Kelowna Joint Water Committee

2005 STRATEGIC WATER SERVICING PLAN

Agua Consulting Inc.
"Engineered Water Solutions"

Mould Engineering

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"Engineered Water Solutions"

Mould Engineering

October 17th, 2005

Rutland Waterworks District
160 Highway 33 West
Kelowna, BC
V1X 1X7

Attention: Mr. Grant Federspiel
Chairman, Kelowna Joint Water Committee Board of the Whole

Dear Grant:

Re: Kelowna Joint Water Committee
2005 Strategic Water Servicing Plan

We are pleased to provide our report summarizing the Kelowna Joint Water Committee 2005 Strategic Water Servicing Plan for all lands within the City of Kelowna boundaries. The plan was developed by a team of skilled individuals with a long history of water supply in the Okanagan Valley. The plan is an update to the 1995 KJWC Water Servicing Plan. It includes the following specific information:

- A review of source capacity in relation to water licenses;
- Plan drawings of the major water supply components and water pressure zones that presently service the City;
- A summary of water system strengths and weaknesses for each utility;
- Plans for improvements for the five large water utilities within the City boundaries;
- A plan for long-term water service boundaries for all lands within City limits.

The plans provide insight into the condition of our water resources and the ability of our water utilities to meet the pressures expected from climate change and continued development.

We are pleased to be of service and look forward to discussing the report with you.

Yours truly:

R.J. Hrasko, P.Eng.
Principal
Agua Consulting Inc.

S.B. Mould, P.Eng.
Mould Engineering

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EXECUTIVE SUMMARY

Plan Objective

This report provides a long-range water servicing plan for ***all*** lands within the City of Kelowna boundaries plus lands in the Regional District that are serviced by the KJWC utilities. The plan closely reflects Kelowna 2020, the Official Community Plan, which was completed in 2000. The report was authorized by the Kelowna Joint Water Technical Committee and was a joint effort from the following water utilities:

- City of Kelowna;
- Black Mountain Irrigation District;
- Glenmore-Ellison Improvement District;
- South East Kelowna Irrigation District;
- Rutland Waterworks District.

This plan updates the 1995 KJWC Water Servicing Plan and provides additional information on the available water sources, licensed capacity, and on water quality issues facing the water suppliers. Also included is a summary of the Capital Plans of the five water utilities complete with estimated costs.

Existing Water Sources

Section 2 of this report provides an in-depth review of the water sources including licenses held, historical water use, and a summary of typical raw water quality of the sources. There are three primary sources of water available to the utilities: groundwater, runoff from the tributary watersheds, and water pumped from Okanagan Lake. The annual average contribution from the three sources to meet the present water demands is as follows:

Okanagan Lake supply	29 %	(14,500 ML)
Mission, Kelowna and Hydraulic Creek Supplies	57 %	(28,675 ML)
Groundwater supply	14 %	(7,025 ML)

The watersheds provide more than half of the water supplied to the five water utilities. The watersheds also recharge the groundwater aquifers and fill Okanagan Lake. The level of water in Okanagan Lake is directly related to the volume of runoff from Mission Creek as Mission Creek is the single largest contributing source to recharge the lake and groundwater in the region. Licensed capacity was reviewed for all water suppliers. It appears that adequate licenses are held by the five water utilities to meet the foreseeable future water demands.

Existing Water Systems

Section 3 provides a description of the distribution systems of the five major water supply systems along with a description of the smaller local utilities. The water system service area, the distribution system, and existing strengths and weaknesses of the systems are presented. Pressure zone mapping, plan drawings of the key infrastructure, and a summary table of major components for each utility are presented. The mapping includes the location of pump stations, reservoirs, PRVs and trunk watermains. Pressure zones drawings are necessary to determine how lands outside of the existing utility boundaries will be serviced, and to determine interconnection opportunities.

Water Servicing Plans

Water servicing plans for the future are presented in Section 4 of this report. Water servicing capacity was reviewed based on meeting the growth projections set out in the Kelowna 2020 OCP. The growth shows that an additional 45,000 persons could be living in Kelowna by the year 2020. The resulting additional annual water demand is projected to be 10,000 ML. This amount is well within the licensed capacity of the five KJWC utilities. A probability review was carried out for the area watersheds and there appears to be sufficient water for the 20 year horizon. Drought cycles will inevitably occur in the future and the water utilities must closely manage their resources to weather these cycles.

Figure 4.2 (after page 68) presents recommended service boundary lines for the unserviced land within the City of Kelowna and adjacent RDCO lands. Table 4.4 presents an explanation for the recommendations and the estimated water demand for the unserviced areas.

Conclusions

The major conclusions generated during the development of this plan include the following:

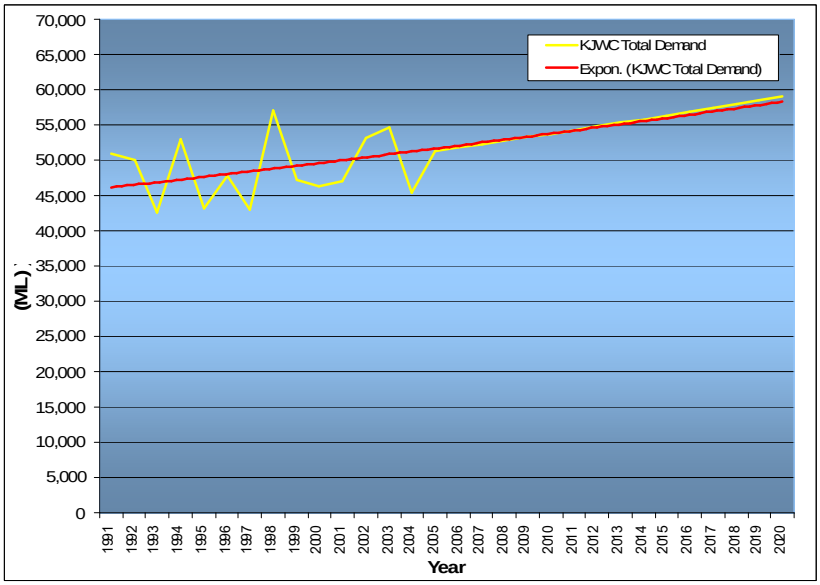
- Based on the information assembled, it appears that no major actions are required for the KJWC related source capacity and licenses as these appear sufficient for the foreseeable future. The utilities that rely on upland watershed storage are more susceptible to drought cycles. Drought management plans in place in draft form for BMID and GEID and will soon be passed as bylaws. SEKID has meters in place with which to manage drought conditions.
- The present annual average water demand for the five large water utilities making up the KJWC is estimated to be in the range of 50,000 ML. The compiled data for water demand had to be "normalized" to create an annual average demand as the characteristic of water use and the climatic factors are constantly changing;
- The current licensed volume of water available to the KJWC utilities is 131,850 ML, meaning that in an average water use year, the water utilities are utilizing only 33 % of their licensed allotment. It appears that there is sufficient licensing for the Kelowna water utilities for the foreseeable future;
- The average amount of water supplied on an annual basis by each of the five Kelowna utilities, and their percentage of the total supply is summarized as follows:

City of Kelowna	14,500 ML	29%
Black Mountain Irrigation District	13,400 ML	27%
Glenmore-Ellison Improvement District	6,800 ML	13%
Rutland Waterworks District	4,000 ML	8%
South East Kelowna Irrigation District	11,500 ML	23%
TOTAL	**50,200 ML**	**100%**

- Annual water demand is closely related to the climatic factors of temperature and precipitation. The climatic factors have a much more prominent impact than the impact of growth and development in the region as shown in the historical demand figures in Section 2 of this report;
- From the trend line in Section 2, Figure 2.12 (page 38) trended historic water demand was found to increase very slowly. Over the last 14 years, the data showed an increase of only 1,000 ML water demand or an annual rate of only 0.15%;

- The trend line on Figure 1 was developed factoring in the projected future growth. Over the 20 year span of the OCP, using an average daily demand of 500 L/person/day for SF and 300 L/person/day for MF development, the annual average water demand is expected to increase by 10,000 ML. The OCP growth rate is projected at 2.40%. The water demand growth rate is estimated to be lower at 0.93% over the lifespan of the OCP;

Figure 1 - KJWC Projected Annual Average Water Demand



- Meeting the long-term water supply requirements is expected to be manageable as it will influenced by the following factors:
  1. The implementation of water meters and demand management tools will help to monitor and control water consumption;
  2. Future development will consist of more multi-family type housing which uses less water per person than single-family type development;
  3. There will be less "dry" land remaining to irrigate;
  4. The value of water will increase, making it more valuable and;
  5. Irrigation practices will continue to be more efficient as has been the case in the past 10 years.

- There is over $120,000,000 in capital expenditures planned for the KJWC utilities in the next 20 years. Water treatment forms approximately half of the total expenditures identified. Major treatment and water quality improvement projects are planned for BMID, GEID and SEKID. The City has plans for additional water quality improvements, however, these will be driven by changes regulations;
- As water treatment forms a significant portion of the overall water improvement projects, the water utilities are in the process of developing financial plans for how to move forward on these issues. Water quality and renewal initiatives will have the largest impact on utility rates in the next 20 years. Rate increases will be necessary to fund these initiatives.

Recommendations

- Water rates must increase at a rate equal to or slightly above the construction inflation rate, otherwise the ability for the utilities to implement upgrading and renewal projects becomes extremely limited;
- With water quality regulations becoming more stringent, the implementation of water treatment will result in higher water rates for both domestic and irrigation users. Maintaining a low rate for irrigation water helps to maintain the green space and high quality of life enjoyed within Kelowna. A significant issue facing three of the KJWC utilities will be treatment and/or separation of the agricultural water supply;
- The KJWC should continue to develop common policies for water supply in the Kelowna area. Meeting occasionally with the Westside Joint Water Committee should yield benefits including the creation of common objectives, shared contributions to public education on water, shared advertising, common policies for water management, and common standards and practises;
- The use of water meters forms the most effective means of controlling water-use during drought years as demonstrated by the utilities with meters. All of the utilities should be working towards implementation of a education and metering program and adjusted rate structure to encourage responsible water-use;
- Local and senior governments must continue to work on expansion of the water quantity and quality monitoring as well as work on a Basin-Wide approach to assess, expand and improve water management in the Okanagan Valley. Once the Provincial work related to the Okanagan Basin capacity and the groundwater inventory are completed, the KJWC should move forward on groundwater protection issues.
- KJWC utilities should plan for expansions of their water systems to service the unserviced lands as identified in Section 4 of this report;
- With 57% of the source water coming from multi-use Crown watersheds, protecting source water quality and quantity is beyond the authority of the KJWC. IHA, RDCO, MoE and the MoAL have statutory authority over watershed land-use and should be encouraged to develop pro-active source water protection policies.
- Land use planning and monitoring will be a component of protecting the groundwater resource and the City and RDCO organization must both be involved at a land use level. Their bylaws should be integrated to help protect the watersheds and groundwater resources;
- In accordance with Provincial direction, all new small scale development should be connected to the nearby larger existing water utilities where it is practical to do so. This allows for qualified operators and better redundancy and capacity to service the population;
- Emergency Response Plans for the KJWC utilities, which are currently being updated with IHA, should be circulated to the other utilities so that involvement and /or support will be made available in times of emergency.

1. INTRODUCTION

1.1 KELOWNA JOINT WATER COMMITTEE

The Kelowna Joint Water Committee (KJWC) is a coordinating organization for the five large water utilities that operate within the City of Kelowna. The KJWC was formed in 1993 to promote standardization of methods and materials, improve communications, and to provide an integrated approach to water supply within the City boundaries. The five utilities include: the City of Kelowna water utility (City), the Black Mountain Irrigation District (BMID), the Glenmore-Ellison Improvement District (GEID), Rutland Waterworks District (RWD), and the South East Kelowna Irrigation District (SEKID).

City of Kelowna: www.city.kelowna.bc.ca

The City of Kelowna Water Utility services approximately 57,000 people within the City of Kelowna boundaries. The City utilizes three major pump stations to obtain all of its water from Okanagan Lake. They serve water to all lands near the lakefront extending from the north end of Clifton Road to the south Mission. The utility has approximately 350 km of watermain, 20 storage reservoirs, 7 large water pump stations, and 25 PRV stations.

Black Mountain Irrigation District: www.bmid.ca

The BMID is an Improvement District serving approximately 17,000 persons within the City and the RDCO. It is the largest Improvement District in the Province and received its Letters Patent in November 20th, 1920. The system services approximately 1,650 ha of irrigation and 7,000 domestic customers to the Black Mountain, Belgo, McKenzie Bench, Scotty Creek, Ellison, North Rutland and Adams Road areas of Kelowna. The BMID has approximately 165 km of watermain, a large WTP off Mission Creek, 4 water pump stations and 15 PRV stations.

Glenmore-Ellison Improvement District: www.glenmoreellison.com

The GEID is an Improvement District with Letters Patent dating back to 1920. GEID is centrally located and is the fastest growing of the five utilities. GEID provides water to approximately 11,000 persons in the Glenmore Valley and Ellison areas of Kelowna and water for 1,220 ha. of agriculture. The GEID resulted from the amalgamation of the Glenmore and Ellison Irrigation Districts in 1991. GEID has approximately 135 km of watermain, 7 storage reservoirs, 10 water pump stations, and 6 PRV stations.

Rutland Waterworks District: www.rutlandwaterworks.com

RWD is an Improvement District with Letters Patent dated Dec. 28th, 1949. RWD utilizes groundwater wells as its source. RWD provides water to approximately 13,500 persons in central Rutland with the customer base being totally domestic. RWD has a large storage reservoir on Teasdale Road, 15 groundwater wells and 2 PRV stations.

South East Kelowna Irrigation District: www.sekid.ca

SEKID is an Improvement District and along with GEID, BMID, Westbank and Naramata, was one of the first five IDs in the Province. With Letters Patent dating back to 1920, SEKID has a long history of water supply in the region. SEKID provides water to approximately 5,800 persons with the majority of water being Irrigation for approximately 3,300 ha. of agriculture. SEKID has 3 groundwater wells, 2 storage reservoirs, 1 water pump station, and 36 PRV stations.

The service boundaries of the five water districts are illustrated on Figure 1.1. Details for each of the utilities with respect to water sources, licenses held, reliability, water distribution, conservation techniques and future Capital Plans are provided within this report.

1.2 AUTHORIZATION

This document has been prepared at the request of the Kelowna Joint Water Committee. It represents a joint effort using the knowledge available from the four Water Districts, the City of Kelowna, and their consultants. The report is a compilation of existing information on the five major water utilities within the City boundaries. It was prepared by a consulting team consisting of representatives from the City of Kelowna, Mould Engineering, and Agua Consulting Inc.

1.3 STUDY AREA

The study area encompasses all lands within the existing City of Kelowna city limits. The study area also includes lands that extend beyond the City limits that are serviced by the five large utilities. It is noted that two of the water utilities, BMID and GEID, service lands that fall within the boundaries of the Regional District of Central Okanagan (RDCO).

The watersheds for three of the Districts also extend outside of the City boundaries into the RDCO. The study area includes the City, the service region of the utilities and their watersheds.

1.4 GOALS AND OBJECTIVES OF THE KJWC

The mandate of the KJWC is to improve communication, cooperation and coordination between the five largest water suppliers within the City of Kelowna boundaries. A primary objective is the development of common policy for all five water utilities on a broad range of water supply issues. The KJWC is to continue development of strategies to improve the overall water management issues of the community and continue to encourage each District to provide a higher level of water service to the community.

The political representatives and the water utility managers met and agreed on these goals at the May 27, 2005 Board Meeting of the Whole. The goals and objectives are to be reviewed and renewed every two years.

The short term goals for 2005, as adopted by the KJWC Board of the Whole, are to:

- Maintain, develop and co-ordinate Hydrant administration.
- Standardize forms and policies for administering the development approval process. Coordinate these activities with City department staff.
- Develop the Advanced Quality Water Advisory Program (AQWA) with web, e-mail and telephone communication.
- Standardize forms issued by the member districts related to businesses working across water utility boundaries, e.g. Hydrant use permits, application for water service, etc.

Hydrant Use Procedure

- Call an annual meeting with the Chair of the Okanagan Basin Water Board to discuss the upcoming mandate of the OBWB, and review how the KJWC can assist and support the initiatives.
- Maintain a water efficiency knowledge exchange.
- Update the 1995 KJWC Water Servicing Plan, and make a presentation to Kelowna City Council and to the OBWB.

The longer term goals for the KJWC, as adopted by the KJWC Board of the Whole, are to:

- Continue development of an effective water conservation program for the benefit of the community as a whole.
- Continue to review and develop the servicing standards of all water utilities within the City and maintain standards and a product approval program.
- Continue promotion and practices for a safe water supply.
- Increase education and marketing to the public on the value of water.
- Continue educational programs to advance common water issues and goals.
- Provide utility information for beneficial use by the City of Kelowna Planning Department.
- Develop a strategy for emergency cross boundary servicing between all purveyors within the City of Kelowna. Prepare a comprehensive water distribution plan that can be implemented in the event of a major regional power failure or catastrophe.

