



S U M M A R Y R E P O R T



North Okanagan Water Authority
A Service of the Regional District of North Okanagan



Master Water Plan



April 2002

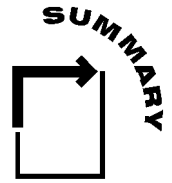
Final Report

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EXECUTIVE SUMMARY



The potential advantages of a regional approach to water supply have been discussed for many years. In 1994, this vision was brought to fruition with signing of a Memorandum of Understanding between the three water utilities in the Greater Vernon area – the City of Vernon, the District of Coldstream and the Vernon Irrigation District. Shortly after, the Vernon Irrigation District was dissolved and the assets transferred to a new regional water commission, entitled the North Okanagan Water Authority. In the eight years since the signing of the MOU, work has continued to develop the governance structure and responsibilities for a regional water system strategy – culminating in the completion of this Master Water Plan.

Arriving at this point has not been without its challenges. In addition to the technical and financial issues normally encountered in a master water planning process, the integration of three existing water utilities into a single governance structure was required. It was originally envisioned that the North Okanagan Water Authority would be the body responsible for the supply of bulk water and long-term water system planning for the region. In the latter stages of the MWP, following the redrafting of the Statement of Principles, a new entity that would own all of the water supply and distribution systems was identified.

This entity would be a new agency, termed the Greater Vernon Water Utility (GVWU), operating under the Greater Vernon Services Commission.

1 THE STARTING POINT

Three independent water supply utilities have operated in the Greater Vernon area for nearly a century. The City of Vernon and the District of Coldstream have both operated piped municipal water systems, serving primarily domestic customers within their respective boundaries. The Vernon Irrigation District originally operated an open flume agricultural irrigation system. This was converted to a piped system, supplying both agricultural and domestic customers, in the 1960s.

In the 1970s and 1980s, the Greater Vernon area experienced significant development. The capacity and the availability of piped water to both the valley and upper hillsides allowed water to be supplied at a relatively low cost. In particular, the domestic customer base on the VID system continued to expand through the servicing of new suburban development. In the late 1980s, concerns regarding long-term water quality and the ability of the supplies to meet the future needs of the region were identified. A series of

engineering studies concluded that approaching water management on a regional basis would offer a number of synergies and would allow the region to tackle the domestic water quality issue on a more cost effective basis.

2 THE WATER QUALITY QUESTION

The most significant issue facing the water utilities in the Greater Vernon area is the question of domestic water quality. For decades, the water from the main valley lakes and the creeks was considered to be excellent quality – low in colour and turbidity – that only required chlorination to be considered potable. The construction of the piped VID system in the 1960s offered the potential to serve additional domestic customers at low cost. While the water suffered from moderately high colour and occasional high turbidity, it was accepted by the customers and only chlorination was required to meet the regulatory standards of the time for drinking water use.

Unfortunately, this is no longer the case. With increasing development and activity in the watersheds, the levels of pathogenic cysts such as *Cryptosporidium* and *Giardia* in the raw water will likely increase. This is not simply a problem in the Vernon area, but a North American wide problem. While more vigilant watershed management can reduce the problem, the ultimate solution is a higher level of drinking water treatment.

The problem is complicated in the Vernon area by the variety and number of water sources. The fact that the NOWA system provides both irrigation and domestic water adds to difficulty of cost effective water treatment. What appeared to be a low cost supply of domestic water is turning out to be a costly problem. NOWA, however, is not alone. Both the City of Vernon and the District of Coldstream are served by intakes and pumping stations on the shore of Kalamalka Lake. Insufficient space is available for additional water treatment at the existing facilities. Sites for water treatment plants need to be obtained and water supply systems reconstructed to allow raw water to be pumped to the water treatment plant sites and treated water to be returned to the distribution systems.

The question to be addressed in the MWP was – how can additional water treatment be provided on a cost-effective basis?

3 THE DO-NOTHING ALTERNATIVE – DOES IT EXIST?

The answer is no – for several reasons.

The first is the issue of domestic water quality. While the risk may be acceptable at the present time, the water quality of the sources will likely continue to decline. If additional water treatment is not implemented, there is a real risk of a water-borne public health problem, such as a *Cryptosporidiosis* outbreak in the coming years.

The second is increasing water demand. The need to increase the capacity of the Kalamalka Lake supply source that serves both the City and the District of Coldstream was identified in the late 1980s. This work has not been carried out due to slower than anticipated growth in the region, the offsetting gains made due to water conservation and the uncertainty due to discussions on regional water. As a result, with water demands now increasing due to growth, the supply capability in the summer months is severely stretched – to the point where a breakdown of pumping equipment during peak summer demand periods could lead to a severe water shortage from the Kalamalka Lake source.

The third reason is the aging of the water system components, particularly in the City of Vernon and the District of Coldstream systems. System replacement or upgrading has been put on hold in a number of instances due to the lack of a long-term plan. Dollars now need to be spent on upgrading water pumping stations and reservoirs and increasing distribution capacity to ensure that the systems meet expected municipal performance and reliability standards.

4 PROJECTED WATER DEMANDS

The serviced residential population of the Greater Vernon area is expected to increase from the current figure of approximately 42,000 to approximately 121,000 over the next 40 years. This tripling of the population will have a significant impact on water management planning. The irrigation land base, on the other hand, will likely see only a slight increase over the 40-year planning horizon.

The annual domestic water use is expected to increase from 8,821 ML to 20,651 ML, over the 40-year period. Maximum day domestic day demands will increase from the current amount of about 56 ML/d, to in the order of 113 ML/d in 2041.

While irrigated land area is expected to increase slightly over the planning horizon, more efficient irrigation practice will keep overall annual irrigation water use at about 14,000 ML. The portion of overall water used for irrigation in the region will decrease from the current level of 55% to 36% by 2041. Maximum day irrigation demands are expected to drop from the current figure of 209 ML/d to about 180 ML/d by 2011. The

demand is then expected to rise slightly over the remainder of the planning horizon. This drop reflects the impact of water use efficiency and changing land use.

5 THE REGIONAL WATER CONCEPT

On an average annual basis, about 80% of the water use in the existing NOWA combined system goes to irrigation. The remainder is for domestic use. The quality of water used for potable purposes must be improved to meet the water quality goals. The question is therefore – is it better to treat all of the water or is it better to separate the irrigation and domestic functions and treat only the domestic supply?

The major factor in this decision is cost. This was investigated using an economic analysis technique known as “life cycle costing”. The results clearly show that water system separation, to create a domestic water system and an irrigation water system, has a clear economic advantage over the long-term. Based on a 50-year lifecycle cost analysis, the cost to implement and operate a separated water system is about \$149 million. The cost for a combined water system, over the same period and providing the same domestic water quality, is about \$198 million – some \$49 million higher!

The regional water strategy, that has been adopted, is to separate the existing combined water system over the next five years and construct a new water treatment plant in the Middleton Mountain area in the same time frame. This water treatment plant would be supplied by both raw Kalamalka Lake water and raw Duteau Creek water. It will ultimately supply all of the domestic water demands in the Vernon region.

6 WATER SOURCE DEVELOPMENT

Kalamalka Lake and Duteau Creek will be the major water sources over the next 40-years. Kalamalka Lake will serve as a domestic water source only. Duteau Creek will provide both irrigation water and raw water to the treatment plant, primarily during the non-irrigation season.

Deer Creek and groundwater in the Coldstream Valley will continue to be utilized as irrigation sources and as supplemental sources of raw water to the water treatment plant. Other local creeks, where licenses are currently in place, may also play a role in providing local irrigation water. Reclaimed water from the City of Vernon’s wastewater system offers a significant potential irrigation water source to offset other irrigation supplies. This would free up additional raw water from the Duteau Creek source to supply the water treatment plant.

The development of Okanagan Lake, as a domestic water supply source, may be required by the end of the 40-year planning horizon.

7 WATER TREATMENT

Domestic water supply to the region will come from a new water treatment plant, termed the Middleton Mountain water treatment plant, located near the Regional District office, on a site yet to be determined. The treatment processes will be housed entirely in a building with clearwell storage provided beneath the process units.

This plant will be in place by 2006. The initial treatment processes will likely include high-rate clarification and ultraviolet/chlorination disinfection. Activated carbon addition and filtration will be added by about 2021 to provide an increased level of treatment and additional process robustness. Final process selection will occur following pilot-testing. The plant capacity will be expanded in stages over the remainder of the planning period to meet the growth needs of the region.

8 DOMESTIC WATER SYSTEM

There are currently over 50 pressure zones in the Greater Vernon area. The Master Water Plan identifies primary and secondary zones. Primary zones are intended to be the long-term pressure zone development goal. Secondary zones exist due to a local topographic constraint or an existing water system component. It is intended that these zones be consolidated with the primary zones over time, based on the zone development strategy contained in the plan.

9 IRRIGATION SYSTEM

The future irrigation system will function in a very similar manner to the original VID irrigation system, constructed in the 1960s. The primary difference is that surplus water will be used as a raw water supply to the new Middleton Mountain water treatment plant.

Based on the low operating cost for the system and the generally good condition of the components, the GVWU should be able to meet the goal of providing irrigation water at a competitive rate. Long term financial planning, however, needs to consider the eventual replacement of irrigation system components.

Reclaimed water will continue to play a role in irrigation in the Greater Vernon area. Additional work and discussion needs to be carried out to explore the degree of integration of reclaimed water with the GVWU system.

10 CAPITAL PROGRAM

Implementation of the Master Water Plan will have a capital cost of \$72 million over the next six years. A further \$24 million will be spend in the period from 2008 to 2041.

A public information program, pilot-testing of water treatment activities, and preliminary engineering will commence in mid-2002. Design and construction of water treatment works, supply and transmission improvements and water system separation will occur between 2003 and the end of 2007.

A Program Management approach is proposed to implement the new capital works.

11 THE GREATER VERNON WATER UTILITY

The GVWU is proposed as a stand-alone water utility that will service the entire Greater Vernon region (including the City of Vernon, District of Coldstream, and parts of Electoral Areas B, C, and D). GVWU will also provide bulk water under contract to parts of the Township of Spallumcheen. It is proposed that the utility be established as a service of NORD and governed under the Greater Vernon Services Commission. The GVWU will assume the responsibility of supplying and distributing water to both domestic and irrigation customers within the designated service area.

Initially, NORD will enter into contract arrangements with the City of Vernon and the District of Coldstream to perform all operation and maintenance services required on the water system. Current NOWA operations and maintenance staff will transfer their employment to one of the two organizations, based upon criteria to be determined. In the future, other organizational and service delivery strategies may be examined and selected based upon the regional needs that can be evaluated over the long term.

12 FINANCIAL MANAGEMENT

The required capital program creates a significant impact on domestic water rates over the next six years. The actual impact will depend upon the availability of senior government grants. As an example, a “low-moderate” water consumer, such as reflected by a smaller single-family dwelling, currently pays (2002) about \$21 per month. With the proposed capital program, this will rise to between \$32 and \$43 per month by 2007, depending upon the level of senior government funding that is received. The higher value reflects zero grant dollars. After 2007, the rates will tend to flatten out.

The GVWU needs to establish operating, capital and DCC and Regrade reserves. A significant portion (approximately 65%) of the capital program over the next four decades years will be eligible for DCC contributions. It will be a number of years, however, before the DCCs can be collected and, in the interim, carrying charges will be incurred.

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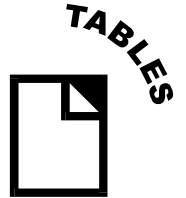


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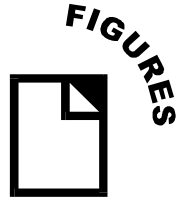
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WHAT IS A MASTER WATER PLAN?

A Master Water Plan (MWP), such as this one, is intended to outline in broad terms the long-term strategy for the development and operation of the water supply and distribution system. A Master Water Plan is a planning document that identifies the improvements that are required to meet current and future needs and objectives. Options for water sources, water treatment and transmission system improvements are developed and discussed. The feasibility of these options, from both a technical and economic point of view, is assessed and recommendations as to the best long-term strategy are presented.

1.1 THE STEPS

The exercise to develop a Master Water Plan starts with an inventory of the existing water system. Factors such as capacity and quality of supply, capacity of the transmission system, and age and condition of components are reviewed.

Population projections and official community plans and policies are used to determine population growth and distribution. Existing water demands are determined, and the potential impacts of conservation measures and other factors are used to project future unit demands. From these, the future water demands faced by the utility are estimated. With future water demands known, the adequacy of the existing supply, treatment and transmission system can be assessed for its ability to meet these demands. This assessment can consider many factors including:

- Are existing sources adequate to meet future demands, or will additional sources be required? What opportunities for expanding sources exist?
- Do water supply facilities have sufficient capacity to meet current and future demands?
- Does the water quality adequately protect public health? Is additional water treatment required and what is the timing?
- Does the transmission system have adequate hydraulic capacity; can it get water to where it is needed at sufficient pressure and in sufficient quantity?



Finally, the objectives of the water utility must also be incorporated in the planning process. These objectives may be relatively simple, such as demand management through

implementation of water metering, or complex, such as the integration of separate utilities into a new governance structure.

The final product is the Master Water Plan. This will provide direction for all subsequent preliminary engineering work and implementation of projects.

1.2 THE NORTH OKANAGAN WATER AUTHORITY MASTER WATER PLAN

The potential advantages of a regional approach to water supply have been discussed for many years. In 1994, this vision was brought to fruition with signing of a Memorandum of Understanding (MOU) between the three water utilities in the Greater Vernon area – the City of Vernon, the District of Coldstream and the Vernon Irrigation District. Shortly after, the Vernon Irrigation District was dissolved and the assets transferred to a new regional water commission, entitled the North Okanagan Water Authority. In the eight years since the signing of the MOU, work has continued to develop the governance structure and responsibilities for a regional water system strategy – culminating in the completion of this Master Water Plan.

Arriving at this point has not been without its challenges. In addition to the technical and financial issues normally encountered in a master water planning process, the integration of three existing water utilities into a single governance structure was required. Prior to undertaking the development of the Master Water Plan, a number of governance models were developed and debated. Decisions were made and a Statement of Principles developed. Work then started on the Master Water Plan. Part way through the process, however, it became evident that the proposed governance structure was complex and unworkable. Progress on the plan then stopped until a new approach was determined and the Statement of Principles redrafted. The Master Water Plan was then completed.

It was originally envisioned that the North Okanagan Water Authority would be the body responsible for the supply of bulk water and long-term water system planning for the region. The MWP was thus entitled the NOWA Master Water Plan. In the latter stages of the MWP, following the redrafting of the Statement of Principles, a new entity, that would own all of the water supply and distribution systems, was identified. This entity would be new agency, termed the Greater Vernon Water Utility (GVWU), operating under the Greater Vernon Services Commission. The reader should thus be aware of the evolution in the governance structure and the use of the terms, NOWA and GVWU, in the Master Water Plan.

The key objective of the Master Water Plan, is that stated in the original 1994 MOU:

To ensure the economical supply and distribution of a sufficient quantity and quality of water in the interests of both the agricultural and non-agricultural users in the Greater Vernon community.

The Master Water Plan describes the proposed strategy to meet the above objective. This strategy has been developed over a period of about 16 months of technical and financial analysis and considerable discussion with the three water utilities. The issues involved in reaching the end point are very complex. It is not simply a matter of developing a number of options and selecting the best one. Various aspects of water supply planning needed to be examined and interim decisions made in order to build the basis for more detailed technical and economic analysis. The final strategy is thus not a single decision – but a series of informed decisions along the way that leads to a long-term direction.



The Master Water Plan uses the terms “domestic water system, irrigation water system and combined water system”. In the context of this plan, “domestic water system” refers to a water system whose primary purpose is to deliver water for domestic or municipal purposes. This type of system thus serves primarily residential, industrial, commercial and institutional customers. A portion of the water in the system is used for lawn watering and other non-potable uses. An “irrigation water system” is defined as a non-potable water system whose primary function is to supply irrigation water to agricultural customers. A “combined water system” is one that combines the functions of a domestic water system and an irrigation water system.

1.3 THE PLANNING HORIZON

The planning horizon for the Master Water Plan is from 2001 to 2041 – a period of forty years. This time frame was selected, as it is sufficiently long to look at the longer-term issues of water supply capacity yet it is still within a reasonable projection period for community development.

Economic analyses for decision making is based on the 40-year period, taking into account the appropriate salvage value of the asset at the end of the period. Financial rate projections are focused on a shorter time frame, 10-years, due to the uncertainty of projections beyond this time frame.

1.4 THE FORMAT

This report is the Summary Report. It accompanies 14 technical working papers that have been developed during the course of the Master Water Plan preparation. The entire volume is termed the Master Water Plan. The working papers are summarized below:

Technical Working Paper No. 1 – Inventory of Existing Systems and Water Demands

Technical Working Paper No. 2 – Review of Financial Considerations and Strategies

Technical Working Paper No. 3 – Community Development and Land Use

Technical Working Paper No. 4 – Water Conservation and Reuse

Technical Working Paper No. 5 – Projection of Water Demands

Technical Working Paper No. 6 – Water Quality Goals

Technical Working Paper No. 7 – Evaluation of Water Supply Sources

Technical Working Paper No. 8 – Evaluation of Water Treatment Needs and Alternatives

Technical Working Paper No. 9 – Development of a Separated Water System Concept

Technical Working Paper No. 10 – Domestic Water System Development

Technical Working Paper No. 11 – Irrigation System Development

Technical Working Paper No. 12 – Options for Long Term Water System Development

Technical Working Paper No. 13 – Implementation

Technical Working Paper No. 14 – Water Rate Strategy

The Summary Report is intended to give the reader a concise overview of the contents of the Master Water Plan. It provides a background discussion and a selected direction on the various water system strategic planning issues. It refers the reader to the appropriate technical working paper for a more in-depth discussion or for technical details.

A chapter synopsis is included in bold, italic font at the end of each of the subsequent chapters. These synopses summarize the key discussion or conclusions of the chapter.

1.5 THE CONSULTANT TEAM

The technical and financial evaluations, the facilitation of meetings and the preparation of the Master Water Plan were carried out by a team of consultants. The principal contributors were:

Rick Corbett - Associated Engineering	Team Leader
Ian Wright - Associated Engineering	Water Treatment Planning
David Main – Earth Tech Inc.	Financial Planning
Bob Hrasko – Earth Tech Inc.	Water Distribution Planning
Mike Nolan – Kerr Wood Leidel Associates	Water Demand Projections

1.6 ACKNOWLEDGEMENT

The preparation and completion of the Master Water Plan has involved ongoing consultation with elected representatives, trustees and senior staff from the various stakeholder groups. Their interest and contributions throughout the process have been both useful and greatly appreciated.

Special thanks go to the Technical Steering Committee and the NOWA Committee for their many hours of review and discussion. The progress meetings provided the opportunity to debate the many issues and provided the opportunity to gain a better

understanding of the sensitivities and concerns of each member utility – enabling the consensus necessary for the preparation of this Master Water Plan.

THE EXISTING SITUATION

Three independent water supply utilities have operated in the Greater Vernon area for nearly a century. The City of Vernon and the District of Coldstream have both operated piped municipal water systems, serving primarily domestic customers within their respective boundaries. The Vernon Irrigation District originally operated an open flume agricultural irrigation system. This was converted to a piped system, supplying both agricultural and domestic customers, in the 1960s.

2.1 REGIONAL WATER – WHY CONSIDER IT?

In the 1970s and 1980s, the Greater Vernon area experienced significant development. The capacity and the availability of piped water to both the valley and upper hillsides allowed water to be supplied at a relatively low cost. In particular, the domestic customer base on the VID system continued to expand through the servicing of new suburban development.



Kalamalka Lake

In the late 1980s, concerns regarding long-term water quality and the ability of the supplies to meet the future needs of the region were identified. A series of engineering studies concluded that approaching water management on a regional basis would offer a number of synergies and would allow the region to tackle the domestic water quality issue on a more cost effective basis.

2.2 THE IMPLEMENTATION PLAN

Discussions on a regional water strategy continued on and off throughout the early 1990s. Following municipal elections in November 1999, there was renewed interest in the formation of a regional water supply at the political level. Discussions recommenced and tentative agreement was reached on a revised governance structure for a regional water concept. A revised Statement of Principles was adopted and the Implementation Plan was finalized in August 2000.

The Implementation Plan provided further detail of the proposed governance structure for the regional concept. The next step was the preparation of a master water plan that would set the “road-map” to upgrade and expand the water systems over the next 40 years. Work on this Master Water Plan (MWP) commenced in November 2000.

2.3 THE EXISTING UTILITIES

The Greater Vernon area, covered by the MWP, includes six political jurisdictions within the North Okanagan Regional District. These include:

- City of Vernon
- District of Coldstream
- Electoral Area B
- Electoral Area C
- Electoral Area D
- Portions of the Township of Spallumcheen.

The majority of the area is served by three water utilities: the City of Vernon, the District of Coldstream and the North Okanagan Water Authority. Some residents are supplied by smaller, private water systems or by individual wells or lake intakes. Figure 2-1 shows the boundaries of the political jurisdictions.

The three utilities are described briefly below. The existing domestic and irrigation water customer base, for each utility, are shown in Tables 2-1 and 2-2. Additional details on the existing systems are contained in Technical Working Paper No. 1.

**Table 2-1
Regional Water Service Area – Domestic Water Connections**

Utility	Number of Accounts ¹		
	Residential	ICI	Total
City of Vernon	11,980	720	12,700
District of Coldstream	1905	20	1925
NOWA	5163	112	5275
Total	19,048	852	19,900

Note 1: Estimated 2001 data.

**Table 2-2
Regional Water Service Area – Irrigated Area**

Utility	Irrigated Area ¹(ha)
City of Vernon	20
District of Coldstream	2
NOWA	3455
Total	3477

Note 1: Estimated 2001 data. Does not include residential lawn irrigation areas. Note that the City of Vernon also irrigates 970 ha using reclaimed water.

2.3.1 City of Vernon Water Utility

The majority of the City of Vernon is serviced by the City's water utility. This is primarily a domestic water system with a limited number of irrigation connections. There are currently about 12,700 residential and industrial, commercial and institutional (ICI) accounts. The irrigated area supplied by this system is only about 20 ha.

Water supply was historically from Kalamalka Lake, supplemented by BX Creek. The use of the BX Creek supply was terminated in 2000 due to concerns regarding the high levels of the parasite, *Cryptosporidium*, in the raw water. Water treatment on the Kalamalka Lake supply is limited to chlorination. This supply is also considered to be at risk of parasitic disease transmission due to urban and agricultural drainage entering the lake. Chlorination alone provides little or no barrier to water borne parasitic disease.

The Kalamalka water supply is also currently at its limit. During extended high water use periods in the summer, the pumping station capacity cannot meet the demands. In addition, the annual license capacity is fully committed. The City thus has limited capability to supply water to property owners within the City boundary that are currently supplied from other sources.

2.3.2 District of Coldstream Water Utility

The District of Coldstream water utility is also primarily a domestic water system, supplying about one-half of the District's residential customers (about 1925 residential and ICI connections). The agricultural irrigated area served by this

system is only 2 ha. NOWA supplies the majority of the remainder of the District's residential properties, as well as the majority of the agricultural and industrial customers. Some properties also utilize individual wells, surface water intakes or are served by small private water systems.

Historically the Coldstream system has been operated as three independent systems: the Lavington, Coldstream and Kalview systems. The Lavington system, serving about 744 connections in the eastern portion of the valley, is supplied by the Antwerp Springs groundwater well system. The Coldstream and Kalview systems, serving about 1181 connections in the core urban area of the District, both utilize Kalamalka Lake water. The only water treatment provided on the three systems is chlorination. Water quality issues on the water systems that use Kalamalka Lake water are similar to the City of Vernon's water system. The Antwerp Springs groundwater is very hard and the use of home water softeners is required.

Components of the District's water system are fairly old and in some cases do not meet current performance standards. Although the District has additional license capacity on Kalamalka Lake, it is difficult to cost-effectively utilize this capacity due to the fragmented nature of the intake pumping stations.

2.3.3 North Okanagan Water Authority

The present NOWA system is a large, combined irrigation and domestic system that supplies lands within the District of Coldstream, City of Vernon, Electoral Areas B, C and D, and the Township of Spallumcheen. There are currently about 5275 residential and ICI connections. There are about 960 irrigation connections, serving about 3455 hectares.

The NOWA system was originally designed as a gravity irrigation system with seasonal booster pumping to the agricultural land on the valley sides. While it is the "newest" of the three water systems, the nature of the system design presents some limitations in terms of domestic water supply. In a number of upper areas, fire protection may be unavailable during times of power failure.

The system currently operates near capacity during the periods of peak irrigation demand. While NOWA holds unused license capacity on Kalamalka Lake, there

are currently no water supply works in place. Utilization of this source would thus require the construction of a new water supply system.

In addition to the above three water utilities, the City of Vernon also operates a reclaimed water system that is solely used for irrigation. The system currently uses secondary quality effluent, coupled with long-term storage to meet a variety of irrigation needs including range land, hay production, silviculture and golf courses. At the present time, approximately 970 hectares are under irrigation. The City is currently upgrading its wastewater treatment system to provide a quality of effluent that will be suitable for direct irrigation without storage.

2.4 EXISTING WATER DEMANDS

Assessment of the adequacy of existing water supplies for long-term use requires an understanding of present water use patterns. Table 2-3 provides a summary of existing domestic and irrigation water demands. Additional water use data is contained in Technical Working Papers Nos. 1 and 4.

**Table 2-3
Existing Water Demands - 2001**

Parameter (Note 1)	Vernon Water Utility	Coldstream Water Utility	NOWA Water Utility	Total / Average
Average Annual Domestic Water Use (ML)				
Residential	3,850	670	2,642	7,162
ICI	454	11	248	713
UFW	516	82	347	945
TOTAL	4,820	763	3,237	8,820
Residential Population (Note 2)	26,350	4200	11,200	41,750
Per Capita Water Use (L/d cap) (Note 3)	400	437	646	470
Average Annual Irrigation Water Use (ML)				
Irrigation Use	73	8	12,575	12,656
UFW	9	1	1,509	1,519
TOTAL	82	9	14,084	14,175
Irrigated Area (ha)	20	2	3,455	3,477
Average Irrigation Rate (m/yr) (Note 4)	0.365	0.400	0.364	0.364
Total Annual Water Demand (ML)	4,902	772	17,321	22,995

Notes:

1. Estimated based on 1999 data.
2. Populations shown are estimated serviced populations only. Approximately 10,000 persons in the electoral jurisdictions are served by individual or private community water systems. The average persons per dwelling unit for the region is 2.2.
3. Per capita use is based on residential population and excludes industrial, commercial, and institutional (ICI) and unaccounted for water (UFW) use.
4. Average irrigation rate is based on applied irrigation quantity only and excludes UFW.

The reader should appreciate that while overall water use is measured fairly accurately, the actual split of water use into categories is based on a number of assumptions and calculation methodologies. In particular for the NOWA combined system, there is significant uncertainty in the amount of water used for irrigation versus the water used for domestic purposes due to the lack of metering.

The existing water use data indicates that about 60 % of the overall water demand is going to irrigation use. This figure can fluctuate significantly from year to year, depending upon the amount of rainfall during the irrigation season

2.5 THE WATER QUALITY QUESTION

The most significant issue facing the water utilities in the Greater Vernon area is the question of domestic water quality. For decades, the water from the main valley lakes and the creeks was considered to be excellent quality – low in colour and turbidity – that only required chlorination to be considered potable. The construction of the piped VID system in the 1960s offered the potential to serve additional domestic customers at low cost. While the water suffered from moderately high colour and occasional high turbidity, it was accepted by the customers and only chlorination was required to meet the regulatory standards of the time for drinking water use.

Unfortunately, this is no longer the case. With increasing development and activity in the



watersheds, the levels of pathogenic cysts such as *Cryptosporidium* and *Giardia* in the raw water will likely increase. This is not simply a problem in the Vernon area, but a North American wide problem. While more vigilant watershed management can reduce the problem, the ultimate solution is a higher level of drinking water treatment.

The problem is complicated in the Vernon area by the variety and number of water sources. The fact that the NOWA system provides both irrigation and domestic water adds to difficulty of cost effective water treatment. What appeared to be a low cost supply of domestic water is turning out to be a costly problem.

NOWA, however, is not alone. Both the City of Vernon and the District of Coldstream are served by intakes and pumping stations on the shore of Kalamalka Lake. Insufficient space is available for additional water treatment at the existing facilities. Sites for water treatment plants need to be obtained and water supply systems reconstructed to allow raw water to be pumped to the water treatment plant sites and treated water to be returned to the distribution systems.

The question to be addressed in the MWP was thus – how can additional water treatment be provided on a cost-effective basis?

2.6 THE DO-NOTHING ALTERNATIVE

Does a “do-nothing” alternative exist? The answer is no – for several reasons. The first is the issue of domestic water quality. While the risk may be acceptable at the present time, the water quality of the sources will likely continue to decline. If additional water treatment is not implemented, there is a real risk of a water-borne public health problem, such as a *Cryptosporidiosis* outbreak in the coming years.

The second is increasing water demand. The need to increase the capacity of the Kalamalka Lake supply source that serves both the City and the District of Coldstream was identified in the late 1980s. This work has not been carried out due to slower than anticipated growth in the region, the off-setting gains made due to water conservation and the uncertainty due to discussions on regional water. As a result, with water demands now increasing due to growth, the supply capability in the summer months is severely stretched – to the point where a breakdown of pumping equipment during peak summer demand periods could lead to a severe water shortage from the Kalamalka Lake source.

The third reason is the aging of the water system components, particularly in the City of Vernon and the District of Coldstream systems. System replacement or upgrading has been put on hold in a number of instances due to the lack of a long-term plan. Dollars now need to be spent on upgrading water pumping stations and reservoirs and increasing distribution capacity to ensure that the systems meet expected municipal performance and reliability standards.

The goal of the Master Water Plan is thus to develop a long-term strategy to upgrade and expand the existing water systems to meet the needs of both the domestic water user and the irrigation water user in a cost-effective and sustainable manner.

CHAPTER SYNOPSIS

All three water utilities are facing problems with either domestic water quality and system capacity or both. The City of Vernon and the District of Coldstream also have a number of water system components that need replacement due to age or condition. A “do-nothing” alternative does not exist – each utility needs to invest considerable dollars in addressing the water quality and long-term water demand issues.

Community development and land use changes in the study area have been forecast over the 40-year planning horizon. The reader is referred to Technical Working Paper No. 3 for additional information.

Figure 3-1 indicates projected community development in Greater Vernon, as described in the following sections.

3.1 COMMUNITY GROWTH

The Greater Vernon Settlement Strategy projects that a population of about 140,000 could be accommodated in the Greater Vernon area. The report, completed in 1996, concluded that this population could be reached in about five decades.

In addition to the Strategy, the City of Vernon, the District of Coldstream and NORD have completed Official Community Plans (OCPs). These plans focus on development and growth over the shorter term. A brief discussion of anticipated growth and development in each jurisdiction is provided below.

3.1.1 City of Vernon

As indicated by the City's OCP, Vernon is emphasizing an increased densification of the downtown core, infill of existing developed areas and an increase in the proportion of multi-family housing. Long-term residential development will be accommodated by the gradual annexation of lands within Electoral Areas B and C adjacent to present City boundaries.



Don Weixl Photo

City of Vernon

For the purposes of the Master Water Plan, population growth rates of between 2.0% and 3.0% are considered reasonable for long-term projections. Commercial development is expected to grow at about 0.4% per year, resulting in about 15 ha of additional commercial land development between 2001 and 2011. In addition to continued growth, the City water utility will experience occasional block

increases in its customer base, as existing private systems are integrated in the Okanagan Landing area.

3.1.2 District of Coldstream

The District of Coldstream is predominantly rural/agricultural in character. Residential development is concentrated in the Kalamalka Lake, Middleton Mountain and Coldstream Valley Estates areas, with limited development in the Lavington area. The District's OCP is keyed toward preserving the rural and agricultural character and lifestyle and stresses maintaining large lot sizes. Only limited exclusions from the ALR are anticipated. Limited growth in commercial activities is anticipated. Given the direction in the District's OCP and historic growth rates, low and high growth rates of 1.5% and 3.5% are used for the present Master Water Plan.



The Coldstream Valley

3.1.3 Electoral Areas B & C

The OCPs for these electoral areas anticipate that the main changes will occur as a result of annexations by the City of Vernon. Most of the future annex areas are currently served by NOWA. For the present Master Water Plan high and low population growth rates of 2.0% and 2.75% were used based on historical growth patterns. Block additions may occur, if the Keddleston community in Area C is integrated with the water system.

3.1.4 Township of Spallumcheen

Based on the Township's current planning direction, and existing ALR predominance, it is unlikely that substantial residential growth will occur in the south Spallumcheen area. The exception to this is about 50 one-hectare lots in the area north of Stepping Stones. For the present Master Water Plan, it is assumed that the Spallumcheen service area will increase by 50 to 100 lots, and 100 ha of

irrigation over the study period, representing an overall growth rate of 1.0% to 2.0% over 40 years.

3.1.5 Area D

It is anticipated that there will be some residential infill on the lands serviced within Area D. Growth rates of 3.0% to 5.0% per year were assumed given the few residential dwellings presently existing in this area.

3.2 SERVICED POPULATION GROWTH

Table 3-1 indicates the projected residential water service populations within the study jurisdictions to 2041. Overall, the average expected annual growth rate is approximately 2.7% over the 40-year period. This reflects servicing both existing development on individual or private water supplies, as well as new development. This percentage growth represents about the 75-th percentile relative to the low and high projections. This is believed reasonable for water system planning as it provides a slightly conservative bias – in other words, there is a greater chance that actual growth will be slightly less than projected. In most cases, this means that expansion of water system components could be delayed a few years relative to the projected year in the plan. As it is difficult to predict the actual growth cycles that may occur over the four decades, a linear growth pattern has thus been assumed over the 40-years. Detailed supplementary tables are provided in Technical Working Paper No. 3.

Table 3-1
Projected Average Growth in Water Service Areas,
2001 to 2041

Jurisdiction	Population				
	2001	2011	2021	2031	2041
City of Vernon	30,200	39,700	52,200	67,900	88,200
District of Coldstream	6600	8600	11,200	14,800	19,700
Electoral Area B	2500	3200	4000	5100	6500
Electoral Area C	2100	2600	3700	4700	6000
Spallumcheen	200	250	300	350	400
Electoral Area D	50	50	50	100	200
Total	41,750	54,800	71,850	93,250	121,000

Of key significance to the Master Water Plan, is the fact that the residential population in the Greater Vernon area will essentially triple over the next 40-years, based on the average expected growth rate. In reality, actual long-term growth rates will be higher or lower than projected. The strategy under the plan thus needs to be flexible to accommodate the actual increase in population in the future.

3.3 IRRIGATED LAND AREA

Irrigated land areas, as defined in the MWP, refer to irrigated land used for commercial or institutional purposes. The vast majority of this land base is agricultural – grain or hay crops, rangeland, orchards, or vineyards. The remainder of the irrigated land base is



typically golf courses, playgrounds, recreation fields, cemeteries or other municipal applications. Residential land is not included in the definition. This water is accounted for under the residential water use.

The agricultural area is likely to remain quite stable over the long term, but land uses may change to reflect economic and climatic trends. The most marked influence on water supply required for irrigated land may result from expansion of reclaimed wastewater irrigation onto presently irrigated lands. This item is discussed in Technical Working Papers Nos. 3 and 11.

Projected irrigated land areas are shown in Table 3-2.

Table 3-2
Projected Irrigation Land, 2001 to 2041

Jurisdiction	Irrigation Land Area (ha)				
	2001	2011	2021	2031	2041
City of Vernon	340	390	400	400	400
District of Coldstream	1700	1710	1780	1800	1820
Electoral Area B	660	670	680	680	690
Electoral Area C	510	510	520	520	530
Spallumcheen	100	100	100	150	150
Electoral Area D	170	170	180	180	230
Total	3480	3560	3650	3740	3820

CHAPTER SYNOPSIS

The residential population of the Greater Vernon area is expected to increase from the current figure of about 42,000 to about 121,000 over the next 40 years. This tripling of the population will have a significant impact on water management planning. The irrigation land base, on the other hand, will likely see only a slight increase over the 40-year planning horizon.

PROJECTED WATER DEMANDS

The present Master Water Plan utilizes a 40-year horizon for planning purposes. Projected water demands for that period were developed in Technical Working Paper No. 5, based on the existing usage patterns summarized in Technical Working Paper No. 1, the population and land use projections in Technical Working Paper No. 3, and the expected trends in demand patterns set out in Technical Working Paper No. 4. The reader is referred to these working papers for additional information.

4.1 CURRENT WATER DEMANDS

The three utilities supply an average of 23 billion litres per year. Irrigation water use accounts for about 55 % of the total use. Residential and industrial, commercial and institutional (ICI) are 31% and 3%, respectively, of total use. The remaining 11 % is unmeasured water use and leakage. This is termed unaccounted for water (UFW).

4.2 WATER CONSERVATION – IMPACT ON LONG TERM PLANNING

The District of Coldstream has had universal metering of customers for many years. NOWA has implemented metering of new residential (about 350 customers) and ICI connections but does not yet universally meter domestic water customers.

Agricultural water customers are not metered. The City of Vernon has made significant strides in the last

decade in water conservation, with the implementation of universal metering, as well as a number of other water use reduction programs.



Technical Working Paper No. 4 - Water Conservation and Reuse looked at both existing programs and future trends in the area of water use efficiency. While the region has come a long way, there are still opportunities for further reductions over the planning horizon. The question is the degree of aggressiveness and the acceptance of the public in further conservation measures.

In Technical Working Paper No. 5 - Projection of Water Demands, three scenarios for future water use were developed. The scenarios were termed the low, average and high

estimates. They consider both a range in residential population and irrigation land growth, as well as varying degrees of water conservation.

The low estimates assume minimal customer participation or acceptance of measures, as well as conservative estimates of potential demand reductions. The high estimates represent high levels of implementation by customers, and maximum water savings. The average of the low (cautious) and high (optimistic) estimates may be the best approximation of what could be achieved, given the present state of knowledge. The savings projected for the average estimates are consistent with results that have been achieved by other utilities.

4.3 WATER DEMAND PROJECTIONS

Based on the range of future projections, an “average” water demand scenario was selected for detailed planning. These values are shown in Table 4-1. In reality, actual future water demands will be higher or lower than the values selected. It is important that the on-going water use data be collected and the plan re-visited at five-year intervals to reassess the timing of future water system components.

**Table 4-1
Water Demand Projections
Irrigation**

Year	Irrigation Area ¹ (ha)	Irrigation Rates ² (ML/ha/yr)	Annual Irrigation Demand			Maximum Day Demand ⁴ (ML/d)
			Agricultural (ML)	UFW Allowance ³ (ML)	Total (ML)	
2001	3477	3.64	12,656	1519	14,175	209
2011	3562	3.30	11,755	1411	13,166	178
2021	3648	3.30	12,039	1445	13,484	182
2031	3735	3.30	12,326	1479	13,805	187
2041	3823	3.30	12,615	1514	14,129	191

Note 1: Irrigation area based on 2001 estimate, additions at 0.1%/yr and 50 ha block additions every 10 years.

Note 2: Initial irrigation rate based on 2001 data, assumed to decline to 3.30 ML/ha/yr in 10 years.

Note 3: Overall assumed UFW rate of 12% applied to Agricultural Demands. Assumed constant overtime.

Note 4: Assumed to be 0.06 ML/d per hectare for the period 2001 to 2010, decreasing to 0.05 ML/d per hectare after 2010.

**Table 4-2
Water Demand Projections
Domestic**

Year	Residential Population ¹	Per Capita Demand ² (L/cap/day)	Annual Domestic Demand					Maximum Day Demand (ML/d) ⁵
			Residential (ML)	ICI ⁴ (ML)	Total Before UFW (ML)	UFW Allowance ⁴ (ML)	Total (ML)	
2001	41,750	470	7162	713	7876	945	8821	56
2011	54,800	445	8901	723	9624	962	10,586	58
2021	71,851	420	11,015	784	11,798	1062	12,860	71
2031	93,250	415	14,125	873	14,998	1200	16,198	88
2041	121,000	410	18,108	1014	19,122	1530	20,651	113

Note 1: Population based on an average of high and low growth rate scenarios.

Note 2: Per Capita Demands assuming average effectiveness of water conservation measures.

Note 3: Initial UFW rate of 12% applied to Domestic Demands in 2001, decreasing to 8% by 2031 and constant thereafter.

Note 4: ICI is 3.6% of combined Residential and Agricultural Demands before UFW, decreasing to 3.3% by 2041.

Note 5: Assumed to 2.3 times the average annual demand in 2001, decreasing to 2.0 by 2011 and constant thereafter.

CHAPTER SYNOPSIS

The annual domestic water use is expected to increase from 8,821 ML to 20,651 ML, over the 40-year period. Maximum day domestic demands will increase from the current amount of about 60 ML/d, to in the order of 113 ML/d in 2041.

While irrigated land area is expected to increase slightly over the planning horizon, more efficient irrigation practice will keep overall annual irrigation water use at about 14,000 ML. The portion of overall water used for irrigation in the region will decrease from the current level of 55% to 36% by 2041. Maximum day irrigation demands are expected to drop from the current figure of 209 ML/d to about 180 ML/d by 2011. They are then expected to rise slightly over the remainder of the planning period. This change reflects the impact of metering and changing land use.

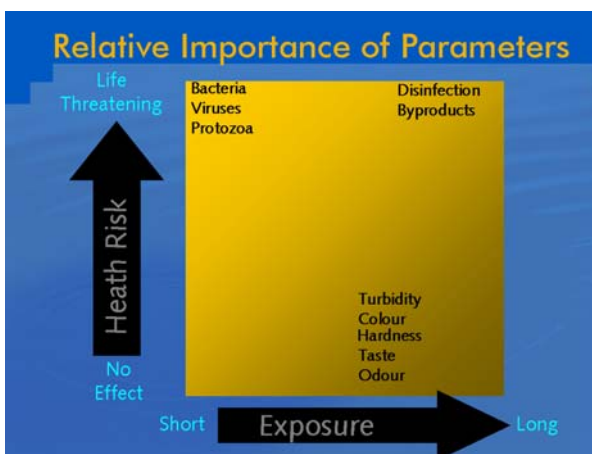
WATER QUALITY GOALS

A key element of the Master Water Plan is the development of water quality goals. While this would initially appear to be fairly straight forward, it is in fact a complex subject. The regulatory environment in North America has changed dramatically over the last decade, as new threats to water quality are better understood. Recent water borne public health problems, such as in Walkerton and North Battleford, has caused provincial regulators to reassess their approach.

In British Columbia, the regulatory situation is even less clear than in other provinces. New legislation was introduced in April 2001 and then shortly thereafter rescinded by the new government. At the time of completion of this MWP, the regulatory direction is still not clear. Technical Working Paper No. 6 provides an in-depth discussion on setting water quality goals. Key elements of this discussion and the selected criteria are discussed below.

5.1 DOMESTIC WATER QUALITY GOALS

The overall objective for potable water quality is to provide water that is safe and aesthetically pleasing. While there is considerable overlap of these two goals, there are differences. Water that is technically quite safe to drink may appear unpleasant to the consumer. Conversely, water that appears good to the human senses may, in fact, threaten the health of the consumer. Where these differences are apparent, it is reasonable to say that water providers have generally leaned towards providing safe water while the customer will generally judge water by its aesthetics. Thus, addressing both goals is important.



Water Quality Standards are a provincial responsibility. In British Columbia, the standards are defined in the Safe Drinking Water Regulation, B.C., Reg. 230/92 adopted under the Health Act. Under Section 5 of the Safe Drinking Water Regulation (SWDR), the water purveyor has the responsibility to provide potable water to all users served by the water works system.

“Potable Water” is defined in the SDWR as “water, which meets the requirements of the schedule (attached to the SDWR) and is safe to drink and fit for domestic purposes without further treatment”.

The schedule attached to the SDWR defines bacterial standards that must be met. The Province, under the former NDP government, introduced the Drinking Water Protection Act in April 2001. This new Act was essentially enabling legislation to allow the establishment of regulations and revisions to the Safe Drinking Water Regulation. In the September 2001, the new Liberal government repealed this legislation and established a Drinking Water Review Panel to review drinking water legislation. In February 2002, the Panel submitted its final report to the Government. The report recommends fairly sweeping changes to drinking water regulation, including more stringent tap water standards. It is not known if the Government will accept all or any of the Panel’s recommendations.



Giardia Cysts

In the absence of a definitive Provincial direction, it is necessary to look elsewhere. Most, if not all, provinces have at least adopted the Guidelines for Canadian Drinking Water Quality (GCDWQ) as their standards. However, application and enforcement vary. Provincial water quality regulations in Ontario and Alberta draw heavily from the U.S. EPA regulations. Thus, if these regulations are not immediately used for guidance by the GVWU, the Master Water Plan must account for the possibility that future regulations in British Columbia may be based on them.



Cryptosporidium Oocysts

Given the current situation in British Columbia, three broad goals have been identified:

- Achieve a quality standard that is within the parameters established by the GCDWQ.
- Reduce the risk of disease caused by ingestion of pathogenic micro-organisms.
- Ensure that disinfection byproducts are maintained within established limits.

Achieving these goals will require a further investment in water treatment. The water treatment requirements and specific treated water criteria will vary depending upon the water supply source, the quality of the raw water and expected impacts on the watershed in the future. In general, the water treatment strategy will have to deal with the following immediate water quality issues: pathogenic organisms, trihalomethanes (THMs), colour, turbidity, taste and odour.

Specific water quality criteria targets are provided in Chapter 8.

5.2 IRRIGATION WATER QUALITY GOALS

The requirements for the quality of irrigation water are less stringent than for drinking water. The major considerations are the potential for gross levels of contamination or high dissolved chemical concentrations. Provincial guidelines exist for irrigation water. These have been adopted as the water quality goal in the Master Water Plan.

As noted earlier, the City of Vernon operates a reclaimed water irrigation system. This system is regulated under an Operational Certificate, issued under the City's Liquid Waste Management Plan. The establishment of water quality goals for this system is outside the scope of this plan.

CHAPTER SYNOPSIS

The Province of British Columbia lacks definite drinking water quality goals at this time. Domestic water quality goals have thus been developed, based on experience elsewhere and the expected regulatory direction of the Province. The four key domestic water quality criteria are pathogenic organisms, trihalomethanes (THMs), colour, turbidity, taste and odour. Specific numerical criteria are contained in Chapter 8.

Irrigation water quality should meet the Provincial guidelines for irrigation water use.

THE REGIONAL WATER CONCEPT

Technical Working Paper No. 9 evaluated the long-term economics of either staying with a combined water system, that serves both domestic and irrigation customers, or separating the existing combined system into two independent systems. The economics strongly favoured separation.

Technical Working Papers Nos. 10 and 11 then examined how the separated domestic and irrigation systems could be developed. Technical Working Paper No. 12 evaluated five possible options for a regional water strategy, considering various water sources and the timing of combined system separation.

A brief overview of the technical aspects covered in the working papers is presented below.

6.1 COMBINED WATER SYSTEM OR SEPARATION?

On an average annual basis, about 80% of the water use in the existing NOWA combined system goes to irrigation. The remainder is for domestic use. The quality of water used for potable purposes must be improved to meet the water quality goals. The question is therefore - is it better to treat all of the water or is it better to separate the irrigation and domestic functions and treat only the domestic supply?

The major factor in this decision is cost. This was investigated using an economic analysis technique known as “life cycle costing”. This analysis essentially determines how much money in year 2001 dollars would be required to meet all cash flow obligations for each option over the analysis period. A 50-year period was selected. The results clearly show that water system separation, to create a domestic water system and an irrigation water system, has a clear economic advantage over the long-term. Based on a 50-year lifecycle cost analysis, the cost to implement and operate a separated water system is about \$149 million. The cost for a combined water system, over the same period and providing the same domestic water quality, is about \$198 million.

The analysis does not consider the economics of future integration of the City of Vernon’s reclaimed water system. When this is subjectively factored in, the move to a separated system becomes more attractive. The reason for this is that, once a non-potable irrigation system has been established, a number of options for blending of irrigation sources are available. This in turn frees up additional upland lake water, that is currently used for irrigation, for domestic water use.

6.2 THE PROPOSED REGIONAL WATER STRATEGY

The regional water strategy, that has been adopted, is to separate the existing combined water system over the next five years and construct a new water treatment plant in the Middleton Mountain area in the same time frame.

This water treatment plant would be supplied by both Kalamalka Lake water and Duteau Creek water. Once in-place, this plant would supply all of the domestic water demands in the Vernon region.



Kalamalka Lake Intake

The main components of the strategy are:

1. Separate the combined water system by constructing new domestic water distribution water mains. This would be accomplished in a five-year program, commencing in 2003 and being completed by the end of 2007.
2. Construct the first stage of a new water treatment plant (clarification, UV primary disinfection and chlorine secondary disinfection) in the Coldstream Valley near Middleton Mountain by the end of 2005. Raw water supply to the plant would come from Kalamalka Lake via a new water supply line and from Duteau Creek via the existing NOWA transmission main.

The subsequent stage of treatment (additional chemical pre-treatment for taste/odour reduction and filtration) and an expansion of plant capacity would occur in about 2021. The actual timing will depend upon the performance of the first stage of treatment, future water quality regulations and the rate of increase of water demands. A third stage of expansion would occur in about 2029.

3. Construct a new, raw water transmission main from the Kalamalka Lake pumping station to the new water treatment plant in 2003. Prior to commissioning of the plant, this main would deliver chlorinated water to the PZ479 zone.
4. Construct a new, covered PZ 479 reservoir on the existing McMechan reservoir site in 2003.

5. Upgrade the Kalamalka Lake pumping station with higher capacity pumps in 2003.
6. Construct miscellaneous improvements in the existing domestic water distribution systems in the City of Vernon and the District of Coldstream over the period from 2003 to 2007 in order to increase hydraulic capacity.
7. Expand the domestic water system to meet the needs of development over the next four decades. This will include both replacing and adding water mains in the core areas to move water across the pressures zones as well as constructing new water mains in the new, outlying development areas.
8. Following creation of a separated irrigation system, operate and maintain this system to provide irrigation water to meet the demands. Irrigation demands are expected to stay relatively constant over the coming decades. Opportunities to integrate the use of reclaimed water need to be explored, once the City of Vernon completes the upgrade of its wastewater treatment plant to provide an effluent quality that will allow direct irrigation.

This strategy is very aggressive in dealing with the separation and domestic water quality issues. It requires a significant capital expenditure in the first five years of the plan to implement both separation and a high level of water treatment. Correspondingly, it reduces the potential risk of water-borne public health problems and reduces aesthetic domestic water quality concerns with colour, taste or odour. Capital expenditures after 2008 will be less onerous.

The regional water strategy strongly emphasizes a multi-barrier approach to drinking water quality. In addition to water treatment, key elements of the long-term strategy will be watershed protection and protection of the water quality within the distribution system. Watershed protection will mean taking an active stakeholder role in ensuring that there is a strong voice for drinking water protection in the overall land use of the upland and valley watersheds, as well as in the protection of the groundwater resource. Protection of the water quality within the distribution system will require implementation of a cross-connection control program, as well as a diligent quality assurance program during the changeover of the combined system customers to the domestic water system.

CHAPTER SYNOPSIS

The regional water strategy, that has been adopted, is to separate the existing combined water system over the next five years and construct a new water treatment plant in the Middleton Mountain area in the same time frame. This water treatment plant would be supplied by both raw Kalamalka Lake water and raw Duteau Creek water. Following the completion of separation and commissioning of the new water treatment plant, the domestic water system would be expanded over the next three decades to meet the development needs of the region.

WATER SOURCE DEVELOPMENT

A number of surface and groundwater sources have been used historically for water supply in the Greater Vernon area. An evaluation of the potential long-term use of the sources has been carried out during the preparation of the Master Water Plan. Two surface water sources, Kalamalka Lake and the Duteau Creek system, have emerged as the two preferred water sources for water supply in the near and medium term. Okanagan Lake has been identified as an additional domestic water source in the long-term. Groundwater in the Coldstream Valley, local surface water sources such as Deer Creek, and reclaimed water will also play a role in irrigation water supply in the region.

The development of these water supplies is discussed below. The reader can find further details on source development in Technical Working Papers Nos. 7 and 13.

7.1 KALAMALKA LAKE

Kalamalka Lake currently supplies the majority of domestic water to the region. Under the regional strategy, this source will be developed to its license limit in the near term. This source has been selected, as one of the two major sources, as it is near the core area of water demand; is at a higher elevation than Okanagan Lake; has a generally good raw water quality and has a significant investment in water supply infrastructure in-place.



Kalamalka Lake

The annual volume of water from this supply is governed by the license capacity set by the provincial government. Historically, the three utilities have each held license capacity.

In addition, some surplus capacity on the lake was unallocated by the government. With the pooling of the licenses under the Greater Vernon Water Utility (GVWU), the existing annual license capacity is 8781 ML.

In the past few years, the Province has indicated that some of the additional, unallocated capacity would be given to the regional water authority, once planning was in place. The most recent correspondence (September 2001) from the Ministry of Sustainable Development, however, indicates that no additional capacity will be granted. While this could again change in the future with further reassessment by the government, for the

purpose of the regional water strategy, it is assumed that the Kalamalka Lake source will be limited to 8781 ML per year. This represents about 92% of the annual average regional domestic demand in 2011. This figure drops to about 43% by 2041.

The license does not limit the short-term extraction volume from the lake. Maximum day withdrawals can thus be considerably higher than the annual average. With the proposed dual raw water feed to the Middleton Mountain water treatment plant, the strategy will be to utilize the Kalamalka Lake source as efficiently as possible, while at the same time ensuring adequate raw water transmission capacity is available for emergency situations.

The near-term operational strategy will be to utilize the Kalamalka Lake source as the primary supply in the summer. The Duteau Creek source and raw water transmission main would be primarily dedicated to meeting the irrigation needs. During the non-irrigation season, the Duteau Creek raw water source would be used to supply raw water to the Middleton Mountain WTP, as this will reduce the costs associated with raw water pumping from the Kalamalka Lake supply. The actual balance of raw water from the two sources to the plant will vary from season to season, depending upon the storage in the upland lakes. In the long-term, irrigation demands may change and it is anticipated that reclaimed water could supplement much of the upland lake and groundwater used currently used for irrigation. This will free up additional upland lake water for supply to the water treatment plant.

The other consideration in sizing the Kalamalka Lake raw water supply is emergency operation. An example of this would be an interruption in the raw water supply from the Duteau Creek source. In this event, the majority of the domestic water supply for the region would have to come from the Kalamalka Lake source. A reasonable approach would be to provide for a delivery capacity of about three times the average annual license capacity, or about 72 ML/d. In an emergency situation, this would allow this source to provide about 64% of the treatment capacity of the water treatment plant in the year 2041. It would also allow for a fairly flexible operating strategy for the two sources.

The above scenario would yield a raw water transmission capacity of about 830 L/s. This figure is almost twice the current capacity of the pumping station. This can be achieved by constructing the new raw water transmission main and replacing the existing pumps in the Kalamalka Lake pumping, while retaining the same structure, and reducing the system total hydraulic grade line. The actual capacity will depend upon the elevation and location of the water treatment plant.

7.2 DUTEAU CREEK

The Duteau Creek source will be the second major water source for the region. This supply will be used to meet the irrigation demands for agricultural areas serviced by the irrigation system and to provide raw water to the Middleton Mountain water treatment plant. This supply was selected as the other major water source due to its significant supply capacity; its generally good raw water quality; and the fact that the infrastructure is in-place to deliver both large quantities of raw domestic water and irrigation water by gravity to the main areas of use.



Duteau Creek

The annual license capacity that will be held by the GVWU for this source is 24,922 ML, or about three times the Kalamalka Lake source. The Duteau Creek source, however, is much more dependent on weather and drought cycles than the Kalamalka Lake supply. Work carried out in Technical Working Paper No. 7 indicates that the average annual runoff (exclusive of upland lake storage) is about 38,800 ML. During a 1 in 10

year drought, the runoff drops to about 14,500 ML. For a 1 in 50 year drought, this value drops further, to about 8500 ML. Prudent management of this source is thus required during drought cycles. The storage volumes in the upland lakes (about 19,000 ML) will need to be utilized to supplement annual runoff in low runoff years.

As noted under the Kalamalka Lake source discussion, it is intended to utilize the Duteau Creek source as a raw water supply to the water treatment plant during the non-irrigation period. In the initial years of plant operation, this would mean that 5000 to 6000 ML per year would be used for domestic use, if all the non-irrigation season domestic demand was provided by this source. By 2041, with the Kalamalka Lake license fully used, the average annual volume of Duteau Creek supply that would go to domestic use would be 11,870 ML, or about 48% of the license capacity.

Expected average annual irrigation demands for the service area are expected to remain relatively constant over the next four decades. The estimated annual irrigation use in 2041 is 14,129 ML. This amount would be supplied by a combination of the remaining volume in the Duteau Creek license (13,052 ML), the Deer Creek supply, the

groundwater supply and, possibly, reclaimed water. As an example, if the Deer Creek supply was used to its license capacity (3699 ML) and no groundwater or reclaimed water was used, then the quantity required from Duteau Creek would be 10,430 ML. Combining the domestic and irrigation demands for the Duteau Creek source (22,300 ML) indicates that 89% of the water license capacity would be used.

The license capacity (24,922 ML) can be easily provided in an average run-off year (38,800 ML). During drought years, water stored in the upland lakes will be required to supplement available runoff. In a 1 in 50 year drought, it is likely that less than 5000 ML of runoff may be available once downstream releases are considered. This would mean that upland storage volumes (19,000 ML) would be virtually completely depleted to meet the combined domestic and irrigation demand. At this time, there is considerable uncertainty in any long-term projections due the changing irrigation demands, the use of reclaimed water and global climate change. While under most scenarios there should be adequate water from the proposed sources to meet the 40-year demands, the GVWU should develop a statistical forecast model for watershed management to allow determination of the “what if” scenarios, based on expected runoff and future water demands. This model should be used in the future to track demands versus supply volumes and to determine when new supplies, such as Okanagan Lake, are required.

The Duteau Creek transmission system was originally designed to meet the peak irrigation needs of the service area. The maximum day delivery is thus far greater than the average annual license capacity. The peak capacity to deliver flow is dependent upon the supply from other upland sources, from Goose Lake, and the HGL created by the irrigation demands. Detailed hydraulic modeling is required at the preliminary engineering stage to determine delivery capacities under future scenarios. Based on current operating data, the transmission system should be capable of delivering raw water to the water treatment plant at a rate of about 2400 L/s. This is about 1.8 times the plant maximum day capacity in the year 2041. In the winter months, when the plant is supplied entirely on Duteau Creek water, the transmission system would only be operating at about 20 to 25% capacity.

The worst-case scenario would be if the Kalamalka Lake water raw water supply was not available during the peak summer demand period. In this event (assuming the year 2041), about 55% of the capacity of the Duteau Creek transmission system would be dedicated to supplying the plant demands. The remaining capacity (1100 L/s) would be available for irrigation demands. As the peak irrigation demand is about double this amount, some restrictions in irrigation would be required during the emergency. This

will depend upon the availability of supply from other surface water sources, groundwater and reclaimed water.

7.3 OTHER UPLAND SOURCES

Other potential upland sources include Deer Creek, Coldstream Creek and BX Creek. The regional strategy proposes to keep the Deer Creek source as an active irrigation source and as a raw water source to the Middleton Mountain water treatment plant, as it is an integral part to the irrigation system. The annual license capacity of this source is 3699 ML, or about 11% of the total regional water demand in 2041.

The Coldstream Creek and BX Creek sources should be decommissioned but the works retained. These sources could be utilized for local irrigation water at some point in the future. In the case of Coldstream Creek, it may be possible to transfer this license capacity to Kalamalka Lake, as the creek drains to the lake.



BX Creek

7.4 GROUNDWATER

In the upper portion of the valley, the Antwerp Springs groundwater wells have supplied the Lavington water system for a number of years. This water, however, is very hard (325 mg/L) and has necessitated the use of home water softeners. While the continued use of this water source was contemplated in the early stages of the plan, the feedback from water users was that the hardness made the long-term use of the water unacceptable, particularly if a high-quality water was available from a regional treatment plant. Evaluations carried out comparing hardness removal from the Antwerp Springs supply versus supply from the Middleton Mountain water treatment plant concluded that the latter was more cost effective. The decision was thus made to discontinue the Antwerp Springs supply as a domestic water source, after the regional water treatment plant was on-line.

Groundwater in the Coldstream Valley will continue to play a role in irrigation water supply. The existing Wells Nos. 1 and 2 in the western part of the valley will continue to feed into the existing irrigation water system. The current Antwerp Springs wells could

be used for either local irrigation or will be tied into the regional irrigation grid. This should be evaluated further in the preliminary engineering stage.

As the Antwerp Springs supply will continue to be used as a domestic source until 2008, a well-head survey, conducted in 2002 or 2003, is recommended to confirm that the wells are not influenced by surface runoff and the current method of disinfection provides an adequate level of public health protection.

7.5 RECLAIMED WATER

Irrigation, using reclaimed water, will be a significant component of overall irrigation use in the region. The question is - to what degree will reclaimed water be integrated into the separated irrigation system?

Currently the City utilizes about 4900 ML/yr in its own irrigation system. Over the next 40 years, the additional volume available is estimated to be about 9300 ML/yr. This represents about 65% of the expected irrigation demand in the GVWU irrigation system. There is thus ample reclaimed water available to be considered as a possible source water for the GVWU irrigation system.

This is discussed further in Chapter 10.

7.6 OKANAGAN LAKE

The development of Okanagan Lake, as a regional water source, is not required from a capacity viewpoint over the next 40 years, based on the selected regional water strategy.

At this point, it is difficult to look beyond 40 years with any confidence. If the expected population growth did not happen and a significant use of reclaimed water occurs, the development of Okanagan Lake, as a domestic water source, may not be needed for well beyond the 40 years. On the other hand, if the population exceeds the 120,000 figure and technology and economics dictate only a limited expansion of the City's water reuse system, then development of the Okanagan Lake source may be required near the end of the 40-year planning period.

If this is the case, a local treatment plant will be required. It would be prudent to secure a site at an early stage prior to in-fill of the area around the head of the lake. It may also be

prudent for the GVWU to secure license capacity on Okanagan Lake, well in advance of development of this source.

CHAPTER SYNOPSIS

Kalamalka Lake and Duteau Creek will be the major water sources over the next 40-years. Kalamalka Lake will serve as a domestic water source only. Duteau Creek will provide both irrigation water and raw water to the treatment plant, primarily during the non-irrigation season. Groundwater in the Coldstream Valley will continue to be utilized as a irrigation water source. Deer Creek, other local creeks, and groundwater are potential local irrigation sources. Reclaimed water from the City of Vernon's wastewater system offers a significant potential irrigation water source to offset other irrigation supplies. This would free up additional raw water supply to the water treatment plant. The development of Okanagan Lake, as a supply source, may be required by the end of the 40-year planning horizon.

WATER TREATMENT

Domestic water for the Greater Vernon area will be provided by a single source – the Middleton Mountain water treatment plant. The proposed Middleton Mountain water treatment plant will be located northeast of Middleton Mountain. This plant will utilize both Kalamalka Lake and Duteau Creek as raw water sources.

A brief description of the facilities is provided below. Additional information is contained in Technical Working Paper No. 13.

8.1 SITING

The Middleton Mountain water treatment plant would be a new facility on a, yet to be determined, site in the Coldstream Valley, northeast of Middleton Mountain near Hwy 6. This location is reasonably near the two raw water sources, near the core water demands in the PZ 479 pressure zone, and allows access to the City's sanitary sewer system.

The plant site should be at least 4 ha in area. The average site elevation should be between about 430 and 475 m. As the water treatment plant is a very heavy structure, the bearing capacity of the underlying soils is critical in site selection. A number of potential sites exist in the general vicinity. Evaluation of specific sites would occur at the preliminary engineering stage. For the purpose of planning and costing out the water transmission mains, the plant site was assumed to be located near the NORD office. Figure 8-1 presents the general layout of the plant on a generic site.

8.2 PLANT CAPACITY

The ultimate plant capacity is set by the amount of raw water that can be delivered to the plant site by the two raw water sources, Kalamalka Lake and Duteau Creek. This is governed by license capacity and the amount of irrigation water supplied by the Duteau Creek source in the future.

The actual plant would be constructed in stages. Based on the projected populations over a 40-year period, a Stage 1 capacity has been selected at 71 ML/d. This would provide capacity to meet domestic demands until about 2021. The plant would then be expanded in two additional stages to provide the following capacities, 85 ML/d in 2021 and 113 ML/d in 2029. The site would be laid out for a further 50% expansion, after 2041.

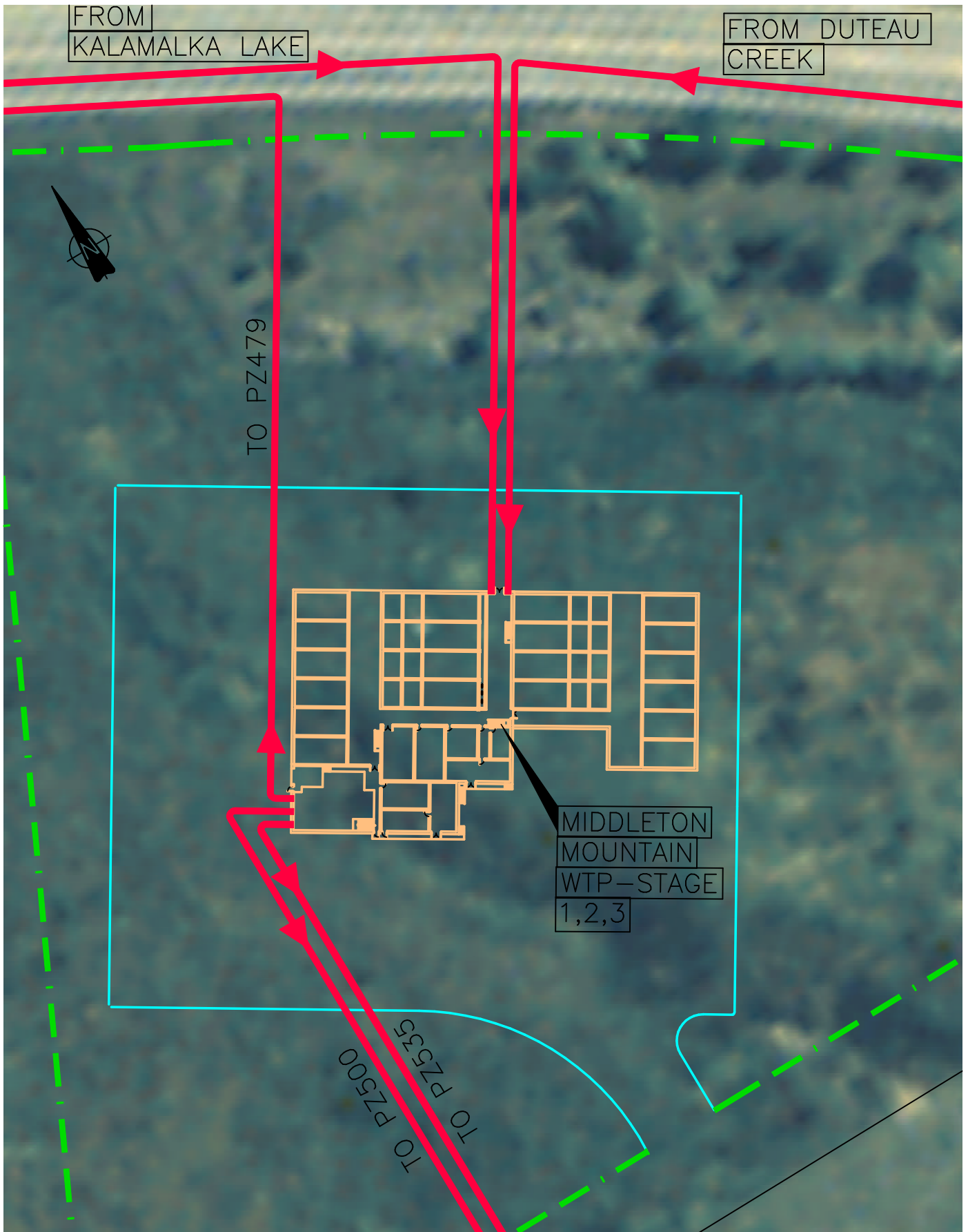


FIGURE 8-1
PROPOSED MIDDLETON MOUNTAIN
WATER TREATMENT PLANT-TYPICAL LAYOUT
SCALE: 1:2000±

The timing of expansions will depend upon the growth in water demand in the region. As multiple process trains are proposed, it would also be possible to increase the number of expansion stages and to expand the capacity in smaller increments. This will be evaluated further at the preliminary engineering stage.

8.3 DESIGN PARAMETERS

Goals for long term treated water quality were set out in Chapter 5. The immediate goals for Duteau Creek and Kalamalka Lake water include addressing colour, turbidity, taste and odour, and reduction of pathogenic organisms and chlorinated disinfection by-products (e.g., trihalomethanes). Based on the raw water quality characteristics of Duteau Creek and Kalamalka Lake, the expected treated water quality is summarized in Table 8-1.

**Table 8-1
Summary of Raw Water Quality and Treated Water Goals**

Parameter	Duteau Creek Range	Kalamalka Lake Range	GCDWQ Guideline Description	Treated Water Target Level
Alkalinity (mg/L)	20 to 40	140 to 150	No standard	min 25 mg/L (as CaCO ₃)
Aluminum (mg/L)	0.100 to 0.150		0.1 mg/L ¹	≤ 0.1 mg/L
Coliform Bacteria	n/a ⁷	N/a ⁷	<1 org./100mL ²	<1 org./100mL
Cryptosporidium	n/a ⁷	N/a ⁷	No standard ³	>2 log reduction
Enteric Viruses	n/a ⁷	N/a ⁷	No standard ⁴	4-log reduction
Giardia (cysts/1000 L)	3 to 200	n/a ⁷	No standard ³	>3 log reduction (> 2.5 log by clarification/filtration/UV, 0.5 log by Cl ₂)
Iron (mg/L)	0.050 to 0.800		≤ 0.3mg/L AO	≤ 0.3 mg/L
Sulphate	6.50 to 6.80		≤ 200 mg/L	≤ 200 mg/L
PH	5.85 to 8.50	6.7 to 9	6.5 – 8.5	Stable, non-aggressive
Temperature (°C)			≤ 15 AO	≤ 15
THM (total)			< 100 µg/L MAC	< 80 µg/L
TOC	8.0 to 10.2	0.3 to 7	No standard	Sufficient to meet THM & aesthetic targets

Parameter	Duteau Creek Range	Kalamalka Lake Range	GCDWQ Guideline Description	Treated Water Target Level
True Colour (TCU)	20 to 130	< 5	≤ 15 TCU AO	≤ 15 TCU 100 % of time
Turbidity	0.0 to 14.15	0.50 to 0.54	1.0 NTU MAC ⁵ (≤ 5 NTU AO) ⁶	≤ 0.3 NTU 95 % of time ≤ 1 NTU 100 % of time

Notes

1. A health-based guideline for aluminum in drinking water has not been established. However, water treatment plants using aluminum-based coagulants should optimize their operations to reduce residual aluminum levels in treated water to the lowest extent possible as a precautionary measure. *Operational guidance values* of less than 100µg/L total aluminum for conventional treatment plants and less than 200 µg/L total aluminum for other types of treatment systems are recommended.
2. Under review. No sample should contain more that 10 total coliform organisms per 100 mL, none of which should be *E.Coli* or thermotolerant coliforms; or No consecutive sample from the same site should show the presence of coliform organisms; and not more than one sample from a set of samples taken from a community on a given day should show the presence of coliform organisms; and not more than 10% of the samples based on a minimum of 10 samples should show the presence of coliform organisms.
3. Health Canada guidelines state that protozoa should not be present. US EPA has set 3 log reduction as a minimum where there is less than one cyst per 100 L.
4. Health Canada is currently preparing a guideline for human enteric viruses. It is anticipated that an approach similar to that used for protozoa will be taken, rather than stipulating a numerical value.
5. Under review. For rapid sand filtration proposed is a 95 percentile of <0.3 NTU when monthly average raw water turbidity >1.5 NTU, a 95 percentile of <0.2 NTU when monthly average raw water turbidity <1.5 NTU, and maintaining the MAC at 1.0 NTU. For membrane filtration a combined filtered water 95%ile of <0.1 NTU is proposed and a MAC of 0.3 NTU.
6. At the point of consumption.
7. No reported data reviewed but given the watershed characteristics, these organisms are to be expected.

AO = Aesthetic Objective
 IMAC = Interim Maximum Allowable Concentration
 MAC = Maximum Allowable Concentration

8.4 TREATMENT PROCESSES

Two water treatment process technologies could be considered for this plant. One process would combine high-rate clarification, filtration and UV disinfection. The second process choice would be membrane separation and chlorine disinfection. The final process selection should be made at the preliminary engineering stage, following pilot testing of the water treatment processes.



Clarification Process

For the purposes of developing a plant layout and costing, the former process technology has been selected. A process schematic, floor plans and sections are provided in Technical Working Paper No.13.

The proposed unit processes include:

- Chemical pre-treatment (coagulant, activated carbon) for turbidity, taste, colour and odour reduction
- High-rate clarification (i.e. DAF or ballasted flocculation)
- Granular filtration
- UV and chlorine primary disinfection
- Clearwell storage
- Chlorine or chloramine post-disinfection

Dissolved air flotation (DAF) is a non-proprietary process that would occupy a larger footprint than ballasted flocculation. Otherwise, the two processes have many of their components in common (e.g., rapid mix, flocculation and coagulant). Given the characteristics of the raw water, it is anticipated that DAF will perform well but is the more conservative and established of the two alternatives. Therefore, the layout has been developed using the dissolved air flotation process.

Under the proposed concept, the initial treatment steps that would be built include chemical pre-treatment (coagulant addition only), high-rate clarification, UV and chlorine primary disinfection and chlorine (or chloramines) post-disinfection. These processes, termed Stage 1, will greatly improve the quality of the raw water, addressing colour, some taste and odour and reduction of pathogens.

At Stage 2, additional pre-treatment (powder activated carbon) and granular filtration would be added. These additional treatment processes will further reduce any taste and odour concerns and will provide an additional barrier to protozoan pathogens. This process change is shown to occur in conjunction with the capacity increase in 2021. In actual fact, it could be either implemented at an earlier or later time depending upon the

performance of the first stage of treatment and the regulatory criteria. This needs to be evaluated further at the preliminary engineering stage, following pilot plant testing.

8.5 RAW WATER SUPPLY AND TRANSMISSION MAINS

A 750 mm diameter raw water feed to the plant would be constructed from the existing NOWA transmission system to the plant. A similar 750 mm diameter raw water main would provide Kalamalka Lake water to the plant.

Both raw water mains would enter into a central raw water pipe gallery in the plant building. The Duteau Creek main would be gravity fed while the Kalamalka Lake main would be pumped. The hydraulic head on the Duteau Creek main needs to be reduced upon entering the plant. This is normally accomplished through a pressure reducing valve. During the non-irrigation season, a significant reduction in hydraulic head may be necessary. This may make the installation of a micro-turbine to utilize the available head to generate power for the water treatment plant attractive. The pay-back period for installation of a turbine should be reviewed at the preliminary engineering stage.

Three treated water transmission mains would exit the site. The major water main would be the feed to the PZ 479 zone. A second transmission main would supply treated water to the two PZ 535 zones; one on Middleton Mountain and the second in East Vernon. The third transmission main would provide water to the PZ500 zone in the urban area of Coldstream.

8.6 CLEARWELL STORAGE

The plant's clearwell storage would provide multiple functions, namely contact time (CT) to meet minimum chlorine disinfection requirements, and storage for operational and distribution system demands. The operational storage requirements would significantly increase at Stage 2 when filtration would introduce demands and loss of production through backwashing and filtering-to-waste. It is proposed that the plant's clearwell be constructed in stages, based on the overall plant staging.

A treated water pump station would be constructed as part of the Stage 1 main plant building. The pump well would be sized to accommodate the Stage 3 plant pumping equipment, however, initial pumping capacity provided at Stage 1 would be sized to satisfy the Stage 2 design flows, with a pumping capacity upgrade required at Stage 3. It is proposed that initially seven low-lift finished water pumps would be required to supply

the three pressure zones (PZ 479, PZ 500 and PZ 535). Space would also be provided in the finished water pump well for two backwash supply pumps required at Stage 2.

8.7 PROCESS WASTEWATER MANAGEMENT

The process wastewater from the DAF system would be disposed to the sanitary sewer system, thereby negating the requirement for on-site sludge storage and dewatering facilities. Periodic cleaning of the flocculation and DAF process tanks would also produce a short-term waste sludge stream, which would also be disposed to the sanitary sewer system. The estimated volume of wastewater from this source is about 0.5 to 1% of the water treatment plant throughput.

With the addition of filtration in Stage 2, the wastewater volume from the plant could potentially increase to the range of 4 or 5% of the plant throughput, without internal backwash recycling. The alternative is to provide a concentration step for the backwash water and recycle the supernatant back through the plant. This will create a lower volume, higher concentration wastewater to the sanitary sewer system.

The optimum solution depends on the costs to implement and operate the internal recycle system, the impact of the discharge on the City's sewerage system and the disposal fee charged by the City. This needs to be looked in greater detail at the preliminary engineering stage.

8.8 PLANT BUILDING

The main plant building would be designed to fully enclose all process units, providing protection against winter operating conditions. The plant building also serves to house ancillary equipment and functions.

The proposed building is of masonry construction, approximately 78 m by 47 m at Stage 3. For the purposes of the conceptual design the construction method has been assumed to be a raft foundation. This would be confirmed following geotechnical evaluation at the preliminary design stage.

The proposed building would have a gently pitched roof to accommodate the headspace requirements of the DAF's packed tower air saturation tanks and to aid in developing an aesthetic architecture. The architectural design of the building would be suited to be

compatible with the surround landscape. A construction material with an aesthetically attractive appearance, such as split-face concrete block, would be selected.

The clearwell level would be positioned below the existing site grade level, with earth berms being employed to reduce the visual impact of the two story operations building. It is proposed that the main operations floor would be slightly above the finished grade level, allowing for easy unloading of bulk chemicals into the plant's storage facilities.

Main access to the building would be provided on the main operating floor level, where the control room, offices and laboratory would be located. Various stairwells would be provided for access between the main floor and lower floor, along with external access to the lower floor to satisfy emergency exit requirements.

CHAPTER SYNOPSIS

The region's domestic water supply facility will be the new Middleton Mountain water treatment plant, located near the Regional District office, on a site yet to be determined. The treatment processes will be housed entirely in a building with clearwell storage provided beneath the process units. The plant will be constructed in a staged approach to meet water quality targets and increasing demand.

DOMESTIC WATER SYSTEM

The Master Water Plan sets out the basis for the development of the domestic water system over the next 40 years. The chapter briefly describes the strategy and timing of system development. Technical Working Papers Nos. 10 and 13 provide more detailed information.

The work in the plan has essentially been carried out to a “planning” level. The next step is to move to a preliminary engineering level that would see the development of hydraulic distribution models to confirm piping sizes. This would then be followed by analysis of the specific water main routing requirements and determination of sites for pumping stations and reservoirs. Detailed designs would then be prepared for the various areas to allow tendering of construction contracts.

9.1 DESIGN CRITERIA

The design criteria suggested for initial sizing of domestic water system components is shown in Table 9-1.

**Table 9-1
Water System Design Criteria**

Criteria	Value	
	Short-Term Year 2011	Long-Term Year 2041
Annual Average Per Capita Demand ¹ (L/d/cap)	580	470
Ratio of Maximum Day to Average Annual Demand	2.0	2.0
Ratio of Peak Hour Demand to Maximum Day Demand	1.5	1.5

Note 1: Based on residential population. Includes ICI and UFW.

On a domestic system wide basis, annual average per capita demands (based on residential population) are currently in the order of 470 L/d/cap. This excludes institutional, commercial and industrial (ICI) demands, as well as unaccounted for water (UFW) from leakage, flushing, fire fighting or non-recorded connections. If these components are added in, the current annual average per capita demand is about 580 L/d/cap (based on residential population).

The average annual water demand is expected to decrease over the 40-year planning period, due to improvements in technology and in changing public attitude to water use efficiency. By 2041, the average annual per capita water demand is forecast to be about 470 L/d/cap.

The current average ratio of maximum day to annual average demands is about 2.3. This is also expected to decrease over the planning horizon. By 2011, this ratio should drop to about 2.0. This ratio is then expected to stay constant over the duration of the planning horizon. Data on the ratio of peak hour to maximum day demands is not available for the utilities. The implementation of additional metering in the future should provide a reasonable database to estimate this ratio. For the purpose of initial planning, a ratio of peak hour to maximum day of 1.5 is assumed.

In the preliminary sizing of domestic water system components, the following design criteria is suggested:

- Domestic transmission mains should be sized to provide maximum day demands in areas where balancing storage is available.
- Domestic distribution water main size should be adequate to supply the greater of the peak hour demands or the maximum day demands plus fire flow.
- Distribution system piping should be sized so that there is no more than 10 m of headloss across a zone under peak hour demand conditions.
- Pump stations should be sized to provide maximum day demand, where there is balancing storage in the zone above. Where balancing storage is unavailable, pumps must convey peak hour demand and have emergency gen-set power.
- Reservoirs are sized to provide balancing storage; plus fire protection to FUS standard; plus 25% of the first two volumes for emergency conditions.
- In pressure zones without gravity storage for fire protection, pumping stations should be provided with either an engine-drive fire pump or an electric-drive fire pump equipped with emergency gen-set power.

In some rural areas, currently supplied by the NOWA combined water system, fire protection is to less than a current municipal standard in terms of hydrant spacing and

reliability of service. In developing a new domestic water system in these areas, the following approach is suggested.

- .1 Where the area is proposed for further development within a 10-year time frame, the domestic water system should be designed to provide a municipal standard of fire protection. Opportunities to decrease the initial water main size and supplement future capacity with “looping” should be investigated.
- .2 If the area will not realistically be developed and will remain with the current land use, the rural standard of fire protection should be maintained.
- .3 If the area may see redevelopment after the 10-year horizon, consideration should be given to oversizing water mains to provide a future level of municipal fire protection, only if the opportunity to increase capacity in the future through “looping” or alternative supply points does not reasonably exist.

9.2 PRESSURE ZONE DEVELOPMENT

Historic pressure zone development in the Greater Vernon area has been influenced by the varied topography, the large number of municipal and private water systems and the differing nature of the water systems. At the present time, there are over 50 different pressure zones.

The development of pressure zones over the planning horizon will be governed by a number of factors. A key driver will be to consolidate the pressure zones, where possible, to allow the efficient distribution of water with a minimum of booster pumping stations and reservoirs. The major obstacle in zone consolidation is the presence of development on either side of the north-south Okanagan Valley and the east-west Coldstream Valley. This means, that while lower zones can be consolidated, the upper zones on each side of the valleys will have independent pumping and reservoir systems.

Another major factor in zone development is the presence of existing reservoirs and pumping stations. While this is not an overriding criterion in long-term planning, many of the structures have years of service remaining. This needs to be considered in the short-term planning of pressure zones.

For the purpose of pressure zone planning, the terms primary and secondary zones are introduced. Primary zones are intended to be the long-term pressure zone development

goal. Secondary zones, on the other hand, exist due to a local topographic constraint or existing water system components. It is intended that these zones be consolidated with the primary zones over time. Some of these zones may remain for some time, however, if consolidation with a primary zone is not feasible.

Pressure zones are identified by their normal hydraulic grade line in metres. In the case of a pressure zone with a reservoir, this would be the top water level (TWL) of the reservoir. For a zone without a reservoir, the zone grade line would be the normal operating head created by the pumps. The zone “spread” or difference between adjacent zone hydraulic grade lines is typically 45 to 60-m. In general, the zone should be set to provide a minimum static pressure at the upper zone boundary of 40 m or 390 kPa. The pressure at the lower zone boundary should be a maximum of 100 m or 980 kPa. This would provide a zone normal operating pressure ranging from about 340 kPa at the top of the zone (under peak demands) to 1030 kPa at the bottom (under reservoir re-filling at night).

9.3 PRESSURE ZONES

The proposed primary domestic water service zones are as follows:

- PZ 425 Okanagan Landing
- PZ 479 Vernon – Main Zone
- PZ 535 Vernon – East, West and Middleton Mountain
- PZ 585 Vernon – Upper East, West and Lavington

In addition to the major pressure zones, there are numerous secondary zones that provide water service to local areas. Given the large number of secondary pressure zones, the Greater Vernon area has been divided up into six geographical regions. Table 9-2 shows the primary and secondary pressure zones for each region. These zones are shown in Figure 9-1. Detail drawings of the various zones and proposed water main locations are contained in Technical Working Paper No. 13.

**Table 9-2
Pressure Zone Criteria
Vernon-West**

Pressure Zone	Upper Boundary		Lower Boundary		Zone Type
	Elev (m)	Pressure (m)	Elev (m)	Pressure (m)	
425	385	40	343	82	Primary - existing
479	439	40	385	94	Primary - existing
535 W	495	40	439	96	Primary - future
585 W	545	40	495	90	Primary - future
635	595	40	545	90	Secondary - future
685	645	40	595	90	Secondary - future
735	695	40	645	90	Secondary - future
785	745	40	695	90	Secondary - future

**Pressure Zone Criteria
Vernon – East**

Pressure Zone	Upper Boundary		Lower Boundary		Zone Type
	Elev (m)	Pressure (m)	Elev (m)	Pressure (m)	
479	439	40	385	94	Primary - existing
535 E & NE	495	40	439	96	Primary - future
585 NE	545	40	495	90	Primary - future
620	580	40	545	75	Secondary - existing
633	593	40	548	85	Secondary - future
665	625	40	593	72	Secondary - existing
683	643	40	593]	90	Secondary - existing
715	675	40	625	90	Secondary - existing
765	725	40	675	90	Secondary - existing

**Pressure Zone Criteria
Middleton Mountain**

Pressure Zone	Upper Boundary		Lower Boundary		Zone Type
	Elev (m)	Pressure (m)	Elev (m)	Pressure (m)	
479	439	40	390	89	Primary - existing
535 S	495	40	439	96	Primary - existing
572	532	40	495	77	Secondary - future
619	579	40	532	87	Secondary - future

**Pressure Zone Criteria
Coldstream West**

Pressure Zone	Upper Boundary		Lower Boundary		Zone Type
	Elev (m)	Pressure (m)	Elev (m)	Pressure (m)	
500	460	40	394	106	Secondary - existing
533	493	40	439	94	Secondary - existing
545	505	40	460	85	Secondary - existing
550	510	40	460	90	Secondary - existing

**Pressure Zone Criteria
Coldstream East**

Pressure Zone	Upper Boundary		Lower Boundary		Zone Type
	Elev (m)	Pressure (m)	Elev (m)	Pressure (m)	
500	460	40	395	106	Secondary - existing
535 E	495	40	460	75	Primary - future
585 E	545	40	495	90	Primary - future
630	590	40	545	85	Secondary - future
650	610	40	545	105	Secondary - existing
700	660	40	610	90	Secondary - existing
728	688	40	623	105	Secondary - existing

**Pressure Zone Criteria
Okanagan Lake - South**

Pressure Zone	Upper Boundary		Lower Boundary		Zone Type
	Elev (m)	Pressure (m)	Elev (m)	Pressure (m)	
425	385	40	343	82	Primary - existing
479	439	40	385	94	Primary - existing
518	478	40	439	79	Secondary - existing
563	523	40	478	85	Secondary - existing
624	584	40	523	101	Secondary - future
685	645	40	584	101	Secondary - future
745	705	40	645	100	Secondary - existing

A breakdown of population for each zone for the years 2001, 2011 and 2041, as well as a reservoir storage strategy, are contained in Technical Working Paper No. 13.

Descriptions of primary and significant secondary pressure zones are also provided in Technical Working Paper No.13.

CHAPTER SYNOPSIS

There are currently over 50 pressure zones in the Greater Vernon area. The Master Water Plan identifies primary and secondary zones. Primary zones are intended to be the long-term pressure zone development goal. Secondary zones exist due to a local topographic constraint or existing water system component. It is intended that these zones be consolidated with the primary zones over time, based on the zone development strategy contained in the plan.

IRRIGATION SYSTEM

10 SECTION

Following the “separation” of the NOWA combined water system and removal of the domestic customers, the irrigation system reverts back to its original function – provision of non-potable irrigation water. This is scheduled to occur by the end of 2007. This chapter provides a brief discussion of irrigation system development and operation. Water source development is discussed in Chapter 7.

Additional information on the irrigation system can be found in Technical Working Papers Nos. 11 and 13.

10.1 IRRIGATION SYSTEM DEVELOPMENT

As compared to the domestic water system, there is essentially no development beyond removal of the domestic water customers from the irrigation system mainline and laterals. In essence, the irrigation system returns to its original intent – a piped irrigation system.

The system, however, will have a second function – the supply of raw water from the Duteau Creek Headgates intake to the new Middleton Mountain water treatment plant. The delivery of water to the plant will be on a year-round basis. This section of the transmission main must thus be kept in continuous operation. In other sections of the system, purely used for irrigation, the pipes could be isolated and drained during the non-irrigation months.

The irrigation system, as it will function after 2007, is shown in Figure 10-1. The major change in the system is that chlorination at the Duteau Creek Headgates intake is no longer required, as the water is not intended for potable use. In reality, the system should be simply shutdown in the initial years after the system separation and retained as an emergency backup. After a few years of operational experience, a decision of whether or not to fully decommission the chlorination equipment can be made.

10.2 SEASONAL OPERATION

During the irrigation season, the system will be fully operational. Flow will be by gravity from the Duteau Creek intake to the Goose Lake reservoir, with line pressure controlled by the two mainline PRV stations. Pressure on the upper valley sides will be provided by the existing booster pumping stations.

During the non-irrigation season, the irrigation system, with the exception of the main transmission main to the Middleton Mountain water treatment plant, could be shutdown and drained. This is a major change from the operation of the combined system, where year-round operation was required to supply domestic customers. This possibility, however, needs to be further assessed at the design stage of the system separation. In some areas, it may be desirable to maintain fire hydrants on the irrigation laterals. In this case, the pipeline would need to be operational year-round.

The advantages of draining the system during the non-irrigation months needs to be compared to the costs of draining and reactivating the irrigation system prior to the start of the irrigation season. As the water is not used for potable purposes, taste and odours caused by the water sitting in the pipes for an extended period is less of an issue. In any event, this operational decision can be made at a later date.

10.3 USE OF RECLAIMED WATER

In the near term, irrigation using reclaimed water will be carried out by an independent irrigation system. At the current time, the management of this system falls under the City of Vernon. The effluent produced will be suitable for unrestricted use on public lands. This is not to say, however, that the local public will accept the effluent. The City of Vernon has spent several years in the investigation of expansion of the reclaimed water system into urban areas. This idea has met opposition from some local groups. Given the opposition and the high costs, the City has reaffirmed the original wastewater management concept that would see reclaimed water used for irrigation. Discharge of effluent to Okanagan Lake would only occur on an emergency basis, if sufficient reuse capacity were not available.



The planning for wastewater management is not in the scope of the Master Water Plan. The task under this plan is to consider possible incorporation of reclaimed water into regional wide irrigation management. In looking at this question, there are three possible scenarios:

Scenario 1: Status Quo: The reclaimed water system continues as an independent irrigation system, managed by the City of Vernon. Expansion of the irrigation system, to accommodate the ever-increasing wastewater flows due to population growth, would take place outside of the GVWU supply area.

Scenario 2: Partial Integration: Under this scenario, the City would continue to manage the existing reclaimed water irrigation system but would also sell reclaimed water to GVWU for use in specific portions of the separated irrigation system. If sufficient reclaimed water were not available for GVWU's needs, untreated Duteau Creek water would be blended with reclaimed water to make up the shortfall. The untreated Duteau Creek water would be fed via a one-way valve system to prevent any backflow into the separated irrigation system that uses only untreated Duteau Creek water.

Scenario 3: Full Integration: This would be similar to Scenario 2, but GVWU would purchase reclaimed water from the City for full integration into the separated water system. Under this approach, GVWU would purchase the reclaimed water at or near the wastewater treatment plant and pump it into the separated irrigation transmission system. Portions of the transmission system supplying raw water to a domestic treatment plant would not be connected to the blended water and would remain on the raw Duteau Creek water only.

The above scenarios are presented for discussion at this stage. While the third scenario may appear extreme, a possible transition from the status quo to full integration of reclaimed water into the separated irrigation system could be considered over several years or decades. Planning for water reuse is a complex undertaking – it needs to be approached on a comprehensive basis considering both the science and perception of the issue. While experience elsewhere is beneficial, it is critical that the local situation be understood.

In summary, reclaimed water will undoubtedly continue to play a role as a non-potable water supply in the Greater Vernon area. The question is – what is this role and how can it be achieved.

10.4 METERING OF IRRIGATION CONNECTIONS

At the present time, there are no meters in place on the agricultural irrigation connections. Irrigation water is provided on a flat rate and this is expected to continue in the near

future. The installation of meters, however, is recommended under the MWP in order to provide data for overall water management. A specific schedule for installation has not yet been defined.

There are strong arguments to suggest that measurement of irrigation water use will result in more efficient use of water. This will, in turn, free up additional gravity water supply for raw water feed to the water treatment plant. It is likely that the costs to install and read meters will likely be easily recouped in greater efficiencies in overall water use by the utility.

10.5 LONG TERM CONSIDERATIONS

The irrigation system components are about 35 years old. The major pipelines and components are in good to very good condition and should provide a remaining life of several decades. Booster pumping station structures and piping should also have significant life remaining. Normal maintenance and replacement work will be necessary on pumping station mechanical, electrical and instrumentation components.

With the majority of irrigation water supplied under gravity head and the condition of the system, the costs to operate and maintain the system should be very low and will allow the water authority to meet the goal of keeping the agricultural irrigation rates competitive with other rates in the Okanagan Valley and elsewhere. The eventual replacement of the system, however, needs to be considered in the long term financial planning.

Additional hydraulic evaluations also need to be carried out on the ability of the system to deliver peak demands. With the construction of the water treatment plant, the hydraulic conditions of the transmission system will change. The development of a numerical hydraulic model needs to be carried out at the preliminary engineering stage to confirm the estimates developed in the Master Water Plan.

CHAPTER SYNOPSIS

The future irrigation system will function in a very similar manner to the original VID irrigation system, constructed in the 1960s. The primary difference is that surplus water will be used as a raw water supply to the new Middleton Mountain water treatment plant. Based on the low operating cost for the system and the generally good condition of the components, the GVWU

should be able to meet the goal of providing irrigation water at a competitive rate. Long term financial planning, however, needs to consider the eventual replacement of irrigation system components. Reclaimed water will continue to play a role in irrigation in the Greater Vernon area. Additional work and discussion needs to be carried out to explore the degree of integration of reclaimed water with the GVWU system.

CAPITAL PROGRAM

11 SECTION

The general strategy for regional water system development has been discussed in the various chapters. The period of 2002 through 2007 will see significant activity to plan, design and construct the works required to deal with the water quality issue. This includes implementation of further water treatment and separation of the existing combined water system. A summary of the capital program, the schedule for the work in the near term and the implementation steps are discussed below.

11.1 CASH FLOW

Table 11-1 shows an expected cash flow for the first 10-year period from 2001 to 2010. Table 11-2 shows a similar cash flow for 2012 to 2041. All costs are in 2001 dollars. Costs include a 30% engineering, contingency and administration allowance. The allowance has been reduced from earlier working papers as the level of engineering planning has been refined for this cost estimate.

The tables exclude costs associated with the development of future local distribution systems, as these costs would be borne by the development. Costs to replace aging water infrastructure are also not included. It is assumed that these works would be funded through the annual maintenance and asset replacement budgets. Some of the costs shown for water supply and transmission expansions would be eligible for funding under Development Cost Charges. This is discussed further in Chapter 13.

11.2 SCHEDULE

Figure 11-1 provides a schedule for the proposed activities over the period from 2002 to 2010. Following approval of the Master Water Plan in the spring of 2002, work would commence on public information programs, preliminary engineering and pilot-testing of water treatment technologies. Detailed design on the Kalamalka Lake Pumping Station upgrade and on the new water raw water main would also commence in 2002. Site evaluation and selection for the new water treatment plant would also occur in 2002.

Completion of pilot-testing water treatment processes, process selection and preliminary engineering for the new Middleton Mountain water treatment plant will occur in 2003.

Table 11-1

Regional Water System Capital Program Cash Flow - 2001 to 2011

Item (Note 1)	Cost (\$ million)											
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total	
1 ADMINISTRATION / PRELIMINARY ENGINEERING												
Administration	0.05	0.10	0.10	0.10	0.10	0.10						0.55
Preliminary Engineering (Note 2)	0.10	1.15										1.25
Pilot-testing	0.30	0.10										0.40
Water Transmission / Distribution Hydraulic Modelling	0.05	0.05										0.10
2 WATER SUPPLY												
Kalamalka Lake - Raw Water Main	0.10	2.80	1.10									4.00
Kalamalka Lake PS Upgrade	0.10	1.00										1.10
Duteau Creek - Raw Water Main Extension to WTP				0.60								0.60
3 WATER TREATMENT												
Middleton Mtn WTP - Stage 1		2.00	9.00	8.50								19.50
4 WATER TRANSMISSION / STORAGE												
McMechan Reservoir	0.05	1.95	2.00									4.00
Water Transmission Main - WTP to PZ 479				2.00								2.00
Water Transmission Main - WTP to PZ 500				0.30								0.30
Water Transmission Main - WTP to PZ 535				0.70								0.70
PZ 425 / PZ 479 Hydraulic Improvements			2.00									2.00
5 WATER DISTRIBUTION												
Watermains		3.05	3.43	3.90	2.59	4.11						17.08
Reservoirs		1.06	3.02	0.00	0.00	0.21						4.29
Booster Pumping Stations		1.17	1.37	1.56	0.78	0.59						5.46
PRV Stations		0.31	0.04	0.31	0.35	0.12						1.13
Domestic Water Meters		0.34	0.38	0.25	0.17	0.14						1.30
Service Connections		0.22	0.39	0.31	0.25	0.33						1.51
Miscellaneous		0.52	0.71	0.20	1.76	1.10						4.29
Total	0.75	15.81	23.54	18.74	6.01	6.70	0.00	0.00	0.00	0.00	0.00	71.56

Notes

- 1 Capital component costs include a 30% engineering and contingency allowance.
- 2 Preliminary engineering only. Detailed design and construction administration costs are included under capital components.

**REGIONAL WATER SYSTEM
CAPITAL PROGRAM - SCHEDULE**

FIGURE 11-1

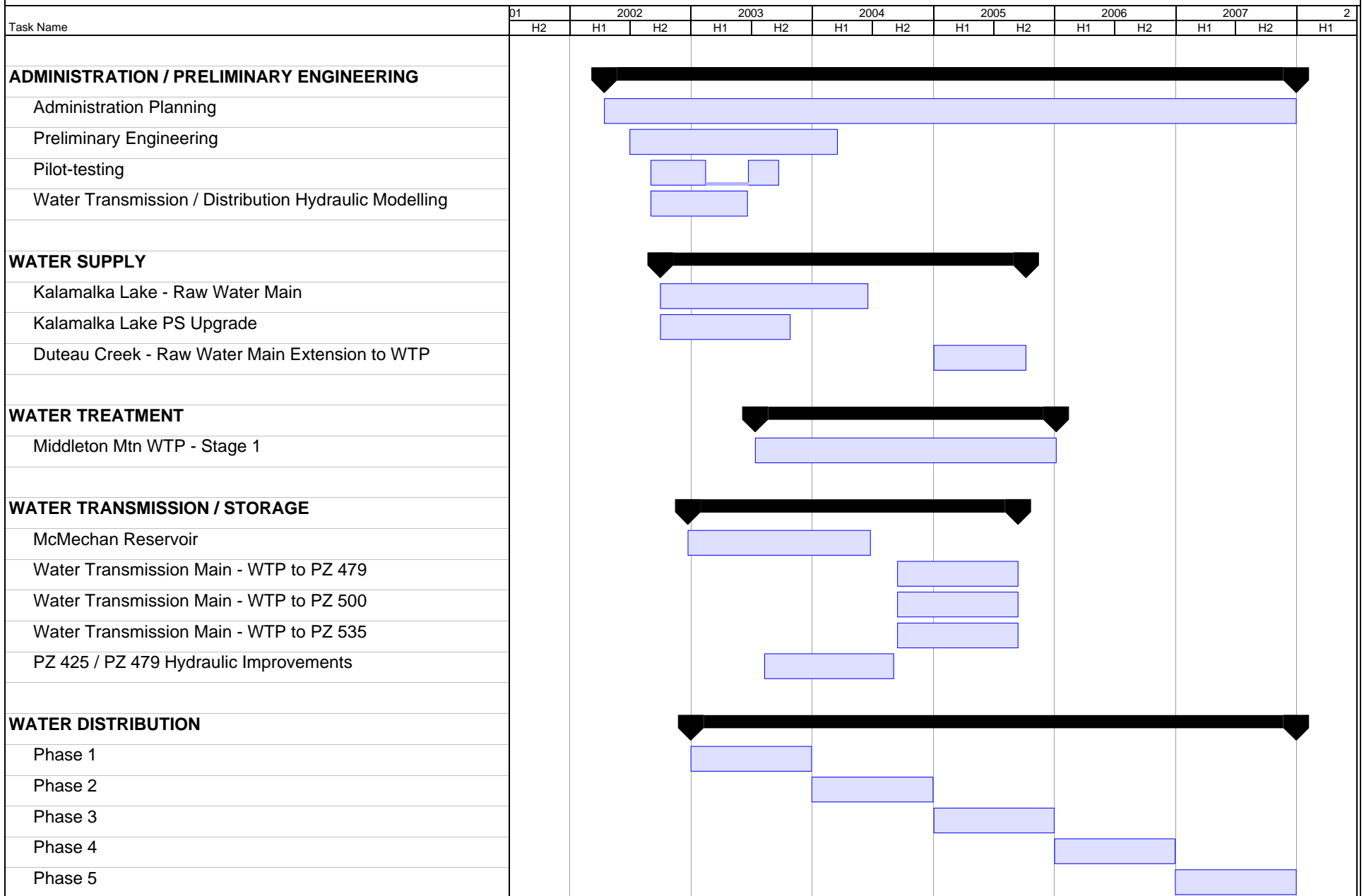


Table 11-2

Regional Water System Capital Program Cash Flow - 2012 to 2041

Item (Note 1)	Cost (\$ million)						
	2012 to 2016	2017 to 2021	2022 to 2026	2027 to 2031	2031 to 2036	2037 to 2041	Total
1 WATER SUPPLY Upland Storage Dam Rehabilitation			2.00				2.00
2 WATER TREATMENT Middleton Mtn WTP - Stage 2 Middleton Mtn WTP - Stage 3		11.80		5.90			11.80 5.90
3 WATER TRANSMISSION / STORAGE Mission Hill Reservoir PZ 425 / PZ 479 Hydraulic Improvements	2.00	2.00					2.00 2.00
4 WATER DISTRIBUTION (Note 2)							
Total	2.00	13.80	2.00	5.90	0.00	0.00	23.70

Notes

- Capital component costs include a 30% engineering and contingency allowance.
- Water distribution costs will be largely due to new development. Costs will be funded through DCCs and are not included in the cash flow.

Detailed design will be finished by early 2004. Construction of the water treatment plant would then commence, with completion scheduled for early 2006.

The proposed schedule for water supply and transmission works would see construction activities commence in 2003. The key priority is to expand the capacity of the Kalamalka Lake supply system to provide additional domestic water to the distribution system, prior to completing the new water treatment plant.

Separation of the existing combined water system into a domestic water system and an irrigation water system would commence in 2003. Figure 11-2 shows the proposed phasing for water system separation. The concept is to commence separation from the core area outwards to supply the maximum number of customers with higher quality water in the shortest time frame. This work would be completed in 2007, at which time the new water treatment plant will be fully on-line.

Beyond 2008, the construction of new works is primarily driven by increases in domestic water demands due to population growth.

11.3 IMPLEMENTATION STEPS

The Master Water Plan is still very much a conceptual plan. Some components, such as the new Middleton Mountain water treatment plant, however, have been developed in some detail, as this level of water treatment is new to the utilities and decisions are required in the near term on land purchase and pilot testing. Other components, such as water mains and reservoirs, are at the conceptual level. Actual routing or siting has not yet been determined.

A number of terms, describing the steps in the implementation process, are used in the Master Water Plan. For clarity, these are defined below. The reader should note that the implementation process described is based on the most common approach – termed design, bid, build. Other implementation processes, such as design-build, vary somewhat from the process described. Alternative implementation strategies, for specific components, could be considered at the preliminary engineering stage.

Conceptual Planning: The work carried out in this Master Water Plan is considered to be at the “concept” level. At this level, the long-term strategy to develop the regional water system is described and preliminary capacities of components are noted. Water treatment processes and locations of water mains,

reservoirs and pumping stations have not been finalized. Cost estimates provided are suitable for budget and rate structure planning.

Preliminary Engineering: This is the next level of implementation, following conceptual planning. At this stage, decisions on process selection, component location and hydraulic sizing are made. Key activities at this stage are pilot testing of water treatment processes and development of a numerical hydraulic model of the water transmission and distribution systems. Capital and operating and maintenance cost estimates are refined. A contract strategy is developed for detailed design, tendering and construction of the various water system components based on the nature of the work, the location and the timing.

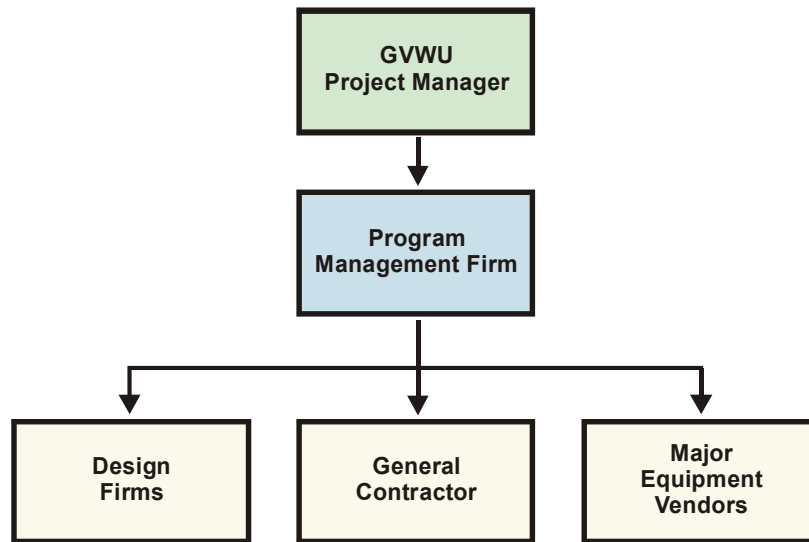
Detailed Design: At this stage, detailed design drawings, specifications and tender documents are prepared to allow contractors to bid on individual water system components. The term, Predesign, is often applied to the first 15% of the detailed design stage. A capital cost estimate, termed a pre-tender estimate, is prepared and refined through the detailed design work.

Tendering / Construction: Competitive bids from contractors are requested, based on the detailed design “packages”. The contractor is then selected on the basis of qualifications and bid price. Construction then proceeds under the supervision of the Owner and the designer.

The construction of \$72 million of water system works over the next six years is a major undertaking. The simultaneous creation of a new water utility to manage this activity adds to the challenge. The best approach to undertake this challenge is to utilize a combination of in-house resources and the private sector forces.

The proposed project implementation model is shown in Figure 11-3. The proposed approach is known in the industry as Program Management. This approach allows a high degree of control to be maintained by the Owner’s team, yet it offers a high degree of competitive pricing on design, equipment purchase and general construction. Value engineering can be easily incorporated into the process to ensure that innovative thinking and ideas to achieve cost savings can be brought in at the appropriate stages.

**Figure 11-3
Project Implementation Model**



The roles of the team members, in the approach, are briefly described as follows:

Project Manager: This individual would have overall authority for the design and construction activities. He would report to a Steering Committee of the GVWU. The duration of this position would be about six years. This could either be a full-time staff position with the GVWU, a contract position with the GVWU or a secondment from a private sector firm.

Program Management Firm: This is a private sector consulting engineering firm, reporting to the Project Manager. The Program Management firm would be responsible for the preliminary engineering, pilot testing, the packaging of design contracts, tendering of equipment supply and general construction contracts, and quality control and assurance during construction and commissioning.

Design Firms: Engineering design firms would be hired on a competitive basis to complete the detailed design packages. This would include major components such as the water treatment plant, pumping stations and transmission mains, as well as the various phases of water distribution system separation. The design firms would also provide input during the construction process.

Equipment Vendors: Specific equipment vendors would be selected on a competitive bid basis to provide Owner's Supplied equipment on major equipment items. This process bypasses the additional contractor mark-up and can provide scheduling advantages.

Construction Contractors: Construction contractors would be engaged through a tender bid process on individual construction packages. They would be responsible for equipment installation and overall construction and commissioning.

CHAPTER SYNOPSIS

Implementation of the Master Water Plan will have a capital cost of \$72 million over the next 6 years. A further \$24 million will be spent in the period from 2008 to 2041. The impact of the cash flow on the water rate structures is discussed in Chapter 13. A public information program, pilot-testing of water treatment activities, and preliminary engineering will commence in mid-2002. Design and construction of water treatment works, supply and transmission improvements and water system separation will occur between 2003 and the end of 2007. A Program Management approach is proposed to implement the new capital works.

In the past, three jurisdictions (NOWA, City of Vernon, District of Coldstream) have operated their water utilities somewhat independently. Each jurisdiction performed the same basic processes associated with drinking water management, and developed various policies and tools to meet their local needs.

In October 2001, the originally proposed management structure of one water supply utility selling bulk water to two or more municipal water distribution utilities was discarded in favour of a single regional water utility that will take the full responsibility of supplying and distributing water to all customers (both domestic and irrigation) within the greater Vernon service area.

This regional utility will be called the Greater Vernon Water Utility (GVWU). This chapter presents a brief summary of the structure and function of the new utility. Additional information is contained in Technical Working Papers Nos. 2 and 14.

12.1 GVWU GOVERNANCE

The GVWU is proposed as a stand-alone water utility that will service the entire Greater Vernon region (including the City of Vernon, District of Coldstream, and parts of Electoral Areas B, C, and D). GVWU will also provide bulk water under contract to parts of Spallumcheen. The GVWU will assume the responsibility of supplying and distributing water to both domestic and irrigation customers within the designated service area. The utility will assume the combined functions and customers of the following regional water utilities:

- NOWA
- District of Coldstream
- City of Vernon

It is proposed that the utility be established as a service of NORD and governed under the Greater Vernon Services Commission. The utility would have all powers provided under the Local Government Act, including:

- Ability to borrow money for the purpose of new capital investment.
- Establish cash reserve funds for specified purposes.
- Ability to set and adjust water rates based on the established governance mechanisms.

The general principle is that NOWA, the City of Vernon, and the District of Coldstream, will transfer all assets, related debts, and liabilities of their existing water utilities to the GVWU for a nominal fee. This is in keeping with the fact that all assets and liabilities will remain in the service of the regional ratepayers.

NORD, on behalf of the Greater Vernon Services Commission, will own and administer the entire water supply and distribution system within the service area. Initially, NORD will enter into contract arrangements with the City of Vernon and the District of Coldstream to perform all operations and maintenance services required on the water system. Current NOWA operations and maintenance staff will transfer their employment to one of the two organizations, based upon criteria to be determined.

In the future, other organizational and service delivery strategies may be examined and selected based upon the regional needs that can be evaluated over the long term.

12.2 GVWU CUSTOMERS

GVWU will serve all water customers in the greater Vernon region, including domestic water users (household, commercial, and industrial customers) and irrigation users.

The MWP calls for separation of the existing combined water system into a separate domestic and irrigation system by 2008. A fully separated water system will allow a financial strategy that is specific to the needs of each group. For example, the Statements of Principle make specific reference to the need to keep agriculture water rates competitive within the region, and that water rates remain on a flat rate basis for the foreseeable future. A separated water system will simplify the management of the two different water products and customer groups.

The definition of “irrigation water customer”, however, needs to be clear. Since this water will be sold at a much cheaper rate, many domestic customers will prefer to use irrigation water for lawn watering, gardening, and hobby farm irrigation. Unless a firm definition is established that clearly defines what customers are eligible for irrigation water, customers may become confused. It is recommended that the definition of

irrigation water be tied to the use of water for the sole purpose of farming or for a high irrigation water use commercial/industrial customer such as a golf course.

12.3 WATER UTILITY CAPITAL ASSET PLAN

GVWU will be responsible for establishing a long-range capital plan. This plan will be used in the planning of water rates, service levels, and capital works projects. GVWU may require considerable detail and information from each of the political jurisdictions on an ongoing basis, and especially during construction of water distribution mains as a result of system separation. The ongoing task of managing and updating the Capital Asset Plan should be the exclusive responsibility of GVWU, since GVWU will be solely responsible to insure that upgrades and expansions according to the plan are delivered within budget and on time.

To the best of its ability, GVWU will attempt to incorporate late changes resulting from requests from the local jurisdictions that might cause a deviation from the latest version of the capital plan - for example the coordination of water system construction with other infrastructure works, such as sewers or roads. However, GVWU should retain the authority to reject change requests if it causes budget or schedule variances beyond GVWU's allowable limits, or if the requested change adversely impacts GVWU's ability to deliver on its planned commitments.

12.4 REVENUE REQUIREMENTS AND COST ALLOCATION

GVWU will operate as a non-profit utility for the sole benefit of its regional water customers, and for the political jurisdictions that exist within the GVWU service area. As such, GVWU costs and expenditures must be allocated to customers in a manner that is fair, equitable, and in a manner that meets the regional principles as stated in the Implementation Plan.

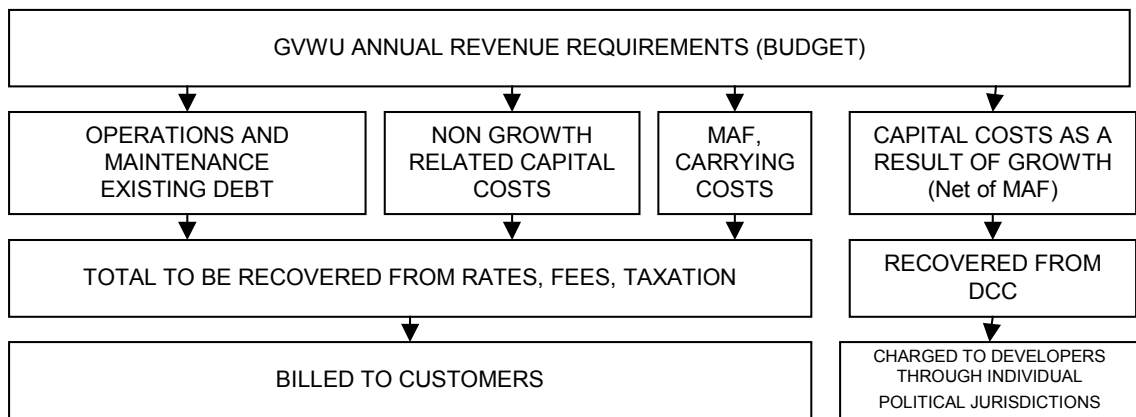
12.4.1 Recoveries from Rates and Fees

The costs associated with operating the utility on a year-to-year basis will be recovered through a variety of rate structures fees and taxation. Expenditures that are typical to all public water utilities include utility operations and maintenance costs, debt charges, capital costs associated with improving water quality and security of supply, and new capital costs associated with expanding the system for new customers and regional growth.

Within GVWU, it is recommended that water rates be used to fund operations and maintenance of all facilities, existing debt requirements, and future debt on capital expenditures required for the purpose of meeting future water quality improvements. It is also recommended that Development Cost Charges be used to fund the cost of increasing capacity as a result of growth.

Figure 12-1 presents a summary of GVWU revenue requirements and proposed revenue sources.

**Figure 12-1
GVWU Revenue Sources**



12.4.2 Water Rates

Water rates are proposed for the bulk of GVWU expenditures, including annual operations and maintenance, existing debt, and new water quality related capital projects.

There are a variety of rate structures in common use throughout publicly operated water utilities. Since the utility operates solely in the interest of its customers, a cost allocation mechanism must be developed that reflects the values of the consumers. In general, volume consumption based systems offer the highest blend of benefits especially in terms of fairness. Consumers pay only for what they use. Consumption-based cost allocation is also preferential if the utility wishes to employ demand side management options.

The proposed basis for domestic and agricultural irrigation rates are as follows:

Domestic Water Rates

The Implementation Plan provides a specific direction that the regional utility will adopt a volume rate allocation method. Since consumption based billing is well established in the greater Vernon region service area (within domestic and commercial accounts), it is recommended that GVVU adopt a consumption-based water rate for all domestic water customers. It is recommended that water rates be used to fund operations and maintenance of all facilities, existing debt requirements, and future debt on capital expenditures required for the purpose of meeting future water quality improvements.

Domestic water consumption rates are normally composed of two components: an annual flat rate portion that reflects and pays for the right of the customer to draw on the system's capacity (known as a capacity charge); and a per unit consumption charge (known as a consumption charge) based upon actual water consumption. The total bill is a combination of both components.

Irrigation Water Rates

The Statement of Principles proposes that irrigation water rates remain on a flat annual rate and at their current levels (which may be adjusted for inflation), at least until the water systems are separated and sufficient data is available to clearly determine the actual cost of operating and maintaining the irrigation water system. If an adjustment to the flat rate is required in order to cover all costs, the adjustment can be considered at a future time. Any proposed adjustment will be balanced with the Statement of Principle that requires irrigation rates to "remain competitive within the region"

It is recommended that the current allocation-based rate structure used within NOWA be maintained in the GVVU, and that the current allocation rates remain stable until such time that a detailed costs analysis can be performed, following system separation. An "allocation" is a right to obtain water from the system and is tied to the property, thus it is more closely related to a "capacity" charge. The allocation fee is approximately \$185 per hectare per year, and is charged whether water is consumed or not.

With regard to the irrigation water system, it is recommended that the allocation charges be used to fund operations and maintenance of facilities, any existing debt requirements, and on capital expenditures required for future infrastructure renewal. It is also recommended that expansion of the system be funded by the customers requesting new system connections through the existing “regrade” process.

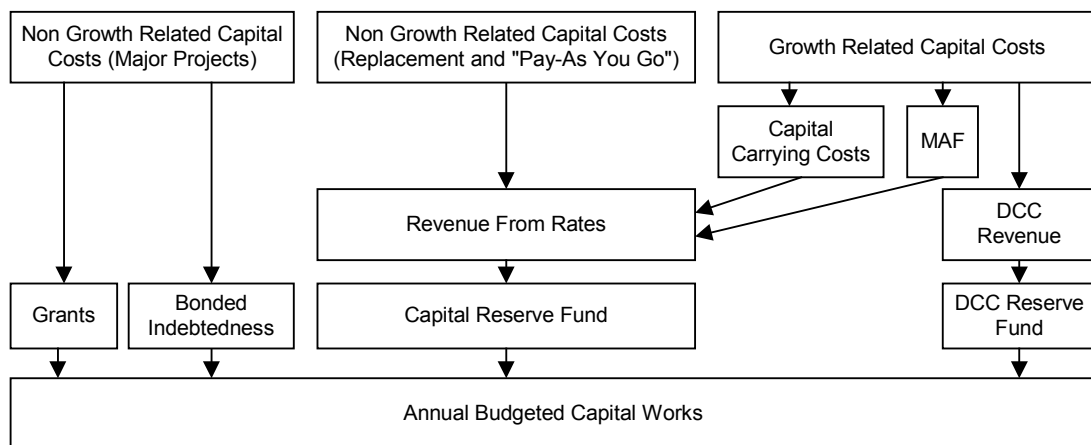
12.5 FUNDING CAPITAL WORKS

Capital works will be one of two categories:

- capital works as a result of system improvement, or
- capital works as a result of growth.

Figure 12-2 shows how capital projects would be funded.

**Figure 12-2
Funding Capital Works**



Capital works as a result of improvement, reinvestment and replacement will be paid through rates. Major capital works will be funded largely through debt. Grants, such as the Federal/Provincial Infrastructure Program, will be applied for and accessed as much as is possible.

Capital works, associated with expanding the supply of water, or the capacity of the utility's transmission and distribution system should be paid through Development Cost Charges (DCCs) in the case of the domestic system, and through Regrade Charges in the irrigation system. It is proposed that a separate DCC fund be established for the domestic system and a "regrade" fund be established for the irrigation system. However, once all new capital works are in place, all associated O&M expenses should be covered by the appropriate water rate structure. This will require new DCC and Regrade bylaws specific to GVWU as the water utility.

A separate DCC for water supply and transmission, and water distribution should be considered. This will improve the transparency of the DCC charges. Water distribution network extensions to new developments usually occur in a similar timeframe as the actual development. Expansion of water supply and transmission facilities, however, may occur many years before or after the development. The difference in timing the expansion works may make two separate DCC Funds worthwhile.

Additional discussion on DCCs and Regrade Funds can be found in Technical Working Paper No. 2.

12.6 GVWU RESERVE FUNDS

The following reserve funds are anticipated for the realigned GVWU. Each will require a new bylaw.

12.6.1 Operating Reserve

A "consumption-based" revenue system will result in the utility being affected from a revenue standpoint by annual variations in water demand. Very few of the GVWU costs will be variable with consumption, while revenue from domestic water will be variable with consumption. If water rates are based on average annual consumption, it can be expected that revenue shortfalls may occur during wet years (when demand is typically lower), and revenue may exceed utility costs during dry years.

Creation and use of an "Operating Reserve" is recommended as a strategy to insure that utility costs can be met without the need to adjust water rates each year. Transfers to and from this fund would normally be through an "end of year"

adjustment based upon the past year's total water demand in comparison to the "average" demand from which the water rate is set.

12.6.2 Capital Reserve Funds

A Capital Reserve fund is recommended for the purpose of providing long term rate stability through the planned "non-growth related" capital investment plan. Without a Capital Reserve, the water rate is subject to frequent and possibly dramatic changes from year to year as a result of the capital investment plan.

It is recommended that a separate Capital Reserve Fund be established for each of the domestic water system and the irrigation water system. This will assist in accounting for the full cost of operating both systems, and reduce the chances of unintentional cross subsidization.

12.6.3 DCC and Regrade Reserves

In association with the establishment of the proposed DCC bylaws, DCC Reserve Funds must also be established. Separate DCC bylaws and reserves for domestic growth and new irrigation connections will be required. The option of a DCC fund specific to supply & transmission, and one that is specific to distribution is also suggested to increase the transparency of the funds.

12.7 CHANGES IN THE FORMER WATER UTILITIES

Even though most administration staff from the former water utilities (Vernon, Coldstream, and NOWA) will be accommodated in the proposed GVWU organization, the jurisdictions will need to make other service and financial changes to their structure. It is expected that the utility assets associated with water supply and distribution will be assigned to the GVWU. Along with the transferred assets, any outstanding debt will also be transferred.

Jurisdictions will also need to revisit their DCC by-laws and utility charges. Most DCC and reserve bylaws will likely need to be modified to remove that portion that pertains to water utility costs, or discontinued entirely.

Reserve funds within all of the existing utilities (Vernon, Coldstream, and NOWA) will need to be transferred to the new utility. The principles for reserved fund transfers should be consistent with the transfer of the assets and the outstanding debt charges. That is,

funds put into reserve for the replacement and/or construction of new water assets should be transferred to the appropriate GVWU reserve fund.

New cost accounting systems and processes may be required by both Coldstream and Vernon to account for work performed under contract to GVWU. Unless municipal staff are seconded exclusively for GVWU contract work, Vernon and Coldstream will need to account for time and materials between the two customers (local municipality and GVWU). Since this distinction must be financially auditable, clear distinction and cost accounting between the works performed under contract will be necessary.

12.8 CUSTOMER SERVICE, BILLING AND MEETING

GVWU will be responsible for customer service and billing for all of its customers. This will require some coordination with the political jurisdictions, since some of this information will be shared. For example, most jurisdictions use water consumption information as a basis to charge sewerage fees.

Consumption billing is the recommended approach for the allocation of costs for the domestic water system. A complete water-metering network will be required as a priority for all GVWU domestic customers. Currently, the only GVWU customers that are not metered are the former NOWA residential customers. NOWA ICI customers and newer residences in the NOWA service area are metered.

The anticipated cost to complete the domestic metering program within the former NOWA service area is approximately \$1,300,000. It will be important that the cost of metering is allocated fairly, since most customers have already borne at least some of the cost of metering. It is therefore recommended that metering programs for the initial installation are paid through a specified area tax, such as is the case for the remainder of the debt associated with Vernon water meter installations (where about \$600,000 remaining debt is being collected).

GVWU will need to provide adequate customer billing and service mechanisms within the service area. These services include:

- Customer Information and Billing
- Customer Call Centre and Information
- Meter Reading

Customer service is also seen as a utility function that is growing in importance within utility management “best practices”, and one that has benefited with the availability of new technologies. These technologies/strategies include consolidated customer information, billing, and consumption information systems, provision of alternative payment options, including on-line payment, automatic/credit card payment, development and marketing of demand-side management strategies, and automated/remote meter reading as examples. It is widely accepted that close contact and good knowledge of customers through a variety of channels results in higher customer satisfaction levels.

Each of the existing water utility has customer services strategies already in place. Customer service alternatives that the GVWU can consider are discussed in Technical Working Paper No. 2.

CHAPTER SYNOPSIS

The GVWU is proposed as a stand-alone water utility that will service the entire Greater Vernon region (including the City of Vernon, District of Coldstream, and parts of Electoral Areas B, C, and D). GVWU will also provide bulk water under contract to parts of Spallumcheen. It is proposed that the utility be established as a service of NORD and governed under the Greater Vernon Services Commission. The GVWU will assume the responsibility of supplying and distributing water to both domestic and irrigation customers within the designated service area.

Initially, NORD will enter into contract arrangements with the City of Vernon and the District of Coldstream to perform all O&M services required on the water system. Current NOWA operations and maintenance staff will transfer their employment to one of the two organizations, based upon criteria to be determined. In the future, other organizational and service delivery strategies may be examined and selected based upon the regional needs that can be evaluated over the long term.

Three factors have combined to put a significant financial burden on the new GVWU in the next few years.

The first factor is that all three existing water utilities have delayed capital programs over the last decade due to the lengthy discussion on regional water. As a result, several water system components are stretched to the capacity limit. In other cases, planned replacement work has not been carried out. The second factor is the need for additional domestic water treatment – the MWP has identified this as a priority. The third factor is the separation of the combined irrigation and domestic water systems in order to achieve a long-term cost effective water quality strategy.

Working Papers Nos. 2 and 14 have developed a financial strategy and a proposed water rate structure for the new water agency to implement the MWP. A summary of the major elements is provided in this chapter.

13.1 IMPACT ON WATER RATES

The capital program recommended by the MWP will result in water rates increasing for all domestic customers across the service area. Since water bills will be based largely on consumption, apartments and condominiums will see smaller net increases than detached homes, where watering lawns and gardens are a factor. Percentage increases, however, will be similar. It is anticipated that water rates will peak in 2007, once the new works are in place.

Table 13-1 shows the projected impact on various domestic customers based upon their individual consumption. The table also shows the impact on customers of possible levels of infrastructure grants. A precise grant amount cannot be determined in advance of an application to senior levels of government.

**Table 13-1
Effect of Water Program on Monthly Water Bills**

Rate Scenarios	Low Water Consumer 200 m³/Year	Low-Moderate Water Consumer 300 m³/Year	Moderate-High Water Consumer 400 m³/Year	High Water Consumer 500 m³/Year
2002 Water Rates Average Monthly Water Bill	\$16.81	\$21.48	\$26.15	\$30.81
2007 Program as Planned Average Monthly Water Bill	\$31.05	\$42.53	\$54.01	\$65.49
<u>Impact of Grant Scenarios</u> 2007 Program As Planned (With \$10 M. Grant) Average Monthly Water Bill	\$29.12	\$39.63	\$50.14	\$60.65
2007 Program As Planned (With \$20 M Grant) Average Monthly Water Bill	\$27.35	\$36.98	\$46.61	\$56.24
2007 Program As Planned (With \$30 M Grant) Average Monthly Water Bill	\$25.35	\$34.27	\$43.00	\$51.72
2007 Program As Planned (With \$40 M Grant) Average Monthly Water Bill	\$23.76	\$31.60	\$39.43	\$47.26

Notes:

1. Water rates shown are after the 10% discount for quick payment
2. Water rates for 2002 reflect the water rate increases proposed in each jurisdiction's 2002 provisional budget. The 2002 rate is based on a flat rate of \$88.00/year and a consumption rate of 0.56/ m³. (NOWA domestic water rates will still be flat rate based in 2002, but reflect a similar rate increase). Note that 2002 rates are about 20 to 25% higher than 2001 rates, depending upon the utility.
3. Excludes Specified Area Charge for installation of new domestic water meters.

Based on the values in the table, a “low” water consumer, such as reflected by an apartment dwelling unit, currently pays about \$17 per month. With the proposed capital program, this will rise to between \$24 and \$31 per month, depending upon the level of senior government funding that is received. The higher value reflects the “no” grant situation.

A “high water” consumer, reflecting a large single family rural-type lot, would see an increase from the 2002 rate of \$31 per month to between \$47 and \$65 per month. Other levels of water consumer would fall between these rates.

In reviewing the water rate increases, the reader should be aware that 2002 rates were increased by about 20 to 25% over 2001 rates. This rate increase was part of a consolidation of domestic rates across the three utilities to bring rates to a similar basis, as well as to generate revenue to fund the initial activities under the regional water scheme.

13.2 REVENUE AND COST PROJECTIONS

As noted above, the most significant financial variable will be the availability and eligibility of this project for senior government infrastructure grant funding. In Working Paper No. 14, a number of grant scenarios, ranging from zero to \$40 million, were analyzed. The “zero” grant situation is shown in Table 13-2 as an example of the expected revenue and expenditures over the next six years. This should be used for planning purposes until the actual grant value is determined.

The reader should note that project dollar figures in a 2% per year inflationary factor. As per the Statement of Principles is assumed that agricultural rates are fixed, with the exception of inflation.

13.3 STRATEGY TO INCREASE RATES

GVWU will need to develop a strategy and communications program about the timing for increasing water rates. A number of alternatives strategies were presented in Working Paper No. 2. Each alternative has pros and cons associated with it, and no one alternative stood out as obviously preferable. Under all scenarios, water rates will reach their peak in 2007 and then stabilize.

It is recommended that water rates rise gradually and by consistent increments from 2002 to 2007. The most significant impact to customers is that they will have to adjust their household/business budgets to respond to a water rate increase of about 15% to 30% each year until 2007.

A comprehensive public awareness campaign is strongly recommended.

Table 13-2
Revenues and Expenditures with No Grant

	2003	2004	2005	2006	2007	2008
Water Rates (Net of Discount)						
Fixed (per account per year) ⁵	\$ 89.76	\$ 91.56	\$ 93.39	\$ 95.25	\$ 97.16	\$ 99.10
Consumption (per m ³)	\$ 0.63	\$ 0.82	\$ 1.04	\$ 1.21	\$ 1.38	\$ 1.38
Agricultural (per acre per year) ⁵	\$ 75	\$ 77	\$ 78	\$ 80	\$ 81	\$ 83
GVWU Revenue						
Water Rates						
Fixed Portion ³	\$ 1,786,000	\$ 1,873,000	\$ 1,964,000	\$ 2,059,000	\$ 2,159,000	\$ 2,264,000
Consumption Portion ²	\$ 5,167,000	\$ 6,918,000	\$ 8,922,000	\$ 10,585,000	\$ 12,294,000	\$ 12,558,000
Agricultural Water ⁵	\$ 644,000	\$ 657,000	\$ 670,000	\$ 684,000	\$ 697,000	\$ 711,000
Special Area Charge	\$ 289,000	\$ 289,000	\$ 289,000	\$ 289,000	\$ 289,000	\$ 289,000
Other Fees and Services	\$ 441,000	\$ 450,000	\$ 459,000	\$ 468,000	\$ 477,000	\$ 487,000
Total: Fees and Services	\$ 8,328,000	\$ 10,187,000	\$ 12,305,000	\$ 14,085,000	\$ 15,917,000	\$ 16,310,000
Other Sources						
Grants	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Transfer From Reserves	\$ -	\$ -	\$ 500,000	\$ 300,000	\$ -	\$ -
DCC Funded	\$ 250,000	\$ 650,000	\$ 500,000	\$ 500,000	\$ 300,000	\$ 300,000
Surplus From Previous Years	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Total Other Sources	\$ 250,000	\$ 650,000	\$ 1,000,000	\$ 800,000	\$ 300,000	\$ 300,000
Total Revenue	\$ 8,578,000	\$ 10,837,000	\$ 13,305,000	\$ 14,885,000	\$ 16,217,000	\$ 16,610,000
GVWU Expenditures						
Total O&M^{4,5}	\$ 4,404,000	\$ 4,940,000	\$ 5,530,000	\$ 6,377,000	\$ 6,621,000	\$ 6,753,000
Debt Charges						
Existing Debt Servicing	\$ 1,063,000	\$ 1,063,000	\$ 1,063,000	\$ 1,033,000	\$ 1,033,000	\$ 1,033,000
New Debt Servicing ¹	\$ 1,523,000	\$ 3,835,000	\$ 5,712,000	\$ 6,326,000	\$ 7,024,000	\$ 7,024,000
Water Meter Debt	\$ 289,000	\$ 289,000	\$ 289,000	\$ 289,000	\$ 289,000	\$ 289,000
Total Debt Servicing	\$ 2,875,000	\$ 4,897,000	\$ 6,775,000	\$ 7,359,000	\$ 8,057,000	\$ 8,057,000
Capital and Reserves						
Reserve and Rate Funded Capital	\$ 1,300,000	\$ 1,000,000	\$ 1,000,000	\$ 1,150,000	\$ 1,300,000	\$ 1,300,000
Grant Funded Capital	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Transfers to Reserves	\$ -	\$ -	\$ -	\$ -	\$ 240,000	\$ 500,000
Total Capital and Reserves	\$ 1,300,000	\$ 1,000,000	\$ 1,000,000	\$ 1,150,000	\$ 1,540,000	\$ 1,800,000
Total Expenditures	\$ 8,578,000	\$ 10,837,000	\$ 13,305,000	\$ 14,885,000	\$ 16,217,000	\$ 16,610,000
Surplus/(Deficit)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

Notes

- 1: An interest rate of 7% is assumed on all new debt
- 2: Water consumption is based on projections in WP#12 (See Appendix B)
- 3: Domestic Capacity (Fixed) rates increase at 2.8% per year due to growth (new connections)
- 4: Annual O&M costs are based on estimates in WP#12.
- 5: Inflation is assumed at 2% per year. Fixed portion of domestic rates and agricultural water rates are indexed to inflation (and increase 2% per year)

13.4 RESERVE FUNDS

The following reserve funds are anticipated for the realigned GVWU. Each will require a new bylaw:

13.4.1 Operating Reserve

Creation and use of an “Operating Reserve” is recommended as a strategy to insure that utility costs can be met without the need to adjust water rates each year. In years of lower than average consumption, the utility will need to draw on the reserve, while in years of higher consumption, the utility will be able to contribute to the reserve.

Since the GVWU will be starting from a new position, GVWU will have to initially rely on the accumulated surpluses and operating reserves that will be transferred from the current utilities. It is recommended that the bulk of these funds be used as a starting position for the GVWU Operating Reserve. It is also recommended that close attention be paid to water consumption estimates versus actual water consumption and annual precipitation during the first few years of operations to insure that an adequate Operating Reserve is available for unusually wet years, when consumption will be lower.

13.4.2 Capital Reserve

All of the existing utilities currently fund capital replacements primarily from rates and maintain relatively low reserves for the purpose of capital replacement. None of the utilities have a fixed formula for this, and the actual amount varies from year to year, depending on requirements. All utilities maintain some reserves for the purposes of capital replacement.

Assuming that the bulk of the above funds will be transferred to the proposed Capital Reserve Fund, GVWU will have a relatively low initial balance given the total value of capital assets. The GVWU will need to develop a strategy to insure that adequate reserves are in place to replace aging assets when required.

Provided that GVWU continue replacing capital on existing infrastructure in a manner that the three existing utilities are currently managing this function, GVWU may be able to defer increasing its contributions to the Capital Reserve

until the bulk of the master plan capital costs are incurred in 2008). At this time, the budget for Capital Reserves can be increased without having to increase water rates.

13.4.3 DCC and Regrade Reserves

It is proposed that any capital costs associated with expanding the supply of water, or the capacity of the utility's transmission and distribution system should be paid through Development Cost Charges (net of the Municipal Assist Factor) in the case of the domestic system, and through Regrade Charges in the irrigation system. It is proposed that separate DCC funds be established for the domestic system and a "Regrade" fund be established for the irrigation system.

Separate DCCs for domestic water supply, water storage, water treatment, and water transmission, should be considered. This will improve the transparency of the DCC charges. Water distribution network extensions to new developments usually occur in a similar timeframe as the actual development. Expansion of water supply and treatment facilities however, may occur many years before or after a particular development. The difference in timing for the expansion works may make four separate DCC Funds worthwhile. Regardless, provisions for both the cost of increasing the supply of water and in meeting the transmission needs should be taken into account.

All of the existing utilities utilize DCCs to fund domestic system growth. NOWA utilizes the Regrade fund to pay for increasing the capacity of both the irrigation and domestic water system. The existing NOWA Regrade fund will need to be allocated between the domestic system and the irrigation system, and the revised Regrade fund will then be used exclusively for irrigation expansion needs.

13.5 DCC REVENUE FOR CAPITAL IMPROVEMENTS

Since the water treatment and transmission system will be designed to accommodate future growth in addition to providing higher quality water, it is anticipated that some of the capital costs proposed in this master plan will be eligible for DCC funding, once appropriate by-laws are in place.

It is estimated that over the 40-year planning horizon about 65% of the total capital costs would be "net DCC recoverable costs". It should be noted that the costs exclude the

costs for new, local distribution systems that would be directly funded by the developer. The calculations shown also assume no senior government grant. Any grants will need to be taken into consideration in the DCC bylaws.

The reader is cautioned that this calculation is preliminary only for the purpose of illustrating the impact of DCC funding. It is recommended that the required Development Cost Charges, their related by-laws and reserve funds be developed at the preliminary engineering stage.

CHAPTER SYNOPSIS

The required capital program creates a significant impact on domestic water rates over the next six years. The actual impact will depend upon the availability of senior government grants. As an example, a “low-moderate” water consumer, such as reflected by a smaller single-family dwelling, currently pays about \$21 per month. With the proposed capital program, this will rise to between \$32 and \$43 per month, depending upon the level of senior government funding that is received. The GVWU needs to establish operating, capital and DCC and Regrade reserves. A portion of the capital program over the next several years will be eligible for DCC contributions. It will be a number of years, however, before the DCCs can be collected and carrying charges will be incurred.