to be realized by universal metering would cover about 67% of the amortization costs ($27,400 per year) if the District were successful in obtaining a 2/3 project grant under the Canada-BC Infrastructure program, based on current costs to provide water. Using future cost estimates (43210 treatment compliance); the direct savings to be realized by metering ($34,200 per year) are 25% greater than the amortization costs under the grant scenario ($27,400 per year).

Without grant funding, the costs to implement the universal metering program will outweigh the annual supply and treatment cost savings. ***However, as noted previously, even without the grant funding, universal metering is less costly than the future capital costs of 43210 compliance.***

5.4 Public Education and Information

5.4.1 Description and Experience

Public education and information is an essential element of a water conservation plan. An ongoing well conceived public education program has the objective of providing information on costs, the importance and benefits of conservation measures, and descriptive information on specific conservation strategies. Public information programs may include announcements, workshops, school curriculums, websites, bill stuffers, and seminars. Public information initiatives appear to be most effective when combined with the implementation of other water conservation strategies, the most common being universal metering.

The City of Kamloops in the early 1990's implemented a water smart program focusing only on public education and implementable water conservation strategies including low flow shower heads, low volume toilets, appropriate lawn and garden irrigation practices, watering restrictions, xeriscaping, irrigation application rate measuring 'cups', etc. The Kamloops Water Smart program has continued on annual basis and now includes significant enforcement of irrigation restriction regulations. The City of Kamloops estimates that annual average per capita water consumption has been reduced by about 20% by its Water Smart Initiatives. The City of Kamloops has not implemented universal water metering but is proceeding with pilot studies with the objective of at least implementing a voluntary metering program through usage rate incentives.

The Cities of Kelowna and Vernon undertook major public information and education programs concurrently with the implementation of universal water metering. In both cases annual average water consumption reductions of more than 20% were achieved. The City of Kelowna's Water Smart program continues to aggressively pursue water conservation objectives and more recently includes compost applications to lawns to retain moisture and reduce irrigation requirements, experimentation with drought tolerant grasses and free water use audits focusing on the highest volume users.

5.4.2 Lillooet Assessment

Consistent with the recommendations for small water systems outlined in the USEPA Water Conservation Plan Guidelines, it is suggested that the District of Lillooet implement a public information program concurrently with the universal metering program. Customers that are informed and involved are more likely to support the water system conservation planning goals.

In general terms, the public information program should include the following (as listed in the USEPA Guidelines):

- *Understandable Water Bill*
  Customers should be able to read and understand their water bills. An understandable water bill should identify volume of usage, rates and charges, and other relevant information.

- *Information Available*

  Water system purveyors should be prepared to provide information pamphlets to customer on request. Public information and education are important components of every water conservation plan. Consumers are often willing to participate in sound water management practices if provided with accurate information. Furthermore, providing information and educating the public may be the key to getting public support for a utility's water conservation efforts. An information and education program should explain to water users all of the costs involved in supplying drinking water and demonstrate how water conservation practices will provide water users with long term savings.
- *Informative Water Bill*

  An informative water bill goes beyond the basic information used to calculate the bill based on usage and rates. Comparison to previous bills and tips on water conservation can help consumer make informed choice about water use.
- *Water Bill Inserts*

  Purveyors can include inserts in their customer's water bills that can provide information on water use and costs. Inserts also can be used to disseminate tips for home water conservation.

5.4.3 Cost Benefit Analysis

As a stand alone water conservation strategy, consumption reductions to be achieved by a public education and information program are difficult to accurately estimate but the USEPA Water Conservation Plan Guideline suggests that a 2 to 5 percent reduction in water usage could be expected.

Potential annual cost savings to be realized from implementation of this strategy are calculated as follows.

- Total existing "non leakage" consumption = 1,314,000 m^3/year
- Estimated water conserved @ 2% = 26,280 m^3/year
- Annual cost savings, existing = 26,280 m^3/yr x $0.07 = $1840/yr
  future (43210 treatment) =
  26,280 m^3/yr x $0.13 = $3415/yr

Therefore, as a minimum, the District should be spending in the order of $2000 to $3500 per year on public education. At these costs, the public education and information program can be expected to easily "break even" with respect to water savings.

5.5 Low-Flush Toilets

5.5.1 Description

On average, toilets account for 30% of residential indoor water consumption. By mandating or promoting low-flush or dual-flush toilets, local governments can significantly reduce residential water use. Ultra-low consumption toilets have a flush cycle of 6L in contrast to 13L "water saver" toilets and older 20+ L models. Dual-flush toilets have short-flush (three litres) and long-flush (six litres) options.

5.5.2 Experience

The BC *Water Conservation Plumbing Regulation* was amended in September 2005 to include local governments that wished to require the installation of low-flush (6 litre) toilets within their jurisdictions. The Building Policy Branch (of BC Housing) is currently surveying participating local governments regarding the Regulation's effectiveness. Local governments that are not presently included in the Regulation will also have an opportunity to participate in the survey.

In areas that are not mandated to require low-flush toilets, the Regulation requires that newly installed toilets have a flush cycle of no greater than 13.25 litres. New installations are defined as toilets installed in buildings under construction, as well as new toilets that are replacing old toilets. The regulation does not require the replacement of existing functioning toilets.

The Regulation requirement for low consumption toilets currently applies to the following local governments:

- All electoral areas of the Cowichan Valley Regional District;
- All electoral areas of the Regional District of Nanaimo;
- Electoral areas C and D of the North Okanagan Regional District;
- Municipality of Bowen Island;
- City of Enderby;

- City of Kamloops;
- City of Vernon;
- District of Campbell River;
- District of Coldstream;
- District of North Cowichan;
- Greater Vancouver Water District (excluding those areas not subject to regulations established pursuant to the *Local Government Act*);
- Town of Gibsons;
- Township of Spallumcheen;
- Village of Cumberland;
- Village of Lumby;
- Village of Sayward;
- Village of Telkwa;
- Capital Regional District, including areas, such as the Gulf Islands, that are not supplied by CRD water.

The following table describes some of the low-flush toilet incentive programs implemented by municipalities and regional districts across BC:

Municipality/Regional District	Incentive Program	# of Program Participants
Penticton	• $50 rebate (utility credit) for installation of a new 6L or dual flush toilet	• had ceiling of 200; this was reached between March and Nov., 2006 • demand for rebates outstripped available funds • 3.3 million L of water saved due to 200 replaced toilets
Coquitlam	• $100 rebate for each toilet replaced with ultra low flow model (max. 2 toilets per residence) after July 29, 2004 • applies only to flat-rate water utility customers (not metered customers)	• 455 since late 2004
Sunshine Coast Regional District	• Bathroom Fixture Replacement Program allows residents to swap up to two 13+L toilets for new dual flush toilet at no charge (also includes low flow shower head and low flow faucet aerator), **or:** • $200 rebate option for replacement of 13+L toilets with 6L models (free toilet drop-off at landfill)	

Municipality/Regional District	Incentive Program	# of Program Participants
Richmond	• Offers a water saving toilet device (reduces water use by up to 35%) and a low flow shower head to anyone who volunteers for a water meter • both items are free, with free installation	• 55% (477 households) of those who volunteered for water metering (based on survey responses)
District of North Cowichan	• requires low flush toilets and urinals in local Building Bylaw • $75 rebate for replacement of 13+L toilet with approved low flow model (max. 2 rebates per residence)	
Capital Regional District	• $75 rebate per bathroom installing water efficient toilets and showerheads (max. 2 rebates per residence; old toilets must be recycled	• 12,652 (roughly 11,000 since 2001)

5.5.3 <u>Lillooet Assessment</u>

Several municipalities in British Columbia have successful low flush toilet rebate programs with rebates ranging between $50 and $100 for each 6 L (usually two unit maximum) being installed on a retrofit basis of 13 L plus toilets. The response rates of these programs on an overall community basis are difficult to determine based on the data provided.

Until such time as the District of Lillooet completes the planned universal metering program and establishes a metered water rate comparable to other local governments in the area, there is no financial incentive for a homeowner in Lillooet to consider toilet replacement with low flush units. A similar statement can be made with respect to the current flat rate sewer rate structure. A toilet retrofit incentive program therefore does not warrant implementation by the District until such time as the universal metering and rate structure program has been implemented.

5.5.4 Cost Benefit Analysis

A cost benefit assessment of an ultra low flush toilet (6 L or less) incentive program has been undertaken from both the perspective of the District and a property owner. Literature suggests that conversion from 13 L flush toilets to 6 L or less toilets represents water savings of about 40 L per capita per day. Assuming a household population of 2.3, the average water savings per household would be about 100 L per day or 36.5 m^3 per year. This equates to a District-wide water demand reduction of approximately 2%.

A 36.5m^3/year water savings in the average household in Lillooet would represent the following cost savings to the District of Lillooet.

- reduced water supply cost = 36.5m^3 @ $0.070 (existing) = $ 2.56
  @ $0.13 (future treatment) = $ 4.75
- reduced sewer system operating cost = 36.5m^3 @ $0.346 = $12.63
- Total Annual Savings, existing = $15.19
  future (43210 treatment) = $17.38

The above calculated savings to the District of $15.19 per year are for sewer and water system operating costs and do not include any provisions for deferred or reduced capital expenditures. If the District were to offer a $50 per toilet retrofit incentive and the typical home had two toilets (i.e. $100 incentive to reduce water consumption by 36.5m^3), the District's payback period would be about 6.5 years. Based on the potential future savings (IHA 43210 compliance), with District's payback period would be 5.75 years.

From the perspective of the typical homeowner in the District of Lillooet, interest in taking advantage of a toilet retrofit incentive program will be directly proportional to potential water utility bill cost savings. The cost benefit analysis from a homeowner's perspective is:

	Cost for Ultra Low Flush Toilet – assume \$150 x 2 units =	\$300.00
(less)	District Rebate – assume 2 ea. @ \$50	\$100.00
	Net Cost to Homeowner	\$200.00
	Annual Water Bill Savings @ \$0.30/m^3 x 36.5 m^3 =	\$ 11.00
	Payback Period	≈ 18 years

From the above, significant participation by the public in a low flush toilet rebate program would likely not be achieved unless:

- metered water rates were substantially more than \$0.30 per cubic meter, and/or
- District offered rebates of up to \$100 per unit, and/or
- District implemented a system of metered sewer rate charges to replace current flat rate structure.

5.6 Low Flow Fixtures

5.6.1 Description and Experience

Toilets and clothes washers represent the top two indoor water using appliances. Showers and faucets are the next largest, comprising approximately 35% (combined) of the total indoor water consumed.

Typical showerheads and faucets flow at around 19 Lpm (5 USgpm); low flow fixtures (2.25 to 2.5 USgpm) represent simple technologies to reduce flow and thereby conserve water.

As shown in Section 5.5, it is common for municipalities to introduce low flow fixture as a portion of an incentive/rebate program involving low flush toilets.

5.6.2 Lillooet Assessment

As was the case for low flush toilets, low flow fixtures do not warrant implementation until such time as a universal metering and rate structure program are in place. At that time, there will be financial incentive for homeowners to consider installing these water conservation devices.

5.6.3 Cost Benefit Analysis

Similar to the low flush toilets, a cost benefit analysis can be undertaken from both the perspective of the District and a property owner. Potential water use reduction resulting from these devices is estimated based on some of the USEPA benchmarking data, as follows:

- Showerhead – assume 1 shower per home
  - Household population = 2.3
  - Low flow showerhead water reduction = 8.33 L/capita/day
  - Total annual reduction per household = 8.33 x 2.3 x 365 ÷ 1000 = 7.0 m^3/yr

- Faucet aerators – assume 2 per home (1 bathroom, 1 kitchen)
  - Household population = 2.3
  - Water reduction = 1.14 L/capita/day
  - Total annual reduction per household = 1.143 x 2.3 x 365 ÷ 1000 = 1.0 m^3/yr

Based on the water reductions shown above, implementation of these strategies would represent the following cost savings to the District of Lillooet:

- Showerhead
  - reduced water supply cost = 7.0 m^3/yr @ $0.07 (existing) = $0.49
    @ $0.13 (future treatment) = $0.91
  - reduced sewer system operating cost = 7.0 m^3/yr @ $0.346 = $2.42
  - Total Annual Savings, existing = $2.91
    future (43210 treatment) = $3.33

- Faucet Aerators
  - reduced water supply cost = 1.0 m^3/yr @ $0.07 (existing) = $0.07
    @ $0.13 (future treatment) = $0.13
  - reduced sewer system operating cost = 1.0 m^3/yr @ $0.346 = $0.35
  - Total Annual Savings, existing = $0.42
    future (43210 treatment) = $0.48

Low flow showerheads are estimated to cost $60 each. Assuming the District offers a $30 rebate, the District's payback period would be about 10 years.

Faucet aerators cost approximately $20 each. However, to achieve the 1.0 m^3/yr flow reduction shown above, two would have to be installed in each home (bathroom and kitchen sinks). Assuming the District sells these devices at a 50% incentive rate (i.e. $10 per aerator), the District's payback period will be approximately 48 years.

From the perspective of the property owner, interest in the low flow fixture program will be directly proportional to potential water bill savings. The cost benefit from a homeowner's perspective (with a future metered water rate of $0.30/$m^3$) is then calculated as follows:

- Showerhead – cost $60
  (less) District rebate <u>$30</u>
  Net cost to homeowner $30
  Annual water bill savings @ $0.3/$m^3$ x $7.0 m^3 = $2.10
  Payback period ≈ 14 years

- Faucet aerators – assume $20 x 2 units = $40
  (less) District rebate <u>$20</u>
  Net cost to homeowner $20
  Annual water bill savings @ $0.3/$m^3$ x $1.0 m^3 = $0.30
  Payback period ≈ 66 years

From the above, significant participation by the public in a low flow fixtures program would not likely be achieved unless: metered water rates were substantially higher than $0.3/$m^3$, or the District increased the rebate/incentive amount, or the District implemented a meter sewer rate.

It is worth noting that full implementation (100% compliance) of the low fixtures program would result in a net annual water use reduction of approximately 0.5%.

5.7 Water Conserving Appliances

5.7.1 Description

The majority of Canadian appliance rebate programs appear to be designed primarily to promote the use of energy-efficient appliances. Most of these programs offer rebates to those who purchase appliances with the ENERGY STAR designation. ENERGY STAR qualified clothes washers use 35 to 50 percent less water and 20 to 50 percent less energy per load than other washers. ENERGY STAR dishwashers use "smart" sensors that adjust the wash cycle and the amount of water to match the load. Water conservation therefore appears to be a positive byproduct of energy conservation programs.

5.7.2 Experience

The following table provides examples of appliance rebate programs:

Jurisdiction	**Program**
Capital Regional District, BC	• $125 rebate to homeowners who purchase a high-efficiency clothes washer • replaced clothes washers must be recycled
Alberta	• $100 rebate for Edmonton and Calgary residents who replace their old clothes washer with an ENERGY STAR washer • $50 rebate to residents in other parts of the province who replace their old clothes washer with an ENERGY STAR washer
Saskatchewan	• PST (7%) exemption for ENERGY STAR clothes washers and dishwashers purchased or leased for minimum of one year

Jurisdiction	Program
Manitoba Hydro	• $100 credit to customer account for purchase of ENERGY STAR front loading clothes washer
Thunder Bay Hydro	• Up to $85 credit to customer account for purchase of ENERGY STAR clothes washers and dishwashers
Yellowknife	• $75 rebate to Northland Utilities customers who replace their old clothes washer with an ENERGY STAR washer (800 rebates avail., first come, first serve) • old washers must be recycled
Hawkesbury Hydro, ON	• 15% rebate for purchase of ENERGY STAR clothes washers and dishwashers (max. $500 per appliance)
Newmarket Hydro, ON	• $100 credit to customer account for purchase of ENERGY STAR clothes washer
City of Toronto	• $60 rebate for purchase of high-efficiency clothes washer • rebate recipients also entered in draw to win amount paid for washer (max. $2500)
Soquel Creek Water District, California	• $100 rebate to customer for purchase and installation of ENERGY STAR clothes washer
Monterey Peninsula Water Management District, California	• $100 rebate for purchase and installation of ultra-low consumption clothes washers and dishwashers

5.7.3 Lillooet Assessment

The USEPA provides estimates of indoor domestic water use; clothes washers and dishwashers comprise approximately 25% of the total. Typical clothes washers use almost 14 times more water than dishwashers, and therefore have the potential to represent a larger water demand reduction. On average, a high efficiency clothes washer uses 40% less water than typical models – this equates to a savings of approximately 25 L/capita/day. At 100% implementation throughout the District, which is unlikely, this represents a potential average day demand reduction of 1%.

Incentive and rebate programs for water conserving appliances appear to be more commonly offered by electrical utility companies. The District of Lillooet may consider participating or partnering in an energy-efficient applicant rebate program which may be developed by BC Hydro or departments of the Provincial or Federal government. As with toilet replacement incentives described in Section 5.5, the public will be in a better position to assess the benefits of high efficiency water conserving appliances once the District has completed the universal metering program and implemented metered rates consistent with other local governments in the BC Interior.

5.8 Landscaping

5.8.1 Description

Xeriscaping is a landscaping technique that significantly reduces water consumption. It involves the selection of plants with minimal water requirements, the use of soil amendments such as compost and mulch, and efficient irrigation and maintenance practices.

5.8.2 Experience

Examples of Canadian communities and organizations that have developed programs to encourage water-efficient landscaping include the following:

British Columbia Buildings Corporation

- In 1997, adopted technical standards requiring improved irrigation and landscaping efficiency for all BCBC owned and operated buildings
- Standards include giving preference to native plant species and practices such as xeriscaping

City of Kelowna

- *Water Smart* program has included a soil amendment program since 2001. In 2005, the lawns of 275 homes received a top-dressing; a compost product that helps soil retain moisture so lawns require less water. The soil amendment program is incentive-based, meaning the homeowner pays for the cost of the product and the *Water Smart* program pays for delivery and spreading.
- Ogogrow is organic matter made up of composted biosolids from Kelowna's wastewater treatment facility. Each participant's lawn received core aeration and a top dressing of Ogogrow, to help customers achieve a green lawn without the use of high-nitrogen fertilizers and excessive water consumption. Participants reduced their average water use in July 2001 by 35 per cent compared to July 2000.
- Offers on a limited basis, a $100 rebate towards the purchase and installation of an irrigation timer with “water saving” features. All available rebates for 2006 were claimed.
- The *Water Smart* program conducted a drought-tolerant grass experiment in 2006. Ten to twelve volunteer participants were sought; interest was such that the program expanded to accommodate 40.

- Offers a professional assessment of participants' irrigation systems and the improvements they could make to increase system efficiencies. Participants were offered financial incentives toward upgrades, with the option of paying for further upgrades themselves. These participants reduced their average July 2001 water consumption by 15 per cent.

Capital Regional District, BC

- $25 rebate for rain sensors or automatic rain shutoff devices
- $50 rebate for irrigation controllers with 365-day calendar

Several communities in the United States offer rebates to homeowners with Xeriscaped yards. The following table provides examples of American water conservation initiatives aimed at reducing irrigation requirements.

Governing Body	Program
Southern Nevada Water Authority	• Water Smart Landscapes Program brings in $1.58 worth of freed-up local water for every dollar spent on rebates (37% positive return) • in modeled scenarios, $1 / sq. ft. is sufficient incentive for homeowners to convert landscapes
City of Peoria, Arizona	• Xeriscape rebate of up to $550 (utility credit) for City water customers who convert a minimum of 500 sq. ft. of high water use landscaping • rebate amounts depend on square footage converted and water use level of new plant material
City of Gallup, New Mexico	• water bill credit of 25 cents / sq. ft. of irrigated turf grass removed and replaced with Xeriscape • spray irrigation not permitted in rebate area
Albuquerque Bernalillo County Water Utility Authority, New Mexico	• water bill credit of 60 cents / sq. ft. of Xeriscape, min. 500 sq. ft. • spray irrigation not permitted in rebate area
City of Scottsdale, Arizona	• turf removal rebate of 25 cents / sq. ft., max. $1500 • 50 cents sq.ft. rebate for turf removal as well as installation of low-water-use plant material, max. $1500 • rebate of up to $250 for installation of landscape irrigation controller
Fargo, North Dakota	• $1200 rebate to those willing to have landscapes converted for Xeriscape study
Denver, Colorado	• $300 new start rebate and $600 retrofit rebate for participants in Xeriscape study (2002)

The new start sign-up rates for both the Fargo and Denver studies were lower than expected, although the larger amount offered in the Fargo study contributed to increased interest. The main obstacles to recruiting participants for the Denver study were:

- cost of installing a landscape
- completing landscape by set date

It is also noteworthy that the Colorado Springs Utilities Board eliminated Xeriscape rebates in 2005, citing the following reasons:

- savings cannot be quantified
- does not pass total resources cost test
- 40% denial rate
- very labour intensive for staff
- difficult for customers to comply with rebate rules and requirements
- landscape contractors indicated that costs associated with complying with rebate requirements exceed rebate amount
- research showed other utility companies cut Xeriscape funding and planned on spending funding on educational water saving programs

5.8.3 Lillooet Assessment

Landscaping related incentive programs to encourage water conservation may be considered by the District of Lillooet at some point in the future. As with other incentive type water conservation strategies, full implementation of the municipal system universal metering program should precede any landscaping related incentive program to enable the public to assess costs and benefits.

As part of the education and information program described in Section 5.4, the District may consider the construction of xeriscape demonstration gardens around public buildings and within public open spaces and parks. Xeriscaping will be an important component of the water conservation education and information activities of the District.

From a regulation perspective, the District should consider implementing a bylaw requiring topsoil removed or stripped for construction of a subdivision or development to be replaced following building or house construction. A bylaw regulating removal of topsoil is relatively straightforward for multi-family type developments where the developer is also constructing the actual dwelling units. The bylaw would be difficult to apply to a single family subdivision where the developer and house building are typically separate parties.

5.9 Rain Barrels

5.9.1 Description

This measure involves the installation of rainwater collection barrels for non potable water outside water use, the most common use being landscape irrigation. Rain barrels are available from several manufacturers and are intended to be permanently installed on drop pipes from household roof rainfall collection gutter systems. Typically the rain barrels are supplied with a cover and outlet tap near the bottom of the barrel to enable easy withdrawal of collected rainwater by the homeowner. In addition to saving water for landscape irrigation, rain barrels reduce stormwater quantities that may be collected by storm drainage infrastructure and discharged to receiving watercourses.

5.9.2 Experience

The two main forms of incentive that local authorities provide to encourage the purchase of rain barrels are rebates and subsidized rates. The latter are more common in Canada, and the former in the United States and Australia. The average retail price for a standard 200L rain barrel is $120 – $150.

Governing Body	Incentive Program
City of Vancouver	Provides rain barrels to residents for $75 (50% subsidy)
City of Calgary	Barrels available for $60 each at annual sale
Township of Langley	Provides rain barrels to residents for $35
Region of Peel, ON	Provides rain barrels to residents for $50
Town of Perth, ON	Provides rain barrels to residents for $74
Monterey Peninsula Water Management District, California	Provides rebates of $25 for every 100 gallons of rainwater storage capacity in a cistern system (max. 3000 gallons)
Soquel Creek Water District, California	Provides customers with a credit of $25 for every 100 gallons of storage capacity (min. 200 gallon tank, max. 3000 gallons for rebate)
City of Albuquerque, New Mexico	Provides $25 water bill credit to those who purchase rain barrels
Wambo Shire Council, Australia	Provides a rebate of up to $750 for the installation of rain barrels (min. combined capacity 20 000L) to those who have already installed low-flush toilet and low-flow shower head
Mackay Water, Australia	Provides a rebate of up to $500 for the installation of rain barrels (min. 5000L)

The City of Armstrong, on a trial period basis in the summer of 2006, offered $50 rebates on rain barrels purchased by City residents from local retailers. Less than 10 residents took advantage of the program. Armstrong, like Lillooet, has a non metered flat rate water billing structure and accordingly there was no ongoing financial benefit to residents to consider the purchase and installation of rain barrels.

5.9.3 Lillooet Assessment

Rainwater harvesting is referenced in a Foundation Research Bulletin prepared by Smart Growth on the Ground as representing the opportunity to reduce water use for lawn and garden irrigation and possibly for toilet flushing. Lawn and garden irrigation is however considered to be the principal use for water collected by rain barrels.

Climate records from Environment Canada for Lillooet for the period 1971 to 2000 indicated an average annual rainfall of 297.1mm. Assuming the catchment area for a rain barrel is one half of the roof area of a typical $120m^2$ single family home, the potential water savings associated with rain barrel is estimated as:

- water collected – $60m^2$ x 0.2971m = $17.83m^3$ per household per year
- average water savings per capita = 7,750L/capita per year
  = 21.2L/capita per day

From Section 3.2, the average annual water consumption is currently 1920 L/capita per day. With 100% acceptance, as well as collecting and using 100% of annual rainfall (which is not likely achievable), rain barrels represent the potential of reducing average annual water consumption by about 1%.

Rainwater harvesting through rain barrels appear to represent the potential for modest water consumption savings. A rain barrel rebate program may be considered at some future date by the District as a component of an overall education and information program. Water metering and a metered rate billing structure will provide a method to describe the potential costs and benefits of rainwater harvesting and create public interest in the concept.

5.10 Major User Audits

5.10.1 Description and Experience

There do not appear to be any potential "major users" on the District water system – no major manufacturing or processing businesses are serviced. The public parks such as Conway, which are owned and operated by the District, may be the largest water "users" through the irrigation season.

As a component of the future water conservation program, the District should meter its public and institutional irrigation uses, and assess opportunities to utilize alternative sources. Once universal water metering is in place, major water users can be identified and audits conducted.

The goal of such audits would be to:

- review existing water demands
- assess opportunities for demand reductions
- suggest implementation strategies to reduce consumption

Since there do not appear to be any significant "major users" identified to date, we are uncertain of the potential water reductions which could result from major user audits.

5.11 Watering Restrictions

5.11.1 Description and Experience

The majority of municipalities in the interior of BC implement some form of watering restrictions through the irrigation season. Watering restrictions are relied upon heavily in arid areas as a means of drought management. Such restrictions are based on the science behind watering requirements for plant growth, and are dependent upon local factors including:

- soil type (affecting runoff/retention)
- plant/grass variety
- air temperature and humidity
- moisture loss due to evapotranspiration (movement of water from soil and plants to the surrounding air)

The basic premise behind watering restrictions is that less water will be "lost" through evapotranspiration if irrigation occurs during times of non-peak temperatures.

Many municipalities implement watering restrictions including:

- irrigation restricted to odd or even days of the month, usually corresponding to odd/even home addresses.
- irrigation restricted to certain times of the day; typically through off-peak temperatures such as 6 PM through to 9 AM.
- guidelines or restrictions on when and where watering types (hose, sprinkler, drip irrigation) can be utilized.

- staged watering restrictions, which can be enacted by the Public Works Department, and become increasingly stringent as conditions dictate.

A great example of staged watering restrictions is that of Summerland BC, where restrictions are summarized as follows:

Stage 1

- three times a week watering
- only sprinklers can be used for watering lawns, trees and shrubs

Stage 2

- twice a week watering, utilizing sprinklers for lawns trees and shrubs, 6 PM to 9 AM only
- micro irrigation and drip irrigation permitted on all days

Stage 3

- once a week watering, utilizing sprinklers for lawns, trees and shrubs, 6 PM to 9 AM only
- micro irrigation and drip irrigation permitted on all days
- no washing driveways or sidewalks with a hose
- no washing vehicles or boats with a hose unless the hose is equipped with a shut-off device
- no operation of decorative fountains unless they utilize recirculating water

Stage 4

- complete lawn watering ban
- no hose washing of exterior building surfaces, windows, parking lots, driveways, and sidewalks
- no vehicle washing except commercial washes
- no filling of swimming pools, hot tubs, garden ponds, or decorative fountains
- trees, shrubs and flowers can only be watered by micro irrigation, drip irrigation, or with a hose equipped with a shut-off device

Finally, most municipal watering restrictions bylaws contain an enforcement section with penalties including fines for non-compliance. Enforcement is a fundamental requirement of an effective watering restriction bylaw.

The results of watering restrictions vary, and are not easily quantified since such restrictions are usually implemented concurrent with other water demand management strategies. Studies in arid areas of the southern United States (Colorado, Arizona) have shown that reductions in water consumption during irrigation season have exceeded 20% as a result of watering restrictions. Due to Lillooet's climate, we feel that the District would see noticeable water demand reductions if watering restrictions were effectively implemented and enforced.

6.1 Summary

The District of Lillooet owns and operates water systems that provide water to approximately 2350 citizens in three separate service areas, including North Lillooet, Central Lillooet, and East Lillooet. The East Lillooet system supply a small industrial park (10 lots) and the airport; water conservation planning would have a minimal impact on supply cost and water demand for that area.

The focus of this plan is the Central and North Lillooet service areas. The District provides water through approximately 1100 services in these areas.

Water consumption data has been reviewed from flow records for the 2002 to 2008 period. Determination of current demands is complicated by system leakage – total leakage volumes are unknown. Volume estimates have been established for leakage from the existing wood stave tank (Town Creek reservoir). Deducting that known leakage, the District water demands are:

- average day demand = 1920 litres/capita/day
- maximum day demand = 4225 litres/capita/day

These demand volumes are double or triple comparable volumes for other BC interior municipalities. The only municipalities that use a similar amount of water (per capita) are Oliver and Osoyoos, which see heavy commercial irrigation rates.

The municipal water system has a current supply capacity of approximately 11.0 ML/day. Existing maximum day demands are 10.0 ML/day. Future growth projects are conservatively estimated between 0.9% and 1.4% per year. As such, if no alterations are made to current per capita water consumption, current supply capacity will be reached by the year 2015; in 20 years the municipal water demand will be 12.5 ML/day. Therefore, to ensure sustainability of the water supply system, the District must either:

- increase supply (and treatment) capacity, or
- decrease per capita water demand

The Master Water Plan showed that the costs to achieve targeted demand reductions will be substantially less than the cost to increase supply and treatment capacity.

The District's actual costs to supply water and treat wastewater were also reviewed. These unit costs form the basis for assessing water conservation strategies on a cost/benefit basis. The variable or volume dependent portion of the District's unit costs are summarized as follows:

- cost to supply, treat, and distribute water:
  - existing (current costs) = $0.07 per m^3
  - potential future (estimate based on treatment for IHA compliance) = $0.13 per m^3

- cost to treat and dispose wastewater = $0.35 per m^3

A range of demand management strategies were then reviewed and assessed in relation to the cost/benefit to the District of Lillooet. These strategies are summarized below.

(1) Leak Detection and Repair

- system leakage appears to be a large factor (20%) of existing water usage.
- implementation of a detection and repair program must be undertaken.
- approximate capitals costs:
  - leak detection program will cost between $15,000 and $25,000
  - leak repair costs are unknown, and will be dependent on size, type, and quantity.
- operating cost savings = $23,000 per year (existing)
  = $42,700 per year (potential future)
- water conservation projections:
  - potential for 20% reduction in existing average day demand

(2) Universal Water Metering and Metered Rate Structure

- implementation of a universal metering program will be a key objective for the water conservation plan.
- the District's current rate structure (currently a flat rate of $204 per parcel per year, which equates to approximately $0.12 per cubic meter) must be revised

to be consistent with other BC municipalities (metered usage rate of $0.30 to $0.40 per cubic meter). In addition, consideration should be given to implementing an increasing block unit rate structure to further promote conservation as a part of a universal water metering program.

- approximate capital cost = $1,000,000
- operating cost savings = $22,000 per year (existing)
  = $41,000 per year (potential future)
- water conservation projections:
  - 20% reduction in average day demand
  - 10% reduction in maximum day demand

(3) Public Education and Information

- essential element of a universal water metering program.
- City of Kamloops has demonstrated that, over a long period of time (15 plus years), significant water demand reductions can be achieved through a public education and conservation program that does not include metering.
- enforcement of irrigation restriction regulations is required.
- USEPA guidelines for public information programs are applicable.
- a portion of a staff member's time (and wage) should be dedicated to water conservation public education and information. Alternatively, the District could hire staff on a part time or seasonal basis to ensure this function is carried out.
- approximate annual cost = $10,000 to $15,000
- operating cost savings = $2,000 to $5,000 per year
- water conservation projections:
  - uncertain, potentially in the range of 2% reduction in average day demand.

(4) Low Flush Toilets

- no financial incentive for homeowner to consider retrofit until universal metering program and metered rate structure is in place.
- District should consider providing incentives of $50 to $100 for every low flush toilet replacement.
- District payback period would be about 6.5 years on a $50 incentive based on existing costs.

- homeowner payback period is about 18 years on a $50 incentive, based on a future metered water rate of $0.30 per cubic meter.
- District should assess participation in Water Conservation Plumbing Regulation to require flow flush (6 litres) toilets on all new construction and renovations.
- water conservation projections:
  - maximum 2% reduction in average day demand, at 100% participation rate.

(5) Low Flow Fixtures

- no financial incentive for homeowner to participate until universal metering program and metered rate structure in place.
- District should consider rebate of at least 50% for every low flow showerhead, and faucet aerator.
- District and homeowner payback periods are lengthy – in the range of 10 to 65 years.
- water conservation projections:
  - maximum 0.5% reduction in average day demand at 100% participation rate.

(6) Water Conserving Appliances

- no financial incentive for homeowner to consider purchasing appliances with ENERGY STAR designation until universal metering and metered rate structure is in place.
- District could consider providing financial incentives; typically, it is the energy provider (i.e. BC Hydro) that provides the primary incentive for these appliances.
- water conservation projections:
  - uncertain; dependent on participation rates

(7) Landscaping

- no financial incentive for homeowner to consider landscaping alterations until a universal metering an metered rate structure is in place.

- wide variety of programs implemented in other jurisdictions including irrigation controller rebates, xeriscaping incentives, and turf removal incentives.
- water conservation projections:
    - uncertain; dependent on participation rates. Reduction percentages have the potential to be significant, but at what cost?
- District should assess bylaw requiring topsoil replacement on landscaped areas of new development.
- District should assess merits of xeriscaping "demonstration gardens" around public buildings and in parks.

(8) Rain Barrels

- no financial incentive for homeowner to consider installing a rain barrel until universal metering and a metered rate structure is in place.
- District should consider providing rain barrels at a subsidized cost (say 50%) subsidy, or $75 per rain barrel).
- water conservation projections:
    - maximum 1% reduction in average day demand, at 100% participation rate and 100% rainfall recovery – which is not likely to be achieved.

(9) Major User Audits

- District should assess alternative irrigation water sources for institutional and public lands including parks and school playing fields.
- it is unlikely that any major water users will be identified in the municipal core, as there are no major commercial or industrial processing businesses in this area.
- water conservation projections:
    - uncertain; variable based on results of audits and subsequent demand management implementation strategies.

(10) Watering Restrictions

- common practice throughout BC municipalities.
- water conservation projections:

- uncertain; dependent on effectiveness of implementation and enforcement. Potential exists to reduce irrigation demands by over 20%.

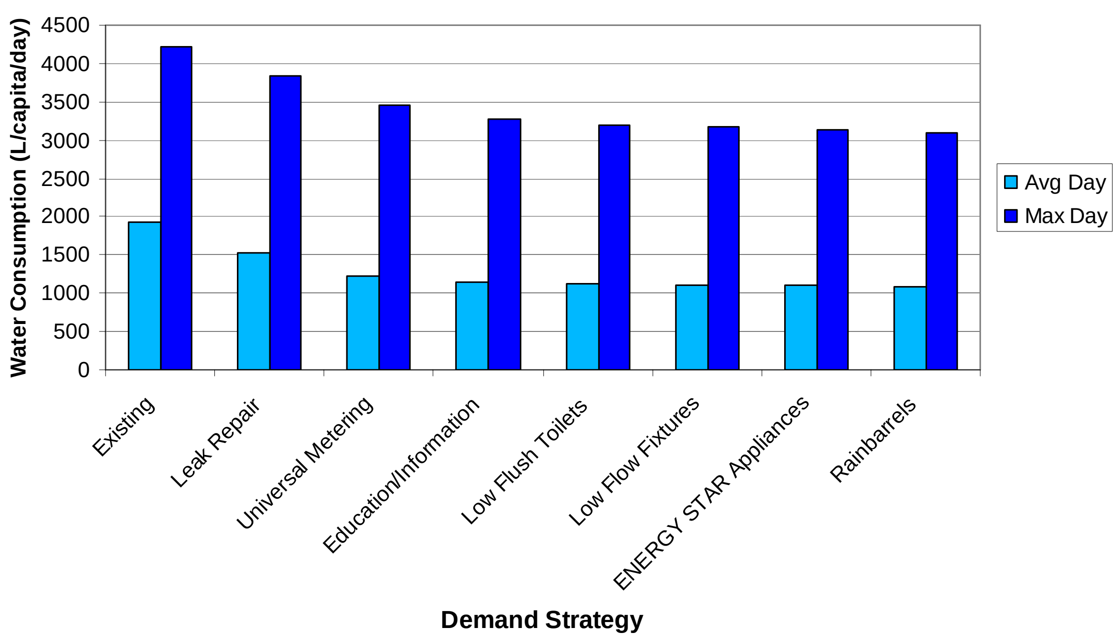
➢ District should implement a watering restriction bylaw with enforcement (penalty) clauses.

➢ consideration should be given to a bylaw containing “staged” restrictions that can be enacted by the Public Works Department.

6.2 Recommendations

Potential water consumption reductions resulting from the demand management strategies described herein are depicted visually on Figure 6.1.

Figure 6.1: Potential Water Conservation Results



As noted in Section 5.1, the District of Lillooet should aim to reduce its maximum day demand to below 3000 L/capita/day, and average day demand to below 1000 L/capita/day.

In order to achieve these goals, measures which warrant implementation in the short term (Years 1 – 3) are described as follows:

- Universal Water Metering and Metered Rate Structure

  Due to the costs involved with implementation of this demand management strategy ($1,000,000), the District should consider splitting the metering component into manageable pieces, to be implemented over the course of several years. In addition, application for funding assistance should be made through government infrastructure programs such as Towns for Tomorrow.

  In terms of metering prioritization, if the District pursues universal metering on a phased basis, emphasis should be placed on metering the highest water demand areas first; i.e. the large rural residential lots contained in the North Lillooet area.

- Public Education and Information

  Concurrent with universal water metering, the District should implement an education and information program. This task must be assigned to an individual to ensure it is completed – the District may want to consider hiring a new staff member on a part time or seasonal basis to oversee these works. In addition, public education must be a consistent, ongoing program over a number of years.

- Leak Detection and Repair

  Due to the large estimated volume of water being lost to leakage (20%), the District must implement a leak detection program. The District could approach this program in one of two ways:

  - following universal metering. The benefit of this timing is that the amount of leakage could potentially be quantified (difference between volume supplied by source and total volume consumed by customers), and results of the detection and repair assessed.
  - concurrent with universal metering. If detection/repair occurs concurrent with universal metering, it will be more difficult for the District to ascertain the specific benefit of either demand management strategy. However, due to timelines, this option will result in <u>larger</u> demand reductions at a <u>sooner</u> date.

To accurately assess the results of these water conservation initiatives, the District should consider replacement of the older water meters located on the Town Creek and Conway Park sources. In addition, the magmeters located on the Dickey Creek and Rec Well sources should be tested/calibrated to ensure accuracy.

Over a longer timeframe (greater than 3 years), the District should consider implementation of additional demand management strategies to provide a more comprehensive conservation program. Many of these other strategies will have varying results, and as depicted on Figure 6.1, corresponding water demand reductions will be significantly less than the three primary strategies listed above. However, depending on local factors and council direction, it may make sense to give priority to any of the following:

- low flush toilets
- low flow fixtures
- water conserving appliances
- landscaping incentives
- rain barrels
- watering restrictions

6.3 Water Conservation Program

Consistent with the summary and recommendations presented in Sections 6.1 and 6.2, a suggested implementation program is presented in the following Table 6.1. The implementation schedule is flexible and will likely be governed by a number of factors including funding availability and political will. Table 6.1 is presented to illustrate how the various conservation measures assessed herein could be implemented over a period of years.

Table 6.1: District of Lillooet Water Conservation and Demand Management Program

Year One – 2009:

- replace water meters at Town Creek and Conway Park sources; test/calibrate meters at Dickey Creek and Rec Well to ensure accuracy.
- install water meters on all North Lillooet water services (approximately 250 total).
- update service charge bylaw and introduce a metered water rate consistent with other interior BC municipalities, to be applied to metered connections.
- budget and hire a water conservation public education and information program coordinator.
- complete leak detection assessment of water system.
- prepare and implement water restriction bylaw.

Year Two – 2010:

- install water meters on all central upper zones and the T'it'q'et Indian Band services (approximately 400 services total).
- extend metered rate structure to newly metered area.
- implement watermain repairs based on 2009 leak detection program and budgeting allowances.
- assess in detail low flow toilet incentive program and implement corresponding program.
- continue to implement a public education and information program.
- continued use and enforcement of watering restriction bylaw.

Year Three – 2011:

- install water meters on all municipal core and central lower zones (approximately 450 services total).
- extend metered rate structure to newly metered area; end of flat rate metering.
- implement watermain repairs based on 2009 leak detection program and budgeting allowances.
- continue to implement a public education and information program.
- assess in detail all potential landscaping initiatives and rain barrel incentives; implement corresponding program.
- continued use and enforcement of watering restriction bylaw.

Year Four and Beyond – 2012 and Beyond:

- continue to implement a public education and information program.
- complete water audits on major water users.
- review metered water rates; assess rate structure and implement an increasing block rate structure.
- ongoing toilet replacement, landscaping and other conservation initiatives.
- review and revisions to watering restrictions bylaw.

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