The goals and objectives are to be reviewed by the KJWC Board of the Whole and will be the guiding principles for the activities and funding of the Kelowna Joint Water Committee.

1.5 STUDY OBJECTIVES

The primary objective is to prepare a strategic water servicing plan for all lands within the City of Kelowna boundaries. For effective planning of the water infrastructure, it is critical that future water utility boundaries be established. The specific objectives of this report are to:

- Summarize the technical data related to water supply for the City of Kelowna water utilities;
- Provide a summary of water supply sources and identify limitations and surplus in the existing water supply sources;
- Identify current strengths and weaknesses of the five water utilities for source supply, distribution, and ability to accommodate development and additional water demand. Long-range planning for the utilities would be summarized and used as the basis for setting out the long-term plan;
- Respect existing boundaries of all of the water utilities;
- Identify current physical servicing constraints such as creeks, major highways, railways, and topographic features for servicing lands outside the utility boundaries;
- Review the opportunity for system interconnection between water utilities where it is beneficial to at least one party;
- Provide recommendations for boundary extensions and servicing revisions;
- Prepare a long-range water servicing plan that closely reflects the City of Kelowna's 2020 Official Community Plan (OCP). The OCP was developed in 2000 to a 20 year horizon.

This report should help to increase the level of understanding of water resources and the direction for the five largest water utilities within the City of Kelowna. The plan provides direction for servicing of lands within the City limits, but currently outside the major water utility boundaries.

1.6 UNITS / CONVERSIONS

Units used throughout the report are in metric with some exceptions. Please note that for ease of access, abbreviations for the terms used in this report are presented on the inside front cover of this report.

- Pressure — Pressure is presented in psi, common to all utilities
- Hydraulic Grade line — Hydraulic grade line is the elevation of the head of water that is at any point within the water distribution system. Pressure zones are presented in terms of hydraulic grade line in metres to the nearest metre under normal operating conditions.
- Instantaneous Flow — Flow is presented in L/s. Some of the utilities operate using USgpm as the flow measurement.
- Annual Flow, Storage — Presented in megalitres (ML). 1.233 ML = 1 acre-foot. Water Licenses for storage and waterworks is presented in megalitres (ML).

Conversions of units are as follows:

Metric to Imperial			Imperial to Metric		
1 m	=	3.28 feet	1 ft	=	0.3048 metres
1 ha	=	2.471 acres	1 acre	=	0.4047 ha.
1 m^3	=	35.315 ft^3	1 ft^3	=	0.028317 m^3
1 L/s	=	15.87 USgpm	1 USgpm	=	0.063 L/s
1 ML	=	0.8107 ac-ft	1 acre-foot	=	1.233 ML
1 Litre	=	0.26455 US gallons	1 US gallon	=	3.78 Litres
1 Litre	=	0.22026 Imperial gallons	1 Imperial gallon	=	4.54 Litres
1 m Head	=	1.422 psi	1 psi	=	0.703 metres of head
1 kPa	=	0.145 psi	1 psi	=	6.89 kiloPascals

1.7 KJWC REPRESENTATIVES

The following is a list of contact persons, their addresses and the parties that they represent.

City of Kelowna, Water Department 1435 Water Street Kelowna, BC V1Y 1J4 Phone: 763-6011 Fax: 862-3349 Technical Committee Rep. Don Degen City Councillor Colin Day	South East Kelowna Irrigation District 3235 Gulley Road East Kelowna, BC, V0H 1G0 Phone: 861-4200 Fax: 861-4213 Technical Committee Rep. Toby Pike SEKID Chairperson Frits Verkerk
Black Mountain Irrigation District 285 Gray Road Kelowna, BC, V1X 1W8 Phone: 765-5169 Fax: 765-0277 Technical Committee Rep. Bob Hrasko BMID Chairman Gord Ivans	Rutland Waterworks District 160 Highway 33 West Kelowna, BC, V1X 1X7 Phone: 765-5218 Fax: 765-7765 Technical Committee Rep. Bruce Wilson RWD Chairman Grant Federspiel
Glenmore-Ellison Improvement District RR #1 Glenmore Road Kelowna, BC, V1Y 7P9 Phone: 763-6506 Fax: 763-5688 Technical Committee Rep. Pat Hickerson GEID Chairman Joe Bulach	Mould Engineering Services Ltd. 206, 437 Glenmore Road, Kelowna, BC, X0X 1N0 Phone: 868-2072 Fax: 868-2078 Stu Mould, P. Eng., Senior Engineer Jody Good, Senior Technologist
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1.8 ACKNOWLEDGEMENTS

Agua Consulting Inc. and Mould Engineering Services Ltd. would like to recognize the following water system staff from the various organizations that provided input to this document.

- Don Degen, Water Manager, City of Kelowna
- Pat Hickerson, General Manager, Glenmore-Ellison Improvement District
- Toby Pike, Manager, South East Kelowna Irrigation District
- Bruce Wilson, Manager, Rutland Waterworks District
- Antonio Faccini, AF Consulting Ltd.
- Ken Higson, Water Consultant for City of Kelowna
- Bill Braden, Water Utility Technologist, City of Kelowna
- Gary Stephen, Acting Manager, Policy, Research and Strategic Planning, City of Kelowna;
- Mike Rojem, Works Superintendent, Glenmore-Ellison Improvement District
- Brian Thorburn, Water Quality Supervisor, Black Mountain Irrigation District
- Jody Good, Mould Engineering Services Ltd.
- Rod McLean, Mould Engineering Services Ltd.
- Adrian Weaden, Water Operations Superintendent, City of Kelowna
- Robin Barnes, Water and Drainage Engineer, City of Kelowna
- Remi Allard, Golder Associates Ltd.
- Don Dobson, P.Eng, Dobson Engineering Ltd.
- James Moller, Manager, Lakeview Irrigation District

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2. WATER SOURCES

2.1 GENERAL

This section provides a review of water sources with respect to source location, source capacity reliability, water licenses, and historic water use. The five major water utilities within the City of Kelowna have an extensive array of water sources from where their supplies originate. The sources are separated into three broad categories:

1. Valley Lakes (i.e. Okanagan Lake);
2. Upstream Watersheds;
3. Groundwater.

The majority of water in the basin originates from spring snowmelt in the upstream watersheds which charges the creeks and flows to Okanagan Lake. Runoff from snowmelt also recharges the aquifers which flow back towards the creeks and valley lakes. Okanagan Lake is the destination for the majority of runoff water after accounting for losses to the atmosphere by evapotranspiration and direct evaporation. Approximately 75% of the total annual precipitation over the basin is lost to the atmosphere through evapotranspiration.

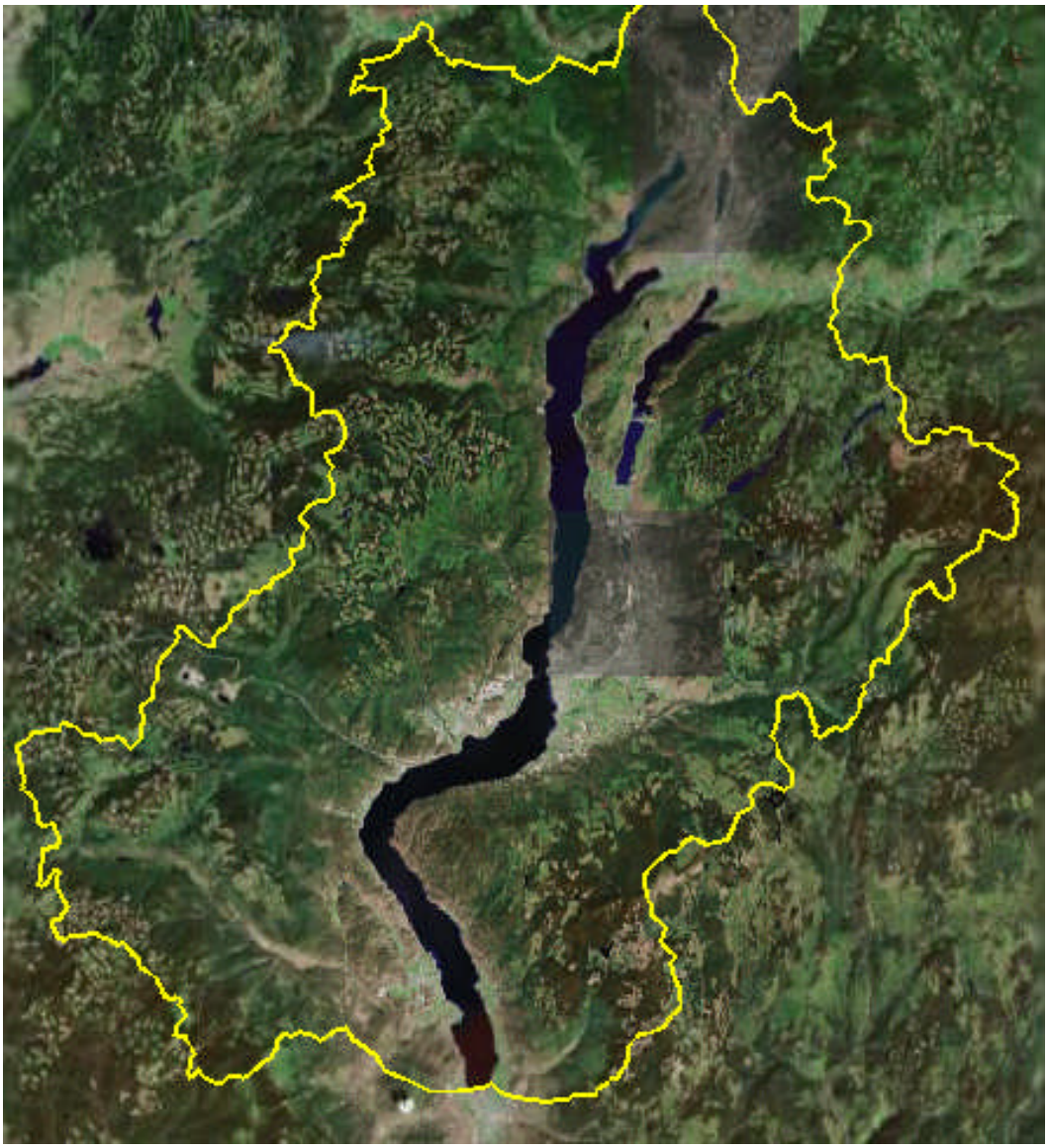
The City of Kelowna relies on Okanagan Lake for all of its water supply. The upstream watersheds supply the majority of water to BMID, GEID and SEKID. RWD is the only supplier that relies solely on groundwater supply.

2.2 OKANAGAN LAKE

Okanagan Lake is the largest hydrological feature in the Okanagan Valley. The lake is nearly 160 km long and is over 200 metres deep in places. The state of the water resources in the region can generally be determined by comparing the water level in the lake with seasonal averages. The operating level of the lake varies 1.21 metres from a "full pool level" of 342.56 metres to a normal "low water level" of 341.35 metres. Extremes have occurred beyond both on the normal high and on the low lake levels as noted during the flood of 1990 and the recent drought of 2003 and early 2004.

Okanagan Lake is the "barometer" of the Okanagan Valley in terms of providing an immediate indicator for the public as to the state of water supply. This was apparent in 2003 and early 2004 when the lake was at very low levels. As the demands on Okanagan Lake increase in the future, so will the controls and shared responsibility of the volumes and allotments of water that can be pumped from Okanagan Lake. Figure 2.1 shows the community watersheds in the Okanagan Lake basin.

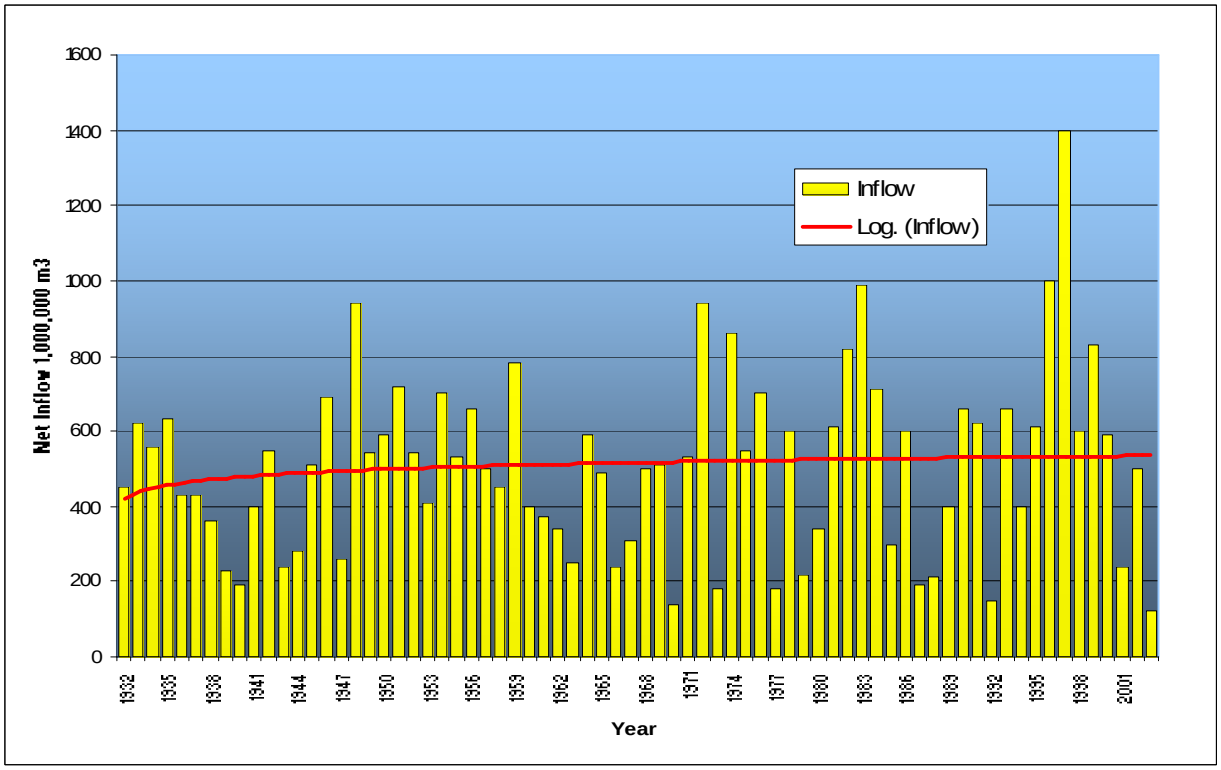
Figure 2.1 - Okanagan Lake Watershed



The term 'net inflow' means the total inflow to Okanagan Lake less surface evaporation and water withdrawals. Evaporation and licensed withdrawals average about 100,000,000 m^3 annually. The average annual net inflow into the lake is in the range of 483,000,000 m^3 with the 120,000,000 m^3 inflow of 2003 being the lowest on record since the 1930's. The net inflow in 2003 was in the range of 25% of the average flow or a 1:100 year drought. Water supply in the region was only marginally compromised due to the large volume of water storage in the basin. It should be noted that the general trend seems to be a minimal **increase** in the amount of water flowing out of the Lake. This is in spite of increases in population and perceived higher water use. Figure 2.2 provides a historic perspective of the runoff from the watersheds into Okanagan Lake.

The red trend line provides a numerical 'best fit' of the average annual inflow. Data is available going back to 1921, however the 1929-31 drought was not included so as not to skew the data to show an unrealistic increase from those three drought years.

Figure 2.2 - Okanagan Lake Net Inflow



Source: Ministry of Water Land and Air Protection

CITY OF KELOWNA – OKANAGAN LAKE

Poplar Point Pump Station

The City of Kelowna relies on Okanagan Lake for all of its water supply. The City operates three main pump stations on Okanagan Lake at Poplar Point, Eldorado and Cedar Creek. These stations are currently being refitted with UV treatment. The City also operates several smaller lake pump stations that are used for isolated areas or emergency supply. The City does not utilize groundwater wells within their supply system.

Presently, the City holds 51,996 ML of annual waterworks licenses on Okanagan Lake and another 404 ML of licenses for irrigation. The City does not hold any storage licenses.

It has been reported that Okanagan Lake presently may have spare license capacity; however, the amount is subject to a water availability study presently underway by the Ministry of Environment. A detailed summary of the licenses that the City holds is provided in Appendix A.

The raw water quality in Okanagan Lake is excellent and requires minimal treatment to meet the Guidelines for Canadian Drinking Water Quality (GCDWQ). A summary of the water quality at the lake intake locations is summarized in Table 2.1. The measured drinking water parameters are presented to provide an indication of the raw water quality in comparison with the GCDWQ.

The raw water quality from Okanagan Lake meets the GCDWQ reliably for almost all parameters. There are issues related to turbidity spikes at the Eldorado Intake which is influenced by lake currents and runoff from Mission Creek.

Table 2.1 – City of Kelowna – Raw Water Quality

Parameter	Units	Sample Point												Regulation
		Poplar Point				Eldorado				Cedar Creek				
		#	Low	Average	High	#	Low	Average	High	#	Low	Average	High	
Chlorine Free	mg/L	569	0.64	1.43	2.20	198	0.01	0.74	1.67	264	0.22	1.28	2.20	< 4.0 ***
Chlorine Total	mg/L	567	0.71	1.56	6.00	198	0.07	0.87	1.87	266	0.39	1.42	2.20	< 4.0 ***
Aluminum Extractable	mg/L	2	<0.005	na	<0.005	1	0.006	0.006	0.006	1	<0.005	<0.005	<0.005	< 0.100 mg/L OGV
Ammonia (Total as N)	mg/L	477	0	0.025	0	254	0	0.9	15	296	0	0.028	0.078	n/a
Antimony Extractable	mg/L	2	<0.0002	na	<0.0002	1	<0.0002	na	<0.0002	1	<0.0002	<0.0002	<0.0002	< 0.006 mg/L MAC
Arsenic Extractable	mg/L	2	0.0005	0.0006	0.0006	1	0.0005	0.0005	0.0005	1	0.0006	0.0006	0.0006	< 0.005 mg/L MAC
Barium Extractable	mg/L	2	0.02	0.02	0.02	1	0.02	0.02	0.02	1	0.02	0.02	0.02	< 1.0 mg/L MAC
Boron Extractable	mg/L	2	0.009	0.009	0.009	1	0.008	0.008	0.008	1	0.009	0.009	0.009	< 5.0 mg/L MAC
Cadmium Extractable	mg/L	2	<0.00001	na	<0.00001	1	<0.00001	na	<0.00001	1	<0.00001	na	<0.00001	< 0.005 mg/L MAC
Chloride	mg/L	2	6.2	6.3	6.3	1	5.7	5.7	5.7	1	5.5	5.5	5.5	< 250 mg/L AO
Chromium Extractable	mg/L	2	0.0009	0.0009	0.0009	1	0.0008	0.0008	0.0008	1	0.0008	0.0008	0.0008	< 0.05 mg/L MAC
Copper Extractable	mg/L	2	0.019	0.062	0.105	1	0.023	0.023	0.023	1	0.003	0.003	0.003	< 1.0 mg/L AO
Fluoride	mg/L	2	0.12	0.13	0.14	1	0.13	0.13	0.13	1	0.14	0.14	0.14	< 1.5 mg/L MAC
Iron Extractable	mg/L	2	<0.01	na	<0.01	1	0.01	0.01	0.01	1	<0.01	na	<0.01	< 0.30 mg/L AO
Lead Extractable	mg/L	2	<0.0004	0.0004	0.0004	1	0.0002	0.0002	0.0002	1	<0.0004	na	<0.0004	< 0.010 mg/L MAC
Manganese Extractable	mg/L	2	<0.005	na	<0.005	1	<0.005	<0.005	<0.005	1	<0.005	na	<0.005	< 0.05 mg/L AO
Nitrate (as N)	mg/L	2	<0.1	na	<0.1	1	<0.1	<0.1	<0.1	1	<0.1	na	<0.1	< 45 mg/L MAC
Nitrite (as N)	mg/L	2	<0.05	na	<0.05	1	<0.05	<0.05	<0.05	1	<0.05	na	<0.05	< 3.2 mg/L MAC
Sodium Extractable	mg/L	2	10.2	10.3	10.4	1	10.7	10.7	10.7	1	10.4	10.4	10.4	< 200 mg/L AO
Sulphate	mg/L	2	26.3	26.7	27.1	1	26.3	26.3	26.3	1	27	27	27	< 500 mg/L AO
Uranium Extractable	mg/L	2	0.0025	0.0025	0.0025	1	0.0024	0.0024	0.0024	1	0.0025	0.0025	0.0025	< 0.02 mg/L IMAC
Zinc Extractable	mg/L	2	0.002	0.003	0.003	1	0.004	0.004	0.004	1	0.001	0.001	0.001	< 5.0 mg/L AO
Cryptosporidium spp. (non-viable, confirm	# /100L	1	0	0	0	1	0	0	0	1	0	0	0	99% inactivation **
Cryptosporidium spp. (total, confirmed)	# /100L	10	0	0	0	7	0	0	0	11	0	0	0	99% inactivation **
Cryptosporidium spp. (viable, confirmed)	# /100L	1	0	0	0	1	0	0	0	1	0	0	0	99% inactivation **
Enterococcus (MPN / PA)	MPN/100mL	656	0	0.2	13.2	297	0	0.1	5.3	399	0	1.1	118	
E-Coli (counts)	CFU/100mL	250	0	0	0	187	0	0.3	4.1					0 present in system **
E-Coli (MPN / NA)	MPN/100mL	659	0	0.3	30.6	193	0	0	0	546	0	0.3	48	0 present in system **
Giardia spp. (nonviable, confirmed)	# /100L	1	0	0	0	1	0	0	0	1	0.3	0.3	0.3	99.9% inactivation **
Giardia spp. (total, confirmed)	# /100L	6	0	1.32	7.92	6	0	0.1	0.3	9	0	0	0.3	99.9% inactivation **
Giardia spp. (viable, confirmed)	# /100L	1	0	0	0	1	0.3	0.3	0.3	1	0	0	0	99.9% inactivation **
Heterotrophic Plate Count / HPC	# /mL									1	0.2	0.2	0.2	0 present in system **
Total coliforms (MPN / PA)	MPN/100mL	910	0	8	2419.2	383	0	4.7	770.1	540	0	10.392	1046.2	0 present in system **
Bromodichloromethane	mg/L					3	0.003	0.004	0.006					< 0.016 mg/L MAC
Bromoform	mg/L					3	na	na	na					< 0.100 mg/L MAC
Chloroform	mg/L					3	0.034	0.045	0.058					< 0.100 mg/L MAC
Chlorodibromomethane	mg/L					3	na	na	na					< 0.100 mg/L MAC
Total Trihalomethanes / TTHM	mg/L					3	0.037	0.049	0.064					<0.100 mg/L MAC
Alkalinity (bicarbonate, as CaCO3)	mg/L	2	111	112	113	1	113	113	113	1	113	113	113	n/a
Colour	TCU	899	1	5.8	148	378	1	5.6	18	543	1	5.6	21	< 5.0 TCU AO
Odour	TON	587	0	1	2	248	0	1	2	381	0	0.7	2	n/a
pH		1806	0.339	7.789	8.6	1310	7.2	8.11	8.9	1465	0.059	8.06	8.6	6.5 - 8.5
Taste		561	0	0.9	8	194	0	1	2	265	0	1	2	n/a
Temperature	degrees C	1767	1	8.95	26.9	1317	1	13.4	22	1458	0.531	12.187	22	< 15 C
Total dissolved solids / TDS	mg/L	2	154	155	155	1	156	156	156	1	155	155	155	< 500 mg/L AO
Turbidity	NTU	1850	0.097	0.219	0.538	1334	0.139	0.4942	0.567	1488	0.097	0.367	1.91	< 1.0
UV absorbance	absorb./cm	888	0.021	0.123	0.0508	383	0	0.051	0.079	525	0.026	0.0528	0.087	n/a

***OGV** - Operational Guidance Value (Health Canada) **MAC** - Max. Acceptable Concentration **AE** - Aesthetic Objective ****IHA** Requirement *****USEPA** recomm. **#** No. of Samples

The City is in the process of installing UV disinfection in each of their three largest pump stations. The addition of UV disinfection will reduce the potential of viable *Giardia* or *Cryptosporidium* entering from the lake source.

GEID – OKANAGAN LAKE

Potential GEID Intake Site

GEID has held a water license on Okanagan Lake since 1931 but they have not utilized the source since the 1950's. It was not until earlier in 2005 that they once again supplied water from this source. GEID purchased the assets of the McKinley Landing water utility and are now running the water utility. GEID has a license in the amount of 2,220 ML for irrigation purposes from Okanagan Lake and another 199 ML for domestic servicing for McKinley Landing. GEID is in the process of applying for an additional license from Okanagan Lake.

Water quality is currently being monitored at the two potential intake sites. Thermistor chains have been installed and initial readings show that warm water currents from the surface reach depths of up to 30 metres. It is expected that the new intake will be installed to a minimum depth of 40 metres. Raw water quality is similar to the quality presently experienced by the City of Kelowna at their Poplar Point water intake.

2.3 UPPER WATERSHEDS

The water districts of Black Mountain Irrigation District (BMID), South East Kelowna Irrigation District (SEKID) and Glenmore-Ellison Improvement District (GEID) rely heavily on the upper watersheds for the majority of their source water supply. A description of the watersheds where their water supplies originate is provided in this section.

BMID WATERSHEDS

BMID obtains water from two watersheds: Mission Creek and Scotty Creek. The primary source of water is Mission Creek, which also supplies approximately 30% of the total inflow to Okanagan Lake.

2002 Mission Creek Freshet at BMID WTP Intake

Mission Creek

The Mission Creek watershed area above the BMID intake is estimated to be 561 km^2. The watershed is unique to the Okanagan as it contains the Graystoke area which has substantial land area with elevations over 5,000 feet. This area produces a significant annual volume of runoff and is now a designated Provincial Park.

BMID operates four storage reservoirs in the Mission Creek watershed to capture snowmelt runoff in the spring. Upper level reservoirs are Fish Hawk Reservoir (1,850 ML), Graystoke Lake Reservoir (4,550 ML), and Ideal Lake (6,780 ML). Loch Long (710 ML) is also operated by BMID. The storage license on Loch Long is held by the Province for the enhancement of fish flows in Mission Creek during the late summer and early fall season each year. After spring runoff subsides, water is released from the reservoirs to Mission Creek and is captured at a lower elevation intake where it is diverted through the water treatment plant, balancing reservoirs, and to the water distribution system.

Under normal climatic conditions, the creek is supplied by surface runoff and groundwater from adjacent lands. In drier years such as 2003, the volume of runoff into the lake from Mission Creek was substantially below normal. It was found through accurate monitoring that creek flow was being lost in the lower reaches of Mission Creek to groundwater. Between the BMID upper watershed reservoirs, the BMID intake, and WSC Station No. 08NM116 at Ziprick Road, leakage and/or transmission loss in the amount of 13.4 ML/day was measured.

Scotty Creek

Scotty Creek, which is a tributary to Kelowna Creek, provides irrigation and domestic water to the Scotty Creek area of Kelowna. There are two upper elevation storage reservoirs, James Lake (1,774 ML) and Little Trapper Lake (560 ML). The dam on Little Trapper Lake has been breached and will require rebuilding.

In total, BMID has 17,791 ML of licensed storage in the Mission Creek watershed and 1,825 ML of storage in the Scotty Creek watershed for a total licensed storage of 19,616 ML. Licensed withdrawals on Mission and Scotty Creeks include 22,674 ML for irrigation and another 5,003 ML for waterworks purposes. A summary of the BMID-held licenses is listed in Appendix A.

Belgo Reservoir

The average annual flow of water coming down from the Mission Creek watershed (561 km^2) above the BMID intake is estimated to be in the order of 175,000 ML. This flow is more than 25 % of the total inflow into Okanagan Lake. The average annual flow in Scotty Creek is estimated to be 5,000 ML.

Figure 2.3 illustrates the boundaries of the watershed that contribute above the BMID intake. The scale of the map is noted to be 1:150,000. A description of the watershed areas is as follows:

1. **Upper James Lake Reservoir Catchment** – 11.0 km^2 area at elevations averaging 1,500 m that is undeveloped and contributes to James Lake. The area's runoff has a relatively high organic content with TOC levels above 10.0 mg/L.
2. **Scotty Creek Residual Catchment** – 36 km^2 area at low elevation averaging 1,100 m that produces low runoff and has agriculture risks and high organic levels. Water quality is relatively poor from this source.
3. **Belgo Reservoir Catchment** - 49 km^2 area consists of natural drainage plus two diversion channels from Mugford Creek and from Hilda Creek. The natural water is of high organic loading. The Hilda Creek area is the highest elevation area and produces the best water quality from this area.
4. **Fish Hawk Reservoir Catchment** - 8 km^2 area produces high volume of good quality water. This natural lake has a peat component that compromises water quality with respect to colour and THM generation during disinfection.
5. **Crescent Lake Catchment** - 4 km^2 small catchment area that produces high annual runoff due to high elevation (above 1,900 m) The dam is breached but may be reconstructed by BMID. Headwaters of Mission Creek.
6. **Graystoke Lake Reservoir Catchment** - 16 km^2 larger high elevation catchment area that produces reliable high quality water for BMID. Colour and turbidity from this lake are < 10 TCU and < 0.50 NTU.
7. **Loch Long Catchment** - 4 km^2 small catchment area to fill small reservoir to provide supplementary flows for fish habitat in lower Mission Creek. Water quality is very good. Organic loading in the lake is low as is turbidity and colour.
8. **Residual area below BMID Reservoirs**: - Very large, unregulated watershed that is approximately 480 km^2 in area. Because of its size, the watershed is considered to be reliable and able to produce a high volume of runoff. A high potential for development of additional storage exists here.

The boundary of Dave's Creek is illustrated on Figure 2.3. Although Dave's Creek is not used as a primary source of water for BMID, it is still able to be used as an emergency source of water.

Table 2.2 – BMID Raw Water Quality

Parameter	Units	Mission Ck (raw)	Mission Ck (after WTP)	Scotty Ck (surface)	Well No.4 (GW)	Well No. 5 (GW)	GCDWQ
Alkalinity	mg/L	20 – 100	45.1	20-100	190	195	No Std
Aluminum (total)	mg/L	0.035 – 0.25	0.035 – 0.25	0.073	-	-	< 0.100 mg/L OGV
Arsenic	mg/L	-	< 0.001	< 0.001	-	-	0.025 mg/L MAC
Calcium	mg/L	3.0 – 30.0	12.2	17.1	57.5	58.9	No std
Chloride	mg/L	0.1 – 4.3	3.8	7.1	6.50	6.40	< 250 mg/L AO
Colour	TCU	12 – 50	< 5	8 – 60	< 5	< 5	<15 TCU AO
Conductivity	umhos/cm	41 – 220	102	133	424	392	No Std
Coliforms (Fecal)	#/100mL	5 – 100	0	50-500	0	0	0 **
Coliforms (Total)	#/100mL	50 – 2000	0	200 - 5000	0	0	0 **
Cryptosporidium	No. viable oocysts				n/a	n / a	99 % inact. **
Flouride	mg/L	-	0.05	0.10	0.25	0.25	< 1.5 mg/L MAC
Giardia	Cysts/100L	n/a	In compliance	CT increased	n/a	n / a	99.9% inact. **
Hardness	mg/L	18 – 110	42	56	194	196	80-100 AO
Iron (total)	mg/L	0.03 – 0.40	< 0.05	0.11	0.21	< 0.02	< 0.30 AO
Magnesium	mg/L	1.30 – 11.0	2.78	3.12	12.2	12.0	No standard
Manganese	mg/L	0.005-0.015	0.007	0.018	< 0.01	< 0.01	< 0.05 AO
Nitrate	mg/L	0.005 – 0.015	< 0.05	< 0.05	1.90	1.88	45 MAC
Nitrite	mg/L	-	< 0.002	< 0.002	< 0.01	< 0.01	3.2 MAC
pH		6.85 – 7.95	7.66	7.36	7.7	7.5	6.5-8.5
Phosphorus (total P)	mg/L	0.005 – 0.12	< 0.15	< 0.15	0.020	0.020	n/a
Potassium	mg/L	0.54 – 1.60	0.8	0.7	1.94	1.97	
Sodium	mg/L	1.35 – 9.0	3.09	3.07	8.73	8.48	< 200 mg/L AO
Sulphate	mg/L	0.005 – 13	4.1	6.0	20	20	< 500 mg/L AO
THM Production	ug/L	n / a	33 – 66	> 100	Min.	Min	<0.10 mg/L MAC
TDS	mg/L	44 - 180	70	97	265	262	< 500 mg/L AO
TOC	mg/L	3.5 – 9.0	3.5 – 5.0		n/a	n/a	No standard
Turbidity	NTU	0.30 – 250	0.30 – 1.2	1.5 – 30	1.50	< 0.10	<1.00 NTU MAC

* Optimal Range ** IHA Requirement OGV – Operational Guidance Value AO - Aesthetic Objective MAC - Max. Acceptable Concentration

Area of Concern Out of Compliance

Table 2.2 provides a summary of the raw water quality for BMID sources. The Mission Creek raw water quality is better than most creeks in the region and with the WTP, BMID can supply water that is below 1.0 NTU reliably year round. BMID is considering UV disinfection to help reduce the risks of *Cryptosporidium* and *Giardia*.

GLENMORE-ELLISON IMPROVEMENT DISTRICT WATERSHED

GEID utilizes Kelowna Creek and groundwater for their sources. The principal water source is the Kelowna Creek watershed with storage reservoirs located at Bulman, Postill and South Lakes. Water is captured in the reservoirs during the snowmelt runoff period in the spring and released in the summer and fall to supplement natural creek flows. A large balancing/storage reservoir near McKinley Road (McKinley Reservoir) is supplied via pipeline from Kelowna Creek and balances system demand with Kelowna Creek flows.

Present licenses for irrigation diversion (for agriculture purposes) includes:

10,940 ML from Kelowna Creek and
2,219 ML from Okanagan Lake
4,781 ML (pending license application on Okanagan Lake).

Licenses for waterworks diversion (for domestic water use) includes:

518 ML from Kelowna Creek and
199 ML from Okanagan Lake.

Storage licenses include:

6,646 ML for Postill Lake and South Lake;
1,233 ML for Bulman Creek and
690 ML from Conroy Creek
8,569 ML = TOTAL

Kelowna Creek Intake Site

Figure 2.4 illustrates the boundaries of the watershed above the GEID intake. Catchment areas for the sub-basins are provided. Postill Reservoir is of significant size and produces water with relatively low turbidity levels. The organic levels are moderate to high which results in elevated colour levels in the water supplied to the users.

1. **Kelowna Creek Residual Catchment** – 30.6 km^2 area at elevations averaging 1,000 m, this area produces a low runoff volume due to the low elevation The area runoff has a relatively high organic content with TOC levels above 10.0 mg/L.
2. **Bulman Creek Catchment** – 12.8 km^2 at low elevation averaging 1,300 m, this area that produces low runoff and has high organic levels. Water quality is relatively poor from this source.
3. **Conroy Creek Catchment area** - 6.7 km^2 naturally draining area. Area averages 1,400 metres, water quality is moderate.
4. **Postill Lake Reservoir Catchment** - 19.3 km^2 area is the primary reservoir for GEID. It produces water of relatively low turbidity; however, due to the relatively low elevation, the colour levels are above those desired in the GCDWQ. Watershed fills the reservoir in most years.
5. **South Lake Reservoir Catchment:** - 4 km^2 in area, this lake is relatively small but higher in elevation than the other small subcatchment areas. Elevation averages 1,525 metres.

Table 2.3 provides a summary of typical water quality characteristics of the source water available to GEID.

Table 2.3 – GEID Raw Water Quality

Parameter	Units	Kelowna Ck (Surface)	Ellison Well (GW)	Airport Well No.1 (GW)	Lochrem Rd Well (GW)	Vector Well (GW)	GCDWQ
Alkalinity	mg/L		284	168	190	155	No Std
Aluminum	mg/L		< 0.02	< 0.20	< 0.01	< 0.01	< 0. 100 mg/L OGV
Arsenic	mg/L		< 0.002	< 0.01	0.0025	0.001	<0.025 mg/L MAC
Calcium	mg/L		72	48.1	56	42	No std
Colour	TCU	40	< 5	< 5	< 5	5	<15 TCU AO
Conductivity	umhos/cm		n/a	320	425	304	No Std
Coliforms (Fecal)	#/100mL	35	0	0	0	0	0 **
Coliforms (total)	#/100mL		0	0	0	0	0 **
Cryptosporidium	No. viable oocysts		n/a	n/a	n/a	n/a	99 % inact. **
Giardia	Cysts/100L		n/a	n/a	n/a	n/a	99.9% Inact. **
Hardness	mg/L		325	166	193	141	80-100 AO
Iron	mg/L		0.41	0.33	0.10	0.13	< 0.30 AO
Manganese	mg/L		0.18	0.111	0.172	0.188	< 0.05 AO
Nitrate	mg/L		0.18	< 0.01	0.79	< 0.01	45 mg/L MAC
Nitrite	mg/L		< 0.01	< 0.01	0.01	< 0.01	3.2 mg/L MAC
pH		6.34	7.7	7.9	7.7	8.2	6.5-8.5
THM Production	ug/L		n/a	n/a	n/a	n/a	<0.100 mg/L MAC
Total Dissolved Solids	mg/L		479	221	268	268	< 500 mg/L AO
Turbidity	NTU	1.50 ave. 0.50 – 10.0	0.50	0.12	0.48	0.25	<1.00 NTU MAC

* Optimal Range ** IHA Requirement OGV – Operational Guidance Value AO - Aesthetic Objective MAC - Max. Acceptable Concentration

Area of Concern Out of Compliance

SOUTH EAST KELOWNA IRRIGATION DISTRICT WATERSHED

The primary sources of water for the District are the Stirling, Hydraulic and KLO Creek watersheds with storage reservoirs on McCulloch Reservoir, Fish, Browne and Long Meadows Lakes. The Hydraulic and KLO Creek flows are supplemented by diversions from the West Kettle watershed (Stirling Creek). Water is released from the reservoirs to Hydraulic Creek and diverted to the distribution system by an intake dam several miles downstream from the reservoirs. In addition to the surface water supplies, the District has developed three groundwater wells in the northwest part of the District; East Kelowna Road Wells No. 1 and No. 2, and O'Reilly Road Well.

McCulloch Reservoir – Aerial view

Present developed storage includes 16,615 ML on McCulloch Reservoir, 730 ML on Browne Lake, and 216 ML from Fish and Long Meadow Lakes. Licensed storage of 21,681 ML is considerably greater than the amount actually developed. Licenses for irrigation withdrawal totals 36,073 ML from Hydraulic and KLO Creeks. Licenses for waterworks total only 1,824 ML annually. The capacity of the watershed is insufficient to meet these annual licensed volumes.

Figure 2.5 illustrates the contributing area of watershed above the SEKID intake on Hydraulic Creek. SEKID utilizes several diversions to provide sufficient water to reliably fill its reservoirs. SEKID has a large irrigation water demand and a relatively small watershed. The reliability of the watershed and the volumes of water that they required resulted in a metering program being implemented in 1994.

1. **Mid Hydraulic Creek Catchment** – 43.7 km^2 area at low elevation averaging 1,000 m, this is the uncontrolled natural catchment area of the lower creek. There is no storage here. Organic levels in the water are high creating colour at certain times of the year.
2. **Pooley Creek Catchment** – 18.8 km^2 area at high elevation averaging 1,800 m, this water is diverted through the Pooley Diversion to Hydraulic Creek. The catchment extends to the top of Little White Mountain and produces water with the the lowest organic levels to which SEKID has access.
3. **KLO Creek Catchment** - 3.7 km^2 area at elevations averaging 1,550 m, area is collected by the Myra Diversion and diverted to McCulloch Reservoir.
4. **Canyon Creek Catchment** - 3.7 km^2 area in the West Kettle River watershed. Elevation is very high and above 1,800 metres.
5. **Upper Stirling Creek Catchment** – 4.1 km^2 is in the adjacent watershed and is diverted to McCulloch Reservoir.
6. **Lower Stirling Creek Catchment** – 6.9 km^2 is in the adjacent watershed and is diverted to McCulloch Reservoir.
7. **Myra Ditch Catchment** – 1.2 km^2 small area at medium elevation that drains to Pooley diversion ditch.
8. **Pooley Ditch Catchment area** - 8.8 km^2 area collecting areas above and between Pooley and KLO Creeks. The area is a medium elevation.

9. **McCulloch Reservoir Catchment** - 29.5 km^2 area produces high volume of good quality water. Natural lake has a peat component that compromises water quality with respect to colour and THM generation during disinfection.
10. **Fish Browne and Long Meadows Lake Reservoirs** - 6.3 km^2 area produces low volume of water. Reservoirs lakes have large adjacent peat marshes.
11. **Hardy Creek** - 3.8 km^2 small area on the shoulder of KLO Creek that produces a small volume of water.

SEKID has a relatively small catchment area of approximately 130 km^2 from where its water is obtained. The implementation of meters for the agricultural component has made the use of the water more efficient and reliable. Table 2.4 provides a summary of typical water quality characteristics of source waters for SEKID.

Table 2.4 - SEKID Raw Water Quality

Parameter	Units	Hydraulic Creek (Surface	East Kel Rd Well No. 1 (GW)	East Kel Rd. Well No. 2 (GW)	O'Reilly Road Well (GW)	GCDWQ
Alkalinity	mg/L	75	175	127	240	No Std
Aluminum	mg/L	0.05	n/a	n/a	<0.2	< 0.100 mg/L OGV
Arsenic	mg/L	<0.0005.	n/a	n/a	<0.01	<0.025 mg/L MAC
Calcium	mg/L	18.4	52.3	49.8	79.5	No std
Colour	TCU	45	n/a	n/a	<5	<15 TCU AO
Conductivity	umhos/cm	155	n/a	n/a	572	No Std
Coliforms (Fecal)	#/100mL	9	n/a	n/a	0	0 **
Coliforms (total)	#/100mL	9	n/a	n/a	0	0 **
Cryptosporidium	No. viable oocysts	n/a	n/a	n/a	n/a	** 99 % Inactiv.
Giardia	Cysts/100L	3 log inactivation	n/a	n/a	n/a	** 99 % Inactiv.
Hardness	mg/L	70	206	178	279	80-100 AO
Iron	mg/L	0.73	<0.01	0.04	<0.03	< 0.30 mg/L AO
Manganese	mg/L	0.043	<0.01	0.02	<0.005	< 0.05 mg/L AO
Nitrate	mg/L	0.14	4.03	3.82	5.5	45 mg/L MAC
Nitrite	mg/L	<0.01			<0.01	3.2 mg/L MAC
pH		7.5	7.88	7.58	7.5	6.5-8.5
THM Production	ug/L	139	n/a	n/a	n/a	<0.100 mg/L MAC
Total Dissolved Solids	mg/L	103	169	155	376	< 500 mg/L AO
Turbidity	NTU	1.5 0.80 – 11.0	0.39	0.25	0.45	<1.00 NTU MAC

* Optimal Range ** IHA Requirement OGV – Operational Guidance Value AO - Aesthetic Objective MAC - Max. Acceptable Concentration

Area of Concern Out of Compliance

WATERSHED SUMMARY

The Ministry of Environment information by D.B. Letvak was utilized to determine the reliability of the watershed in various return period droughts. These results are provided in Table 2.5. The analysis does not consider any carry over of water storage from previous years but provides a total volume on a year to year basis.

Table 2.5 - Watershed Reliability Summary

Drought Frequency	% of Annual Average	BMID Mission Ck (ML)	BMID Scotty Ck (ML)	GEID Mill Creek (ML)	SEKID Hydraulic Ck (ML)	Total all Watershed Source (ML)
1: 10 wet year	1.44	251,222	7,252	14,846	30,532	303,853
Average year	1.00	174,460	5,036	10,310	21,203	211,009
1:10 year drought	0.59	102,931	2,971	6,083	12,510	124,495
1:25 year drought	0.49	85,485	2,468	5,052	10,389	103,394
1:50 year drought	0.43	75,018	2,165	4,433	9,117	90,734
1:100 year drought	0.38	66,295	1,914	3,918	8,057	80,183
1:200 year drought	0.34	59,316	1,712	3,505	7,209	71,743
Catchment Area (km2)		561	36	73.5	130.5	801

The highest utilized watersheds are Hydraulic Creek (SEKID) and Kelowna Creek (GEID). These watersheds are the primary supply for these districts. During significant drought years, these watersheds by themselves are insufficient to meet the system demands. SEKID has improved their ability to manage the water supplied through their metering program. GEID presently manages their shortfall with supplemental flow being provided with groundwater.

2.4 GROUNDWATER

Groundwater Protection Plan

In August, 2004, Golder Associates completed the initial phase of a Groundwater Protection Plan (GWPP) for the KJWC. The overall objective of a GWPP is to identify the potential threats to groundwater quality and to minimize the potential of these threats. The first stage of a GWPP is to establish a planning committee and characterize the aquifers. The planning committee was established as the technical committee of the KJWC. The characterization of the aquifer is summarized in the Golder report. The report contains background information on the wells in the Kelowna area and defines areas of recharge and characteristics of groundwater movement in the region.

The major recharge sources for the Kelowna aquifers are the watershed areas upland to the east and north, and Mission Creek which is the dominant recharge source. Based on the very preliminary calculations by Golder Associates, the order of magnitude recharge capability of the Kelowna aquifer was 28,000 ML annually. Total water drawn from the aquifer was estimated to be in the range of 15 to 20,000 ML of which the water utilities draw approximately half. The surplus capacity of the aquifer was estimated to be in the range of 10,000 ML annually.

A summary of the characteristics of the significant groundwater wells is provided in Tables 2 & 3 of the Golder report and is included in Appendix C of this document.

Kelowna Aquifers

Groundwater is utilized as a supplemental source to BMID, SEKID and GEID. It is the primary source water for Rutland Waterworks District. An area map of all of the Kelowna aquifers is illustrated on Figure 2.6. The location of groundwater wells in the region is available on the internet at the Ministry of Environment website. The mapping is available as the BC Water Resources Atlas at the website address http://srmapps.gov.bc.ca/apps/wrbc/.

Each known aquifer is categorized based on the aquifer yield, vulnerability, and concerns related to the sustainability of the resource. There is a rating system in place by the Provincial government for aquifers throughout much of the Province. There are eleven distinct groundwater aquifers that exist through the central area of the City of Kelowna. The productivity, vulnerability and sensitivity of the aquifers is noted on Table 2.6. There are several areas where the potential for developing additional groundwater is high.

The aquifer classification numbering system provides an indication of the development, vulnerability and management requirements for the aquifer. The classification number designates the development condition of the aquifer as either:

- I heavy aquifer development
- II moderate aquifer development
- III light aquifer development

A vulnerability rating is set within the Aquifer Classification number. It provides an assessment of the vulnerability of the aquifer to contamination or other problems:

- A High Vulnerability
- B Moderate Vulnerability
- C Low Vulnerability

The ranking indicates the priority of the aquifer required for proper management of the resource.

- 21 Highest number, requires the highest attention
- 13 Moderate number for ranking in relation to scale
- 5 Lowest ranking number, requiring lowest attention for aquifer management.

Table 2.6 - Summary of Groundwater Aquifers

Aquifer Classification Number	Location / Name	Area (km²)	Perimeter (km)	Aquifer Materials	Productivity	Vulnerability	Demand
344 I B (13)	Vernon Creek	8.70	16.31	Sand and Gravel	H	M	H
461 III B (9)	Upper Mission Creek Valley	15.05	60.37	Sand and Gravel	M	M	L
462 III A (9)	Upper Bellevue Creek	3.65	10.82	Sand and Gravel	M	H	L
463 I C (14)	Upper SEKID Benchlands	64.15	87.81	Sand and Gravel	M	L	H
464 I C (14)	Mission Creek fan	67.96	99.50	Sand and Gravel	H	L	H
467 I A (12)	Rutland valley floor	10.34	26.74	Sand and Gravel	H	H	H
468 I C (12)	Clifton Road	0.15	1.68	Sand and Gravel	H	H	H
469 III C (9)	Glenmore Valley	12.37	35.62	Sand and Gravel	M	L	L
470 III B (10)	Dilworth – Glenmore Highlands	37.32	65.03	Bedrock	L	M	L
472 III B (8)	Ellison	4.06	11.92	Bedrock	L	M	L
473 II C (8)	Upper North Mission Creek	39.30	30.49	Bedrock	L	L	L

Ratings for Productivity, Vulnerability and demand are listed as H (High), Medium (M), or Low (L).

On June 30th, 2004, the Province of BC released new Groundwater Protection Regulations. They are posted on the web at: http://wlapwww.gov.bc.ca/wat/gws/gws_reg_back/gwpr_oics.pdf

The regulations set out the requirements for qualified and registered well drillers and well pump installers in the Province. The regulation also sets out requirements for groundwater protection, including surface sealing of well heads, well identification procedures, deactivation and closing of wells, well caps and well covers, floodproofing of wells and protection of the wellhead.

Of concern to all of the utilities accessing groundwater is the protection of the aquifers. Presently, the land use policies within the City and Province have limited capacity to protect and monitor the groundwater aquifers. Increased awareness of the potential for groundwater contamination is as important as the water conservation messages that the public now receives.

BLACK MOUNTAIN IRRIGATION DISTRICT - GROUNDWATER

BMID sources of water include three groundwater wells. Two are located in the Scotty Creek subdivision that provide domestic and irrigation water for the local subdivision and nearby agricultural lands. The wells have capacities of 18.9 L/s and 60 L/s. A high capacity (150 L/s) well on Cornish Road provides a source of water to the lower area only in times of emergency. As shown in Table 2.7, the groundwater wells provide a very small percentage of the total volume of water supplied by BMID. Typical water quality for BMID wells is presented in Table 2.2.

Table 2.7 – BMID Water Supply Summary

Year	TOTAL (ML)	Mission Creek (ML)	Scotty Crk (ML)	Well No. 4 (ML)	Well No. 5 (ML)	Cornish Well (ML)	GW % of Total Supply
1991	13956	12140	572	206	1037	0	**8.91%**
1992	13890	12229	403	237	1021	0	**9.05%**
1993	9234	8140	35	174	875	0	**11.36%**
1994	14615	13003	354	225	1032	0	**8.60%**
1995	11929	10970	84	176	699	0	**7.34%**
1996	11959	10843	287	183	645	0	**6.92%**
1997	10362	9392	147	126	696	0	**7.93%**
1998	15546	14152	331	193	874	0	**6.87%**
1999	12064	10861	207	153	841	0	**8.24%**
2000	12085	10917	297	128	742	0	**7.20%**
2001	12689	11726	262	150	550	0	**5.52%**
2002	13993	12856	583	333	1194	0	**10.92%**
2003	14784	13554	427	104	661	0	**5.17%**
2004	11834	10432	359	140	573	0	**6.02%**

GLENMORE-ELLISON IMPROVEMENT DISTRICT - GROUNDWATER

GEID has five high capacity wells (one of which is in Ellison) which are used during periods of high demand or low runoff in the watershed. A new 70 L/s capacity well was constructed this year at the Airport to supplement the GEID supply capacity. The wells are run for approximately 6 months a year.

As shown in Table 2.8, the wells provide a substantial volume of water on an annual basis and provide up to 25% of the total annual water supply for GEID. No water licenses are required presently for groundwater supply. Typical water quality for GEID wells was presented previously in Table 2.3.

125 hp Airport Well No. 1 Pump

Table 2.8 – GEID Groundwater Well Supply Summary

Year	Ellison Well (ML)	Lochrem Well (ML)	Vector Well (ML)	Airport Well (ML)	Sexsmith Well (ML)	Well Sources (ML)	Creek Source (ML)	GW as a % of annual Water Use
1995	42	789	0	0	0	831	3536	19%
1996	493	277	0	0	0	770	4976	13%
1997	446	481	0	0	0	927	4398	17%
1998	568	284	201	0	0	1053	6515	14%
1999	461	921	0	0	0	1382	4611	23%
2000	342	1264	0	0	0	1605	4100	28%
2001	208	1027	0	0	0	1235	5193	19%
2002	240	1002	0	281	0	1524	5509	22%
2003	462	1193	0	281	0	1936	5502	26%
2004	469	991	0	281	0	1741	5163	25%

RUTLAND WATERWORKS DISTRICT - GROUNDWATER

Rutland obtains all of its water from the ground. The District utilizes 15 groundwater wells with varying capacities as listed on Table 2.9. The pumps are remotely operated by a controller located in the District office which utilizes reservoir levels and pressure sensing to vary pumping rates to meet demands. Most of the water from the wells is disinfected by chlorination, but receives no other treatment. The water quality varies from well to well with the wells closest to Mission Creek having the better quality water. Licensing is presently not required for groundwater, therefore RWD does not have water licenses.

RWD - Drilling Well No. 14

Typical quality from the highest supply capacity wells of the District is summarized in Table 2.10. The water quality data shows that there is a hardness and manganese issue from some of the wells. These are aesthetic concerns. RWD is one of only four utilities in the Okanagan that meets the IHA 4,3,2,1,0 requirement. The requirement is for 4 log inactivation of viruses, 3 log inactivation of *Giardia*, 2 log inactivation of *Cryptosporidium*, less than 1.0 NTU turbidity and zero coliforms. This rating is a clear recognition of the safety of the RWD supply.

Table 2.9 – RWD Groundwater Well Supply Summary

Year	Total Pumped (ML) All Wells	Well # 3 (ML)	Well # 6 (ML)	Well # 7E & 7W (ML)	Well # 12 (ML)	Well # 13S (ML)	Well # 15 (ML)	Remaining Wells Pumped (ML)
1996	4,079	98	75	152	547	1,289	880	1,038
1997	3,762	52	17	84	510	1,309	846	944
1998	4,807	193	245	149	466	1,293	1,161	1,300
1999	4,248	101	76	125	486	1,154	1,318	988
2000	4,978	35	191	313	339	1,355	1,557	1,188
2001	4,377	47	322	201	262	1,362	932	1,251
2002	5,161	248	534	312	545	980	609	1,933
2003	5,149	97	915	470	310	1,120	525	1,712
2004	4,053	42	246	285	310	808	863	1,499

Table 2.10 – RWD Water Quality Summary

Parameter	Units	Well 3	Well 6	Well 7 East	Well 7 West	Well 12	Well 13 South	Well 15	GCDWQ
Alkalinity	mg/L CaCO3	575	212	370	404	466	148	69.6	No Std
Aluminum	mg/L	0.006	< 0.005	0.009	< 0.005	< 0.005	< 0.005	0.01	< 0.200 OGV
Arsenic	mg/L	0.002	0.001	< 0.001	< 0.001	< 0.001	< 0.001	<	0.01 MAC
Calcium	mg/L	63.4	55.3	57	65.6	68	38.1	18.1	
Colour	TCU	< 5	< 5	< 5	< 5	< 5	< 5	<	<15 AO
Conductivity	umhos/cm	949	534	706	784	824	349	159	No Std
Coliforms (Fecal)	#/100mL	0	0	0	0	0	0	0	<1.0
Coliforms (total)	#/100mL	0	0	0	0	0	0	0	<1.0
Cryptosporidium	No. viable	N/A	N/A	N/A	N/A	N/A	N/A	N/A	99% Inact.
Giardia	Cysts/100L	N/A	N/A	N/A	N/A	N/A	N/A	N/A	99.9% Inact.
Hardness	mg/L CaCO3	316	222	286	299	336	135	71	80-100 *
Iron	mg/L	0.11	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<	< 0.30 AO
Manganese	mg/L	0.23	0.3	0.21	0.18	0.063	< 0.001	0.003	< 0.05 AO
Nitrate	mg/L	<	<	0.49	<	9.7	12.4	3.63	45 MAC
Nitrite	mg/L	<	<	<	<	<	<	<	3.2 MAC
pH		8.1	8.12	7.92	7.98	8.05	7.8	7.39	6.5-8.5 *
THM Production	ug/L	N/A	N/A	N/A	N/A	N/A	N/A	N/A	<100 MAC
Total Dissolved Solids	mg/L	626	340	471	515	523	209	118	< 500 AO
Turbidity	NTU	0.62	0.32	3	1.7	0.3	0.35	0.39	1.00 MAC

* Optimal Range Area of Concern Out of Compliance

SOUTH EAST KELOWNA IRRIGATION DISTRICT - GROUNDWATER

SEKID has three wells within the district to supplement creek flows. One well is located in the Hall Road area and serves that subdivision. There are also two groundwater wells on East Kelowna Road that provide water during poor quality times or when water capacity is below average in the reservoirs.

Table 2.11 provides a historical summary of water supply from the SEKID water sources.

SEKID Spillway on Hydraulic Creek

Table 2.11 – SEKID Groundwater Well Supply Summary

Year	East Kel Well 1 (ML)	East Kel Well 2 (ML)	O'Reilly Rd Well (ML)	Hydraulic Creek (ML)	Annual Use (ML)	GW as a % of Annual Use
1995	0	142	0	10,813	10,955	1.30%
1996	0	142	0	11,730	11,872	1.20%
1997	0	131	0	10,810	10,942	1.20%
1998	0	106	0	14,123	14,230	0.75%
1999	0	89	0	11,055	11,145	0.80%
2000	0	55	332	10,694	11,082	3.50%
2001	80	301	421	9,217	10,018	8.00%
2002	0	13	420	12,302	12,735	3.40%
2003	239	120	359	11,256	11,975	6.00%
2004	209	42	251	7,875	8,377	6.00%

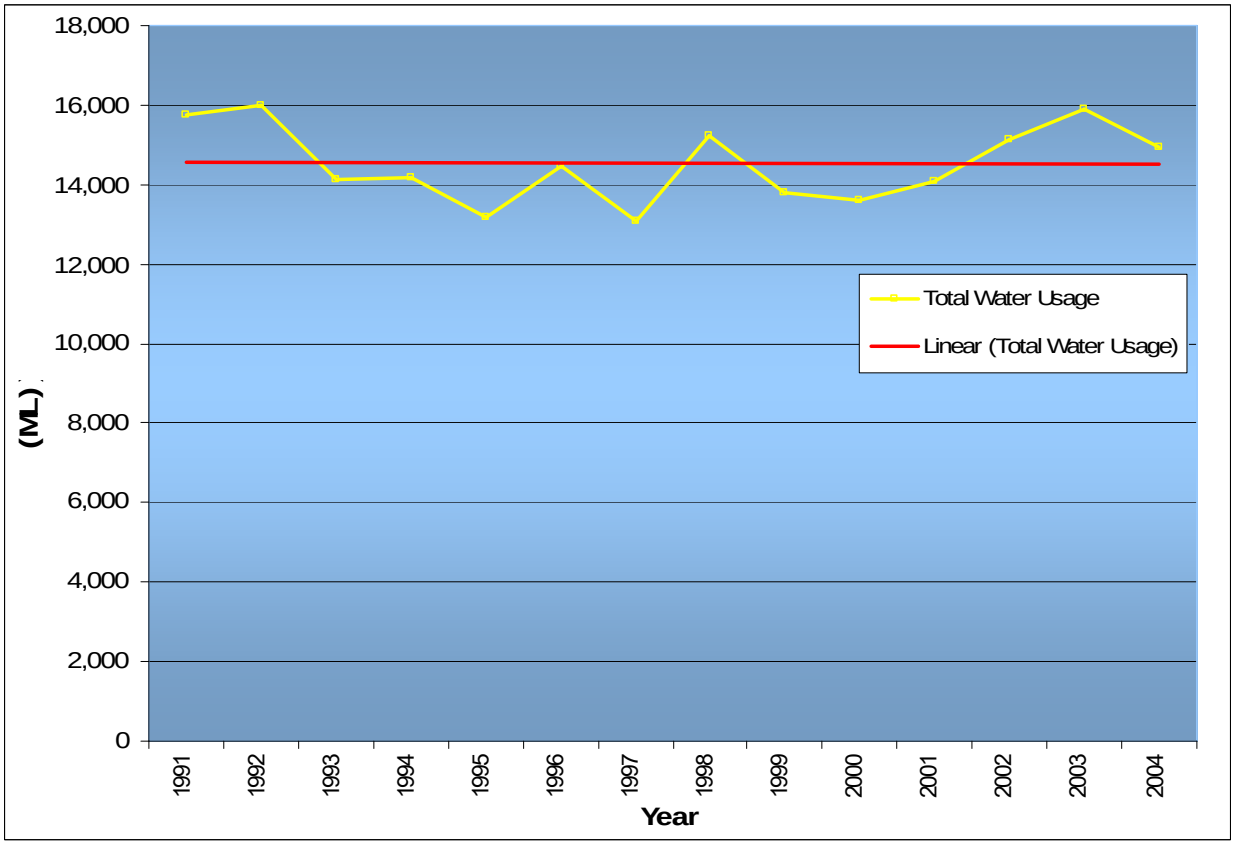
2.5 HISTORICAL WATER DEMAND

This section provides a summary of the historic water demand for the utilities. The trended historic water demands in this section show the impact of annual variations in weather with respect to temperature and precipitation.

CITY OF KELOWNA – HISTORIC WATER DEMAND

Figure 2.7 shows consumption trends over the past 14 years for total water demands. Water demand is maintaining a steady rate. The years of 1992, 1998 and 2003 were all hotter and drier years and the water demand reflects the climatic conditions.

Figure 2.7 - City of Kelowna Historic Water Consumption

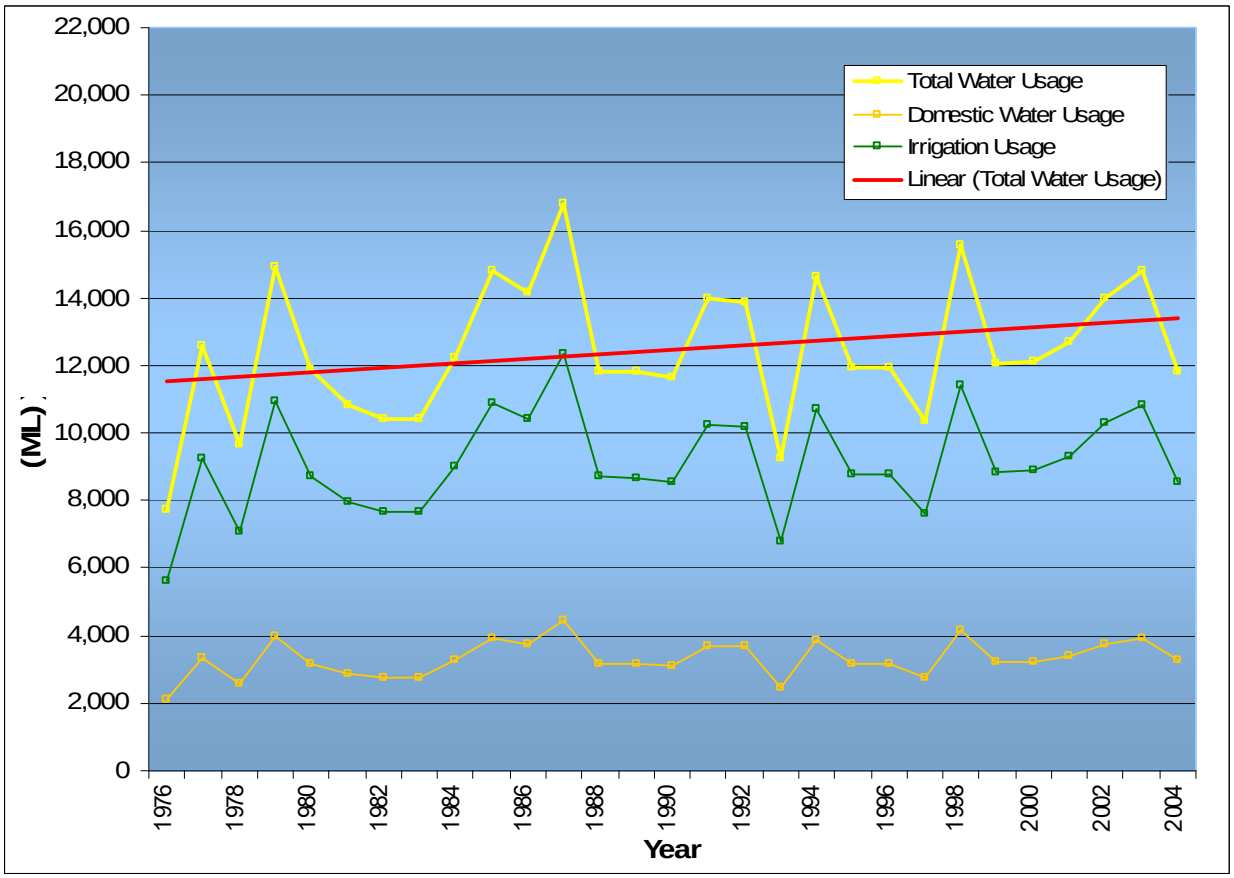


The lack of notable increase in the City's water demand can be attributed to education through "Watersmart", the installation of water meters that were installed in 1996, and effective pricing. Water meters in combination with the equitable water pricing strategy that was implemented in 2005 has resulted in the reduced per capita water usage. The current average annual water demand for the City of Kelowna water utility is estimated to be 14,500 ML. Current allowed licensed use from Okanagan Lake is 52,400 ML annually. The City is using approximately 28% of their allotted licensed use.

BLACK MOUNTAIN IRRIGATION DISTRICT - HISTORIC WATER DEMAND

Figure 2.8 shows consumption trends for BMID over the past 28 years for domestic use, irrigation and their totals. Water demand is increasing at a very slow rate. Agricultural irrigated acreage has remained constant in the last 28 years. Domestic connections form the largest portion of growth for the District. The overall increase in water demand over the last 28 years is calculated to be 0.51%.

Figure 2.8 - BMID Historic Water Consumption

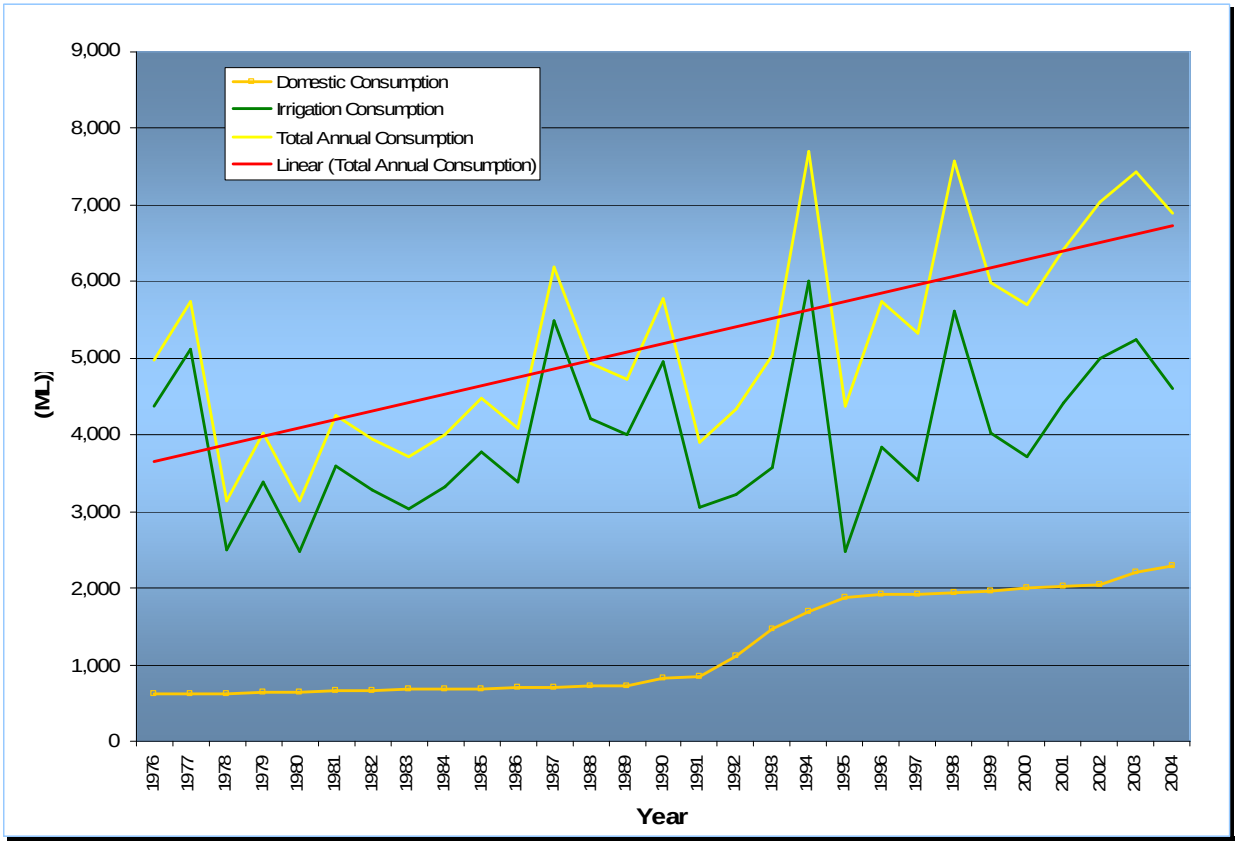


Normalized annual water usage is estimated to be 13,400 ML. BMID licensed usage for waterworks and irrigation is 27,677 ML. BMID is using on average 48.4 % of their licensed allotment.

GLENMORE-ELLISON IMPROVEMENT DISTRICT - HISTORIC WATER DEMAND

Figure 2.9 shows consumption trends over the past 29 years for domestic use, irrigation and their totals. Water demand is increasing at a substantial rate. The domestic component forms the largest portion of growth for GEID.

Figure 2.9 - GEID Historic Water Consumption



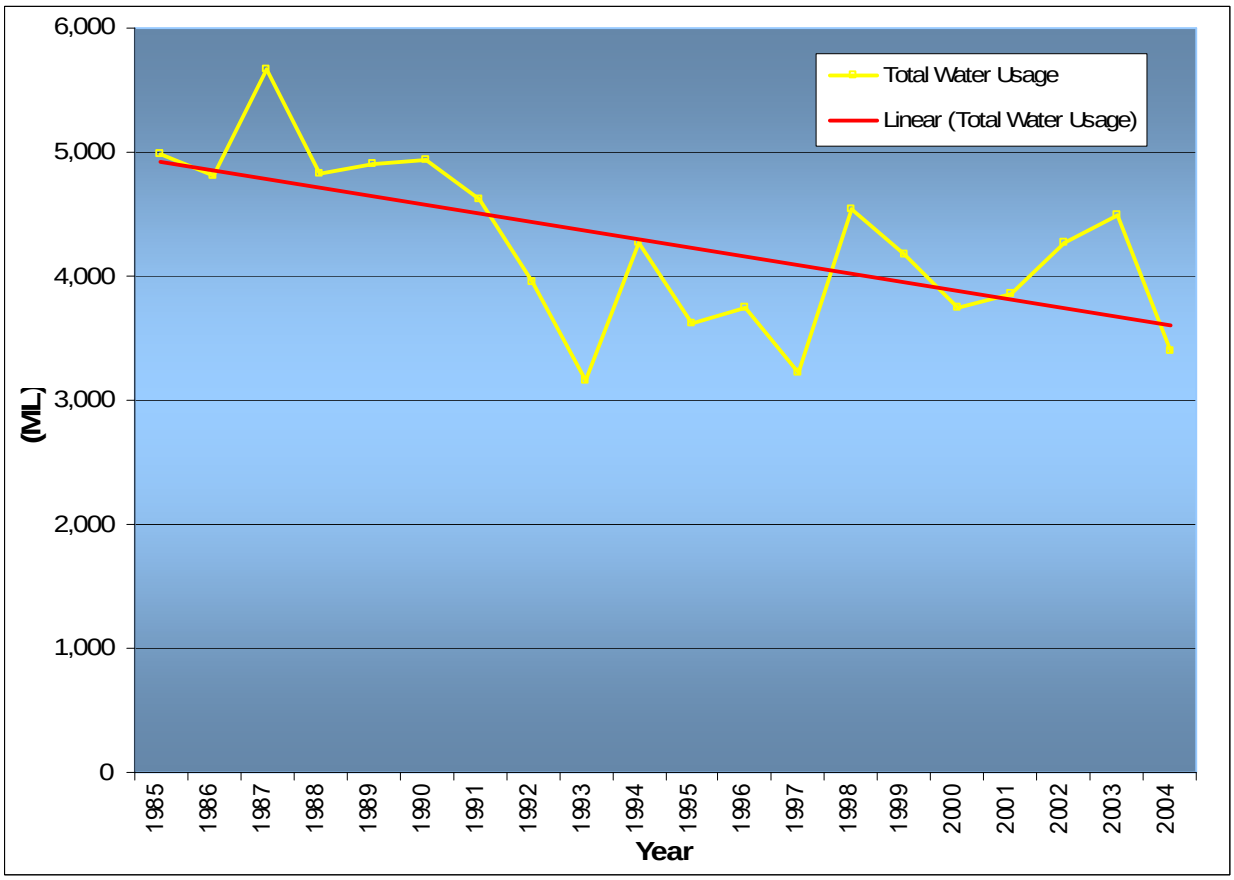
The data from GEID shows a relatively steep line in Total Annual Consumption. The Glenmore Irrigation District and the Ellison Irrigation District amalgamated in 1991, resulting in a significant increase in overall water consumption. The amalgamation added 780 acres of irrigated land to the GEID and approximately 120 single family connections. These numbers are included in the total consumption data in Figure 2.9. In early 2005, GEID purchased the McKinley Landing water utility.

The GEID has the highest growth rate of the five water Districts within the City of Kelowna. The annual growth rate estimated for the past 29 years is 2.10%. Current normalized annual water usage is estimated to be 6,800 ML. GEID licensed usage for waterworks and irrigation is 13,876 ML. GEID is using on average 48.3 % of their licensed allotment.

RUTLAND WATERWORKS DISTRICT HISTORIC CONSUMPTION

Figure 2.10 shows trends for RWD over the past 20 years for total water consumption. Water demand is decreasing at a moderate rate. RWD supplies primarily domestic water to single and multi-family lots. RWD is metered and charges for water on an inclining block rate.

Figure 2.10 - RWD Historic Water Consumption



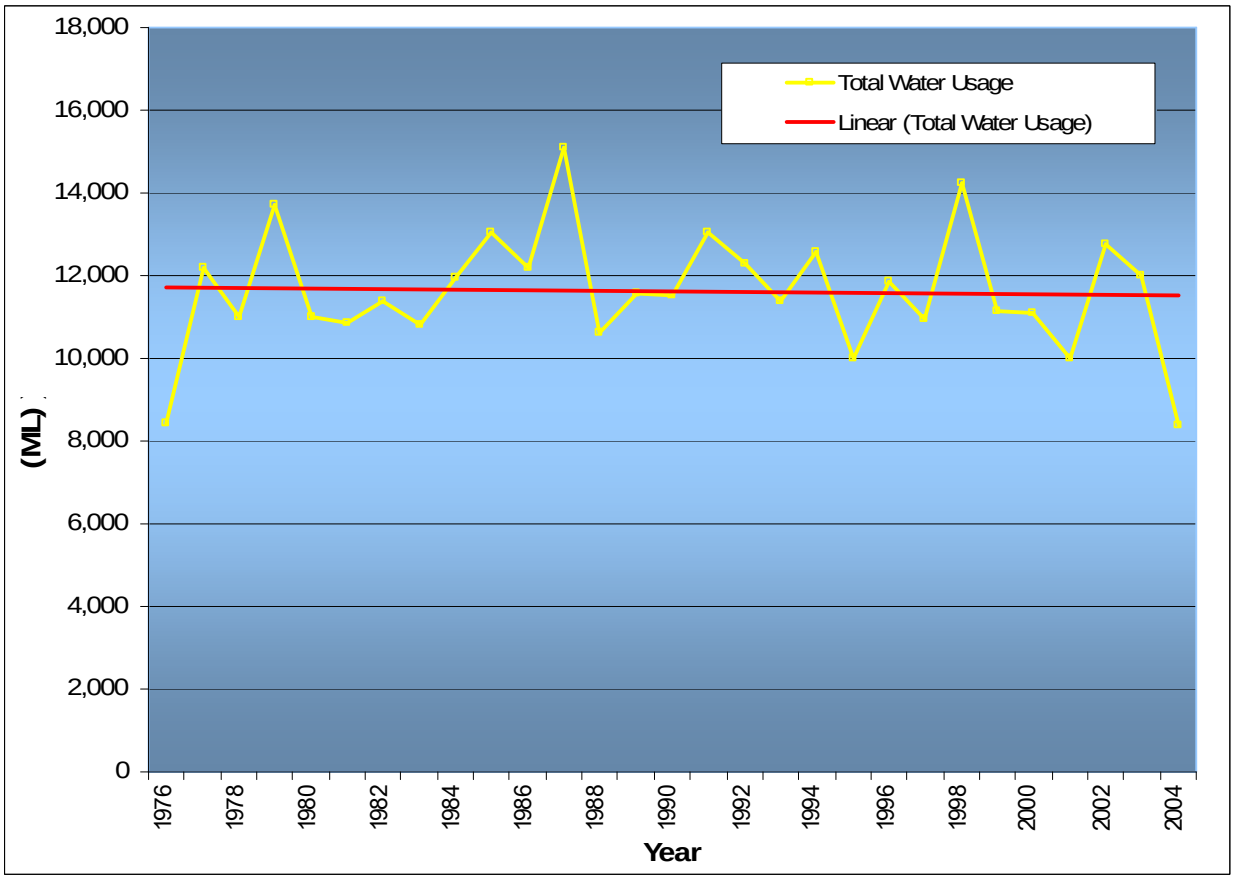
The data from Rutland Waterworks shows a significant decrease in annual water usages despite an increased number of persons living within the District. The linear average for annual water usage shows a decrease of 1.65%. This reduction is due to densification of housing, less irrigation and outdoor usage, public education on water use, effective pricing of water, and operational changes within the utility.

Although the trend line shows water usage reducing to 3,600 ML, normalized annual water usage is estimated to be 4,000 ML. RWD is not licensed for waterworks as their sources are all from groundwater.

SOUTH EAST KELOWNA IRRIGATION DISTRICT – HISTORIC CONSUMPTION

Figure 2.11 shows the trend for SEKID for the past 28 years for total water consumption. Water use was rising from 1976 to 1987. After that time, SEKID became more focused on demand-side management of their water resource. Water meters were installed in 1994 and effective pricing was first implemented in 2003. A moderate drop in consumption occurred. Water demands in GEID and BMID showed that 2004 was a year where water usage was 8% lower than average. SEKID experienced water usage that was 35% lower than the expected water usage. This additional decrease in use by SEKID suggests that the pricing strategy further decreased water use by more than 25%.

Figure 2.11 - SEKID Historic Water Consumption

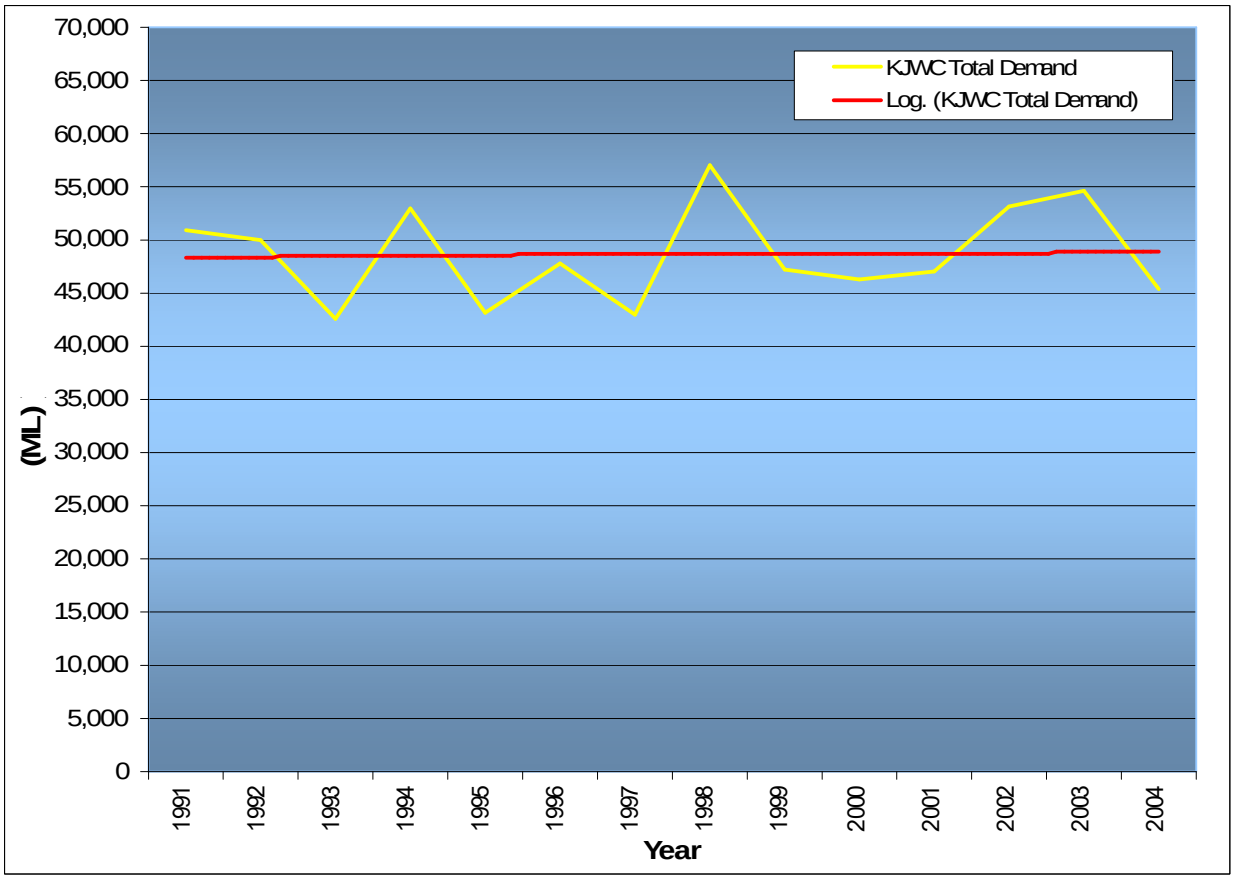


Normalized annual water usage from the trend line is estimated to be 11,500 ML. SEKID licensed usage for waterworks and irrigation is 37,897 ML. In an average year, SEKID is using 30.3 % of their licensed allotment.

SUMMARY OF REGIONAL HISTORIC WATER USAGE

Figure 2.12 provides a regional summary of water consumption for the past 14 years. The trended data appears to be very flat meaning that water demand is relatively constant. The population increased from 77,900 in 1991 to an estimated 105,600 persons in 2004 or at an average rate of 2.36%.

Figure 2.12 - KJWC Historic Water Consumption



The growth experienced in the last 14 years included two building construction booms, one in the early 1990's and another that is currently happening in the Okanagan. In spite of the increase in water demand due to new development, the graphs show that the climatic conditions have a much greater impact on the water demand on a regional basis.

The data from the combined graphs shows that over the 14 years, a minimal water demand increase of only 0.15% was experienced in the region. The two utilities that have seen the greatest reduction in water use in the region are RWD and SEKID. SEKID reduced water consumption through education, meters and effective pricing. RWD reduced consumption through education, continued metering, effective pricing and improved operations.

The City graph was relatively flat as the reduction due to the metering program and the increases due to development appear to be equal. BMID showed minimal growth in the amount of 0.50%. GEID is the District experiencing the highest growth and water demand increases with demand rates increasing at 2.25%.

Table 2.12 provides a summary of water licenses for the five utilities. The five utilities in Kelowna have license for 131,850 ML of water (107,000 acre-feet). This is a substantial volume of water and less than 35% of it is utilized in an average year. During a very dry year, the regional usage may increase to levels as high as 57,000 as experienced in 1998. There is adequate licensed supply to meet the growth for the foreseeable future.

Table 2.12 - KJWC - Licensed vs Actual Water Usage

Water Supplier	Storage Licensed (ML)	Net Storage Constructed (ML)	Irrigation License (ML)	Domestic License (ML)	Total Water Use Licenses (ML)	Total Demand (ML)	Demand from Licensed Water (ML)	% of Licensing Used	% of TOTAL DEMAND (ML)
City of Kelowna	0	0	404	51,996	52,400	14,500	14,500	27.7%	28.9%
BMID	19,616	14,954	22,674	5,003	27,677	13,400	12,600	45.5%	26.7%
GEID	8,793	7,120	13,159	717	13,876	6,800	5,000	36.0%	13.5%
RWD	0	0	0	0	0	4,000	0	n/a	8.0%
SEKID	21,681	17,561	36,073	1,824	37,897	11,500	11,000	29.0%	22.9%
TOTAL	**50,090**	**39,635**	**72,310**	**59,540**	**131,850**	**50,200**	**43,100**	**32.7%**	**100.0%**

It is noted that all wastewater within the City of Kelowna is treated to an extremely high level and is returned to the lake after treatment. This represents no loss in water through the hydrological cycle. The wastewater treatment discharge represents almost a 100% return to Okanagan Lake of the domestic water supplied to residential customers during the winter months and when irrigation and lawn sprinkling is turned off.

2.6 FUTURE DIRECTION FOR THE OKANAGAN BASIN

Global Warming

The issue of global warming continues to gain public attention. The last 100 years have shown a quantifiable increase in global temperatures and this is predicted to continue through the remainder of the 21st Century.

Climatic changes in the Okanagan Valley has been the focus of a team of researchers led by Dr. Stewart Cohen from the University of British Columbia. Their work consisted of analysis of the existing global trending data, input of existing data into three different global weather circulation models and determining the global warming impact on the weather patterns within the Okanagan Valley. The Okanagan Valley was selected for the study due to its semi-arid climate and dependency on the water resource.

The Climate Change study has predicted three significant changes in the annual weather patterns:

1. Temperatures in the next 80 years are expected to continue to rise.
2. In the next 50 years, the length of summer season within the Okanagan is expected to increase by approximately 6 to 8 weeks, although the total annual precipitation levels are predicted to remain nearly the same.
3. The timing for precipitation would be such that a greater proportion would occur over the winter season with less throughout the summer months. This would impact water suppliers as there would be a hotter and longer growing season. Water suppliers would have to access storage water at an earlier date and for a longer period of time.

The Climate Change report suggested that by the year 2050, annual flows from the surrounding watershed creeks could be reduced by as much as 15%, and by the year 2080, the flows could be reduced by 30%. In review of the historical outflow trends for Okanagan Lake, this is not yet visible in the trended data. What can be inferred from the outflow data presented in Figure 2.5 is that the levels of extreme high and extreme low annual runoff may be increasing.

It is clear that with the trends of increased population growth and changing weather patterns, water demands will change. Development of additional sources may be required some day in the future although this is not yet a necessity. Even if the findings do become true, with proper management of the water sources, additional source capacity could be deferred for many years. It may be feasible to plan for a 1:25 year drought horizon and utilize drought stages for reduced consumption in the dry years exceeding the drought frequency year.

Future Water Supply Direction

The following factors are expected to influence the direction for future water supply in the Okanagan Valley. The conclusions presented are the professional opinion of the project team.

1. **Basin-Wide Water Board:** A legislative body for the management of basin-wide water resources must be in place and must be effective. The existing Okanagan Basin Water Board is in the best position to be reorganized and mandated to become that body. The mandates for a basin-wide water board would be to set out policy decisions that affect common water sources such as Okanagan Lake, to set out common sprinkling and water use regulations, to coordinate combined public education and to have a review role in the awarding of senior government funding to the local level.
2. **Knowledge of Quantity:** The major basin studies should be completed within the next 5 years and there will be a better understanding of how much water is available and how much is used on an annual basis and during the various frequency drought years.
3. **Public Awareness:** Public awareness on water-related issues will continue to increase and the implementation of water meters will become standard for most domestic and irrigation connections within the next 5 years. Incentives for water conservation will become policy for water suppliers.

4. **Value:** The price for water will increase. As the price increases, the perceived value will increase as will human nature to save and ration water. Less water will be used per person.
5. **Tools:** With meters and improved technology, water suppliers will become more effective in monitoring water use. Water users will better understand how much water is used and where. Water will be charged equitably and used in a more responsible manner.
6. **Technology:** The more technologically advanced management of surface soils of irrigated lands will increase so that there is more effective water use for these irrigated areas. This will allow water to be better held in the top zones of soils for use by the plant life. Monitoring of soil moisture will also become more advanced.
7. **Densification:** Urban areas will densify where utilities already exist and servicing costs are lower. The amount of outdoor water use in these areas will not increase. Increased demands due to multi-family development will be only for in-home use. The amount of water required per person will continue to be reduced because of densification.
8. **Groundwater Legislation:** Densification will create increased competition for the water resources, including groundwater. Legal battles over groundwater will become inevitable and will occur more frequently. Licensing of groundwater may become necessary.
9. **System Renewal:** The water suppliers will implement full-cost pricing of their utilities, particularly with respect to water quality improvements and system renewal and reinvestment. For Okanagan water utilities, system renewal is the largest annual cost presently not fully accounted for in existing water rates.
10. **Effective Management:** Even as the Okanagan Valley struggles to better understand the water resource, the value of water will increase, and the valley will inevitably reach the finite limit of the annual sustainable supply. After Okanagan Lake is fully licensed, drought management procedures will occur in the dry years with more frequency. Common drought management procedures should occur on a lake-by-lake basis. There will be different drought restrictions for the Kalamalka / Wood Lake chain than there would be for Okanagan Lake. Each watershed may also be required to develop common restrictions and regulations.
11. **Drought Buffering Measures:** There will be a renewed interest in the development of high elevation water supply storage. Additional volume stored at higher elevations will reduce the drought impacts and provide buffering storage through the drought cycles that are expected to occur with more frequency in the future.
12. **Resiliency:** Contingent supply measures both at a physical and at a policy level will be developed by the water suppliers and their ratepayers. For most utilities in the Okanagan, this includes utilizing additional sources such as groundwater. They would also include policy measures such as the ability to regulate water use during water short periods. These measures will result in increased flexibility and reliability in the water supply. This should result in reduced financial hardship by the water users in a community during a major drought. Drought management plans form a part of making a supply more resilient.

WATER SUPPLY RESILIENCY

The public has recently been bombarded with information from the media and the government on the issues of conservation and sustainability of our water supply. The cause was the recent three-year drought which ended with the wet fall season in 2004.

Conservation is one component of a sustainable water supply. The ultimate objective for a sustainable water supply is to have sufficient water so that the region does not experience any severe impacts either environmentally or economically due to the lack of water. Conservation by itself is good practice. Over-irrigation, though wasteful, however, does not result in water lost from the hydrological cycle. It is diverted to ground and in fact recharges the aquifers and eventually reaches Okanagan Lake. Every drop of water that is saved by the residents of the Okanagan and is not utilized will naturally flow southwards to the United States. During a drought, the US will also require more water for use.

The concept of resiliency is one where the water supply is managed to be sustainable, environmentally and fiscally responsible, and adaptable on a seasonal basis. The resiliency must be developed by water utility personnel and their ratepayers. Resiliency requires the water utility to have the tools to adapt during a wet season or a dry year and to inform their public accordingly. Tools include meters and public information such as newsletters and methods of advising their residents of the changes required in water use. There are several economic and social mechanisms that will influence how the public uses water in the future. Some of the mechanisms previously discussed will inherently result in a lower per capita water demand rate. As demands increase, possible solutions may include storage in the upper watersheds. Additional storage would help to buffer the drier years. So might the concept of groundwater recharge where excess water in wet years charges the ground to be stored for future drought scenarios. This practise is being used in the United States in water deficient areas.

3. EXISTING WATER SYSTEMS

3.1 GENERAL

This section presents an overview of the water systems of the five major water utilities within the City boundaries. The service area, water source and licenses, distribution system, and strengths and weaknesses of each water system are presented separately. Figures for major water system components such as sources, reservoirs, booster stations, PRV stations and trunk supply mains are included as are pressure zone drawings. System components identified on the maps are referenced to summary tables that provide information on the specific component.

3.2 CITY OF KELOWNA WATER SYSTEM

The City of Kelowna water system is comprised of the 13 following major demand areas listed below:

- Capri/Guisachan
- Central Lombardy
- Clifton
- Crawford
- Dilworth
- Mission Flats
- North Central
- North Mission
- Okaview
- Orchard Park
- Pandosy/KLO
- South Central and
- South Glenmore.

Okanagan Lake – Photo Credit SATW Dan Leeth

The main distribution system is serviced by Poplar Point Pump Station at the north end and the Eldorado Pump Station in the Mission Area. The Okaview water system is independent from the main system and is serviced by the Cedar Creek Pump Station. The Timberline water system in the extreme south end is serviced by a small pump station on Okanagan Lake.

Supply Area

The City services all lands along Okanagan Lake within the City boundaries with the exception of McKinley Landing. It is bounded by Okanagan Mountain Provincial Park to the south, Okanagan Lake to the west, the north end of Clifton Road to the north, and the Orchard Park retail area and RWD to the east. Land use in the City water service area is primarily for single and multi-family housing. Land use consists

fo agricultural in the Central Mission area, industrial and commercial lands north of the rail tracks in the northwest limits of the City, and commercial areas in the downtown core. Most of the farm lands serviced by the City System are will likely be under significant development pressure in the next ten years.

Distribution System

Pressure zone mapping is presented in Figures 3.1 and 3.2. The pressure zones are defined by the normal operating HGL. Major components of the City water system follow and are presented on Figures 3.3 and 3.4. A summary of the key infrastructure components corresponding to Figures 3.3 and 3.4 is presented on Table 3.1.

Main City System: For the main City Grid and Central Mission areas, water is currently chlorinated at the lake pump stations and fed into the distribution system (PZ 415) and to the balancing reservoirs. The majority of water use is in the lower pressure zone (PZ 415). Water is fed from Poplar Point in this zone to the Knox Mountain, Buckland, Westpoint Drive, and Dilworth Mountain Reservoirs. From the Dilworth Reservoir, water is pumped to the higher reservoirs and pressure zones on Dilworth Mountain. The four major reservoirs; Knox, Dilworth, Westpoint and Bucklands, are centrally controlled by leveling devices that control the inflow and outflow of these reservoirs to maximize turn-over and mixing of water. This reduces stagnant water problems during the low flow months and provides more balanced use of pumping capacity in the high flow months. Poplar Point supplies most of the water during the year and because of its pumping capacity and large diameter trunk mains from the station, can provide the most water for fire protection to the lower zone.

Central Mission Area: The Okanagan Mission Irrigation District system, which included the Eldorado pump station, was taken over by the City in the early 1990's. It is used for one or two months during the summer high demand season. The higher areas in the south Mission are presently fed by the McClure Road booster station and the uppermost areas including Crawford Estates are supplied through the Vector pump station. The Westpoint Drive subdivision is supplied by a hydro-constant drive pump at Bucklands Reservoir. Bartholomew Court and the Upper Paret Road area are also fed by hydro-constant drive pumps.

Skyline Drive: The Skyline Drive water system will ultimately service approximately 3,000 residential units. Skyline pumps to Grainger Reservoir which services the entire area. R&E Reservoir is still on-line but only used to provide adequate pressures in the upper Clifton Road area. The Magic Estates Area is serviced by the Rio Pump Station and Reservoir, which in-turn is supplied from the Grainger Reservoir.

The new Skyline booster station pumping capacity is limited to the watermain capacity on the suction side of the Skyline station. Plans are in place to upgrade this main to 600mm diameter as development in Upper Clifton progresses.

South Mission: Cedar Creek pump station is a separate entity and supplies water only to the south Mission development area. The Okaview water distribution system was taken over in 1981 and provides water for approximately 1,000 single family lots on the hillside in the south Mission. The system is still independent from the City grid with water supplied by Cedar Creek PS on Okanagan Lake. Cedar Creek pumps to Stellar booster station and then to the KVR (Adams) Reservoir, which is the main supply reservoir for the development area. There is another booster station on Frost Road pumping from the Southcrest Reservoir to the Frost Road Reservoir which is the highest in the area. There is considerable growth in this area, consistent with the City's OCP.

Okaview is presently a stand-alone water system and currently has adequate capacity to meet all demands in the area. The new Cedar Creek Pump Station will ultimately consist of four 750 hp pumps to provide all water needed for the foreseeable future.

Timberline System: Installed in 1981, the Timberline system serves 30 lots in a 61 ha residential subdivision located at the extreme west end of Lakeshore Road at Swick Road, and abuts the southern boundary of the City. It is serviced by a small pump station on the Lake which pumps to a small reservoir at the top end of the area.

Existing Strengths and Weaknesses (Refer to Figures 3.3 and 3.4)

Strengths of the supply system include the license capacity and the ability to access the largest water source in the region, Okanagan Lake. The water supplied by the City meets the *Guidelines for Canadian Drinking Water Quality* year round. The lake is considered a high quality source and a very reliable source. Other strengths are the Poplar Point Pump station which has high pumping capacity, and the significant amount of storage in the Dilworth, Knox Mountain and Westpoint and Buckland Reservoirs. The distribution system in the downtown core is generally strong with a well interconnected grid.

The City is currently upgrading its disinfection capacity through the installation of UV disinfection in all three larger pump stations. This will enable the City to improve its protection against *Cryptosporidium* and *Giardia* and allow an improvement in their Concentration x Time rating for disinfection.

Weaknesses in the distribution grid include the lower Mission water system that consists of a significant amount of 100 mm diameter watermain that has signs of deposition and tuberculation. Fire protection is inadequate in some of this area, but when the watermains are eventually renewed, this issue will be corrected.

As the City water distribution grid is dependant on pumping, standby generators are an important supply feature in times of emergency. Poplar Point pump station has a new generator being installed under the UV upgrade contract. The City is working to provide 60% of the station pumping capability under generator power for all of their major pump stations, but longer duration emergency supply is not in place.

Table 3.1 City of Kelowna, Summary of Water System Components

ID	Description	Details
Sources	**(does not include the back-up lake pump stations)**	
S 1	Poplar Point Pump Station	3 - 400 hp, 2 - 500 hp
S 2	Eldorado Road Pump Station	3 - 200 hp
S 3	Cedar Creek Pump Station (Interim capacity)	2 – 125 hp
S 4	Timberline Pump Station	2 - 40 hp, 2 - 15 L/s
Balancing Reservoirs		
R-1	Ash 1 cell Ash Road, Okaview	TWL 458.0m 45 m3
R-2	Buckland 2 cells Wespoint Drive	TWL 411.7m 2,960m3
R-3	Crawford (Lower) 2 cells + wetwell	TWL 530.3m 1,040m3
R-4	Crawford (Upper) 2 cells	TWL 563.6m 920m3
R-5	Dilworth 2 cells Omineca Crt	TWL 414.5m 11,380 m3
R-6	Frost 2 cells	TWL 665.0m 1,100 m3
R-7	Grainger 3 cells	TWL 579.1m 2,080 m3
R-8	Knox Mountain 2 cells South slope of Knox	TWL 419.5m 11,380 m3
R-9	KVR (Adams) 2 cells	TWL 551.7m 2,363m3
R-10	Paret Road 1 cell	TWL 485.9m 45 m3
R-11	Rimrock 1 cell	TWL 456.0m 45m3
R-12	R & E 1 cell	TWL 532.0m 45m3
R-13	Rio 2 cells	TWL 609.0m 750 m3
R-14	Southcrest 1 cell	TWL 551.7m 1,500m3
R-15	Steele Road 2 cells Steele Road	TWL 452.6m 2,180m3
R-16	Stellar 2 cells Stellar Drive	TWL 465.9m 180m3
R-17	Summit 1 cell Dilworth, Summit Drive	TWL 525.8m 1,811 m3
R-18	Summit (Upper) 2 cells Dilworth Peak	TWL 638.9m 1,811 m3
R-19	Timberline 2 cells above Timberline Devel.	TWL 591.0m 450m3
R-20	Westpoint 3 cells Westpoint Drive	TWL 411.7m 6,800m3
Booster Stations		
B 1	Dilworth Reservoir Booster	3 - 125 hp
B 2	Dilworth Mountain (Summit Drive Station)	2 - 50 hp
B 3	Skyline	2 - 500 hp
B 5	McLure Road (OKMID Pump Station. No. 2)	1 - 100 hp, 2 - 50 hp
B 6	Vector Road (OKMID Pump Station No. 3)	1 - 100 hp, 1 - 60 hp
B 7	Stellar	2 – 350 hp

PRV's					
PRV 1	Braeloch 122- 60 psi	PRV 11	Lillooet 136-60 psi	PRV 21	Summit 2 165-109 psi
PRV 2	Broadview 257-60 psi	PRV 12	Paret 177-72 psi	PRV 22	Timberline 143-90 psi
PRV 3	Buckland 175-90 psi	PRV 13	Quarry 160-66 psi	PRV 23	Uplands 138-65 psi
PRV 4	Caraglen 162-80 psi	PRV 14	Rimrock 202-90 psi	PRV 24	Westpoint 177-72 psi
PRV 5	Chilcotin 152-78 psi	PRV 15	Skyline 300-160 psi	PRV 25	Clifton Road
PRV 6	Chute 140-23 psi	PRV 16	Southridge 198-106 psi		
PRV 7	Daon 165-78 psi	PRV 17	Steele 1 113-42 psi		
PRV 8	Golfview 122-29 psi	PRV 18	Steele 2 145-50 psi		
PRV 9	Kuipers 122-68 psi	PRV 19	Stellar 135-78 psi		
PRV 10	Lark 112-50 psi	PRV 20	Summit 1 165-80 psi		

3.3 BLACK MOUNTAIN IRRIGATION DISTRICT

Supply Area

The Black Mountain Irrigation District (BMID) services lands along the eastern limits of the City. The District is bounded by Mission Creek to the south, an old irrigation flume right-of-way and unserviced rangelands to the east, the Rutland Waterworks District (RWD) and Highway 97 to the west, and the Glenmore-Ellison Improvement District (GEID) and Sunset Ranch development to the north.

The District boundaries and pressure zone mapping is provided in Figure 3.5. The District is primarily gravity fed from an intake 5 kms east of the City boundaries on Mission Creek. BMID operates several large diameter PRV stations with multiple PRVs within the stations.

The District boundaries and major components of the water system are presented in Figure 3.6. A description of the major components corresponding to the figure is presented in Table 3.2. The land-use in the district is primarily residential on the Rutland flats and agricultural on the eastern slopes. Irrigation for agriculture accounts for 65% of the total annual water use. During the highest use days in the summer, irrigation use accounts for 80% of the water.

Water Distribution

Water is captured five kilometres east of the City limits at a creek intake at the 654m elevation. BMID operates a WTP that consists of a chemical addition clarification process capable of improving the water quality parameters to within the GCDWQ. After the WTP, the water enters Stevens Reservoir (154 ML) and then Hadden Reservoir (42 ML) which allows additional settling of sediment and WTP floc particles.

April, 1971 Photograph of BMID Flume prior to backfill

Water is chlorinated at the outlet from Hadden Reservoir and then conveyed through a large conduit along the slopes of the Mission Creek valley at the 638m elevation, through three tunnels, including a 900m long tunnel that runs through the shoulder of Black Knight Mountain. The water is fed to the majority of the water system by gravity with the exception of four local areas where pumping is required.

Table 3.2 BMID, Summary of Water System Components

ID	Description	Details
Sources		
S 1	Mission Creek Intake	TWL 638.5m
S 2	Scotty Creek Intake	TWL 535.8m
W 3	Cornish Road Well, Pumphouse No. 3	300 hp 6 cyl. Wakasha nat. gas, 164 L/s pump
W 4	Scotty Creek Subdivision, Well No. 4	45 hp submersible, 25 L/s
W 5	Scotty Creek Subdivision, Well No. 5	200 hp turbine, 69 L/s
Balancing Reservoirs		
R 1	Scotty Creek Subdivision	TWL 537.5m, 341m^3
Booster Stations		
B 1	Gallagher Road	2 - 60 hp, 1 - 15 hp
B 2	Swainson Road	1 - 40 hp
B 3	Latta Road	1 - 5 hp
B 4	Bell Mountain Drive (Bell Mtn)	1-25hp, 3-100 hp, 1 275kw Genset
B 5	Kloppenberg Drive (Kirschner Mtn)	Design phase, 2-40hp, 2-100hp, 1 150kw genset
PRV's		
PRV 1	Mugford Road (2 - PRV's)	PZ (555 > 415) (555 > 512) 100 hp Bst pump in stn
PRV 2	McKenzie Road @ Gibson	PZ (635 > 555) 60 hp booster pump in station
PRV 3	McKenzie Road @ Swainson	PZ (635 > 595)
PRV 5(a)	Toovey Road	PZ (635 > 576)
PRV 5(b)	Ray and Velrose	PZ (635 > 576)
PRV 6	Off Garner Road	PZ (635 > 576)
PRV 7	Garner @ Walburn (2-PRV's)	PZ (635 > 595) (635 > 553)
PRV 8	At Hollywood Road South	Abandoned
PRV 9	Seaford Road	PZ (553 > 512)
PRV 10	Lakha Road	PZ (595 > 537) Flow Control maximum of 69.3 L/s
PRV 11	Scotty Creek Road	PZ (537 > 488)
PRV 12	Upper Garner Road	PZ (635 > 595)
PRV 13	Lower Garner Road	PZ (595 > 553)
PRV 14	Lower McCurdy Road at Morrison	PZ (555 > 512)
PRV 15	Mid McCurdy Road at Gibson	PZ (590 > 555)
PRV 16	Upper McCurdy Road at Day Road	Design Phase PZ (635 > 590)
Special Features		
I 1	Rutland Road at McIntosh Road	Interconnection with RWD
I 2	Primrose Road	Interconnection with RWD
I 3	Hardie Road	Interconnection with RWD
I 4	Leathead Road at Ford Road	Interconnection with RWD
I 5	Highway 97 at Leathead Road	Interconnection with RWD
I 6	Highway 33 at Hollywood Road	Interconnection with RWD

Figure 3.6 presents the key infrastructure components of the water system.

BMID Supply Strengths and Weaknesses

A primary strength of the District is the reliability and size of the primary water source, Mission Creek, which is the second largest water resource in the region next to Okanagan Lake. The water quality meets

GCDWQ for most of the year with the exception of a 6 to 8 week period every spring when color and turbidity is above the levels set out in the GCDWQ.

Most of the water system is gravity fed and has very low operational costs. The system also has an emergency supply from RWD and the Cornish Road Well with the ability to feed up to the higher pressure zones with pumps in PRV Stations No. 1 and No. 2. This is useful when maintenance of the supply conduit is required.

A weakness of the system is no emergency supply or reservoir storage to PZ 665. This system has minimal pressure by gravity, however full redundancy is not available. There is also limited system interconnection with many trunk mains feeding a large area with no second feed. The trunk supply conduit has an estimated capacity of 2,520 L/s (40,000 USgpm). Once this capacity is reached, low level storage at the proposed Black Mountain Reservoir site will be necessary. Presently, the water system relies on large trunk mains to feed water to the agricultural areas. The watermain grid has limited interconnections and the District is working towards providing secondary connections to the most of the singularly fed areas.

3.4 GLENMORE-ELLISON IMPROVEMENT DISTRICT

Service Area

The GEID services lands within the Glenmore Valley, McKinley Landing, east to the Highway 97 corridor and north to encompass Quail Ridge, the Kelowna International Airport and the Ellison area which is in the RDCO. The GEID supplies water to about 1,680 hectares of agricultural land and 4,500 residential services in the northwest sector of the City. In addition to the area supplied within the City boundaries, GEID also supplies water to 280 hectares of agricultural land and 350 residential homes in the Ellison area of the RDCO. In 2005, GEID took over the operation of the McKinley Landing water utility.

Distribution System

The Glenmore part of the GEID system is gravity fed from McKinley Reservoir. Raw water is diverted from Kelowna Creek through a siphon to McKinley Reservoir. From the reservoir, water is fed to the Glenmore Valley via a 750mm transmission main along Glenmore Road. Pressure zones are illustrated as Figures 3.7 and 3.8. The two largest pressure zones are the gravity zone from McKinley, PZ 479, and the zone fed from the Scenic and Tutt Pump Stations, PZ 503. Key infrastructure components are illustrated on Figures 3.9 and 3.10 and listed in Table 3.3.

Strengths and Weaknesses

The GEID system has recently undergone major improvements and can reliably supply the water requirements of all existing users. The system has limitations on supply to new development but planned upgrading will ensure all existing and potential new users can be supplied. Water quality does not meet the Canadian Drinking Water Guidelines for colour and occasionally, for turbidity. All other parameters are within the GCDWQ. Upgrades for supply capacity and water quality are presented in the GEID 2004 Capital Plan. There are storage and emergency supply shortfalls in the Scenic pressure zone that are being corrected. Emergency generators are in place at all of the newer facilities.

Table 3.3 GEID, Summary of Water System Components

ID	Description	Details
Sources		
S-1	Kelowna Creek Intake	Travelling screens, chlorination, primary source, ARDA vintage, WL 537 m
W-1	Lochrem Road (Quail)	150 hp, submersible, 74 L/s, WL drawdown to 422m elev. Grd 496 m
W-2	Vector No. 1	60 hp, vertical turbine, 31 L/s, WL drawdown to 320 elev. Grd 420 m
W-3	Ellison Well	75 hp submersible, 31 L/s WL drawdown to 404 m elev. Grd 435.7m
W-4	Airport Well No. 1	125 hp Vertical Turbine, 30.2 L/s, WL drawdown to 373 m Grd 430.5 m
W-5	Sexsmith Road Well	40 hp vertical turbine, 18.9 L/s Grd 402 m
Balancing Reservoirs		
R-1	McKinley Reservoir	110 ML storage, Open surface reservoir. Primary supply. HWL 480.4 m
R-2	Scenic Road Res.	300 m^3, Concrete 3 cell reservoir HWL 501.4 m
R-3	Union Road Res.	4,822 m3, Concrete circular reservoir HWL 480.4 m
R-4	Quail Ridge Res.	2,725 m3, Concrete rectangular, two cells HWL 573.0 m
R-5	Big Rock Reservoir	1,500 m^3, concrete 2 cell circular reservoir HWL 536.0 m
R-6	Mill Creek Reservoir	2,000 m3, concrete circular reservoir HWL 542.5 m
R-7	Countryview Estates	480 m3, 2 cell conc. Rectang. Reservoir, Owned by Strata HWL 558.0 m
Bst Stns		
B-1	Quail Booster	3 – 50 hp (48 L/s each) vertical turbines, 600V
B-2	Tutt Booster	1 – 40hp (78 L/s@44.8m) manual on/off, 480 V, 1–20 hp (44 L/s@45 m) vertical turbine
B-3	Scenic Bst Stn	1 – 125 hp (170 L/s@45.7 m), 2 – 75 hp (107 L/s @ 45.7 m) split case, 480V, 1 – 10 hp pumps
B-4	Union Road Bst.	3 – 50 hp (94.5 L/s each) low lift pumps, 2 – 75 hp high lift pumps, 600 V
B-5	Big Rock Bst	2 – 5 hp duty pumps 600 V , 1 – 20 hp fire pump
B-6	Bullach Bst. Stn.	1 – 20 hp (24.2 L/s @ 43.3m TDH)
B-7	Capistrano Bst Stn	2 – 5 hp duty pumps, (9.45 L/s @ 22m) 1 – 75 hp fire pump (165 L/s @ 22 m TDH)
B-8	College Heights	1 - 5 hp pump, 1 – 30 hp fire pump, owned by Strata.
B-9	Postill Pump Stn.	2 - 30 hp pumps, (126 L/s @ 13.4 m TDH) 1 – 5 hp, 2.1 L/s @ 105 m TDH
B-10	Countryview Estates	2 – 5 hp (3.15 L/s each) owned by Strata
PRVs		Elevation, (Upstm HGL > Dwnstm HGL) dia Description
PRV-01	Quail Place	490.1m PZ (571 > 543) 150mm Primary zone valve
PRV-02	Quail Lane	482.8m PZ (571 > 539) 150mm Secondary zone valve
PRV-03	Dry Valley Road	480.7m PZ (571 > 532) 150mm Secondary zone valve
PRV-04	Walker Road	399.9m PZ (489 > 532) 2 – 38mm Primary zone valve
PRV-05	Teather Road	422.0m PZ (536 > 495) 150mm Primary zone valve
PRV-06	Black Road	460.0m PZ (530 > 495) 150mm Secondary zone valve
Special Features		
I-1 / I-2	BMID Interconnections	Sexsmith Road flow to BMID, 105 L/s at HGL of 457 meters / Ellison Firehall
I-3 / I-4	City of Kelowna	Glenmore and Summit Drive / Valley Road and Golfview
I-5 / I-6	City of Kelowna	On Ryder Drive / Caro Park, spool piece required in vault

3.5 RUTLAND WATERWORKS DISTRICT

Service Area

The RWD supplies water to approximately 4,735 single-family, duplex, and multi-family units and 380 commercial/institutional/industrial units. The District is surrounded by other water utilities; BMID on the east and the north, SEKID on the south, and the City Water Utility on the west. Virtually all of the land within the District is serviced and there is limited opportunity to expand the boundaries. The City OCP anticipates that there will be considerable re-development of single family lots into multi-family and commercial developments, particularly in the Rutland Road/Highway 33/Leathead Road area. There are also discussions going on as to the height of development within the Rutland core area.

Distribution System

The distribution system is divided into two pressure zones with Hollywood Road generally being the dividing line. The two zones are interconnected with two booster pumps and two PRV stations. The two zones are illustrated in Figure 3.11. Key infrastructure components are illustrated in Figure 3.12.

A 6,800 m^3 reservoir in the upper zone provides balancing and fire flow storage. An automated interconnection with the BMID system on Rutland Road East can be used in emergencies or to assist in providing fire flows. BMID also supplies water for fire protection for properties on the south side of Highway 33 between Hollywood Road and Gerstmar Road.

Strengths and Weaknesses

The Rutland system can meet the domestic and fire flow requirements of all users with only a few exceptions. The system is well interconnected and supplied by multiple sources, and is therefore very reliable. Water quality in most of the wells is good, but water from some wells in the north part of the District is high in hardness, manganese and iron. The poorer quality wells are only used when water demand is high.

Declining water tables in some of the wells is a long-term concern. The District has been able to bring new wells into production as other wells are reduced in capacity, but the availability of land for wells may become a limiting factor. The present knowledge of aquifer recharge and withdrawals is limited, although estimates indicate that the aquifer can support significant increases in withdrawals.

The City OCP recommends major redevelopment of the Rutland core area. Some replacement and upsizing of pipelines in this area will be necessary to service the proposed multi-family and commercial development.

RWD - Teasdale Road Reservoir

Lack of a balancing reservoir in the lower zone requires automated pump on-off sequencing based on water pressure to meet demands. This system may not be as reliable as a reservoir controlled system, but has proven to be very reliable utilizing the SCADA monitoring and a thorough maintenance program.

Table 3.4 RWD - Summary of Water System Components

ID	Description	Details
Sources		
W2	Office	40 hp, vertical turbine, 20 L/s
W3	Hollydell Road	75 hp, submersible, 50 L/s
W4	Cactus Road	30 hp sub., 50 hp booster, 32 L/s
W5	Pipeyard	30 hp, submersible, 15 L/s
W6	Ziprick Road	150 hp, vertical turbine, 92 L/s
W7A, 7B	Ruston Road	2 - 40 hp, submersible, 50 L/s
W8	Pipe Yard	30 hp, submersible, 16 L/s
W9A	Springfield Road	40 hp, submersible, 20 L/s
W10	Springfield Road	200 hp, vertical turbine, 110 L/s
W11	Pipeyard	40 hp, submersible, 18 L/s
W12	Hollywood Road	75 hp, vertical turbine, 50 L/s
W13 W & E	Gerstmar Road	2 - 100 hp, vertical turbines, 90 L/s
W15	Hollywood Road	100 hp VFD, Submersible, 110 L/s
Balancing Reservoirs		
R1	Teasdale Road Reservoir	TWL 475m, 6,820m^3
Booster Stations		
B5B	Pipe Yard	1 - 25 hp
B9B	Highway 33	1 - 30 hp
PRV's		
PRV 1	Highway 33, @ Hollywood (McCraes)	PZ 475 > 415
PRV 2	Highway 33 (at Wendy's)	PZ 475 > 415
PRV9B	Springfield at Well Pump No. 9	PZ 475 > 415
Special Features		
	Interconnections with BMID See Table 3.2	

3.6 SOUTH EAST KELOWNA IRRIGATION DISTRICT

Service Area

The area serviced by the South East Kelowna Irrigation District (SEKID) is generally the area south of Mission Creek and east of Swamp and Crawford Roads. The area within the District boundaries comprises about 3,636 hectares of land of which 2,282 hectares are supplied with water. The remaining 1,354 hectares of land is only partly developable due to topographic constraints (steep slopes, bedrock, etc.). There are 1,936 residential, agricultural and commercial service connections and 400 irrigation services.

Distribution System

The distribution system is gravity supplied from the Hydraulic Creek intake via a 1,080 mm diameter mainline. The mainline divides into three separate systems on McCulloch Road just north of Carter Road: the KLO System; the SKL System; and June Springs System. The distribution system comprises about 200 km of pipelines, ranging in size from 850 mm to 100 mm diameter, a 2,500 m^3 balancing reservoir on Field Road, and 32 Pressure Reducing Stations which regulate system pressures. All agricultural services and newer residential services installed since 1995 are metered.

Figure 3.13 present the major pressure zones within the water distribution system. Key infrastructure components are illustrated in Figure 3.14 and are listed in Table 3.5.

Strengths and Weaknesses

The strength of the system is that it is a relatively new system (1970s) with large diameter mains and high pressures. The District has adequate source and distribution capacity to serve all existing users. Planned increases in storage and a continued water conservation program should allow the District to supply all development within its boundaries for the foreseeable future.

Weaknesses include limited balancing storage at the intake which can result in some water wastage; large quantities of Asbestos Cement pipe; water quality problems, particularly during spring freshet (colour and turbidity); and heavy reliance on the single source that is Hydraulic Creek. The District has minimal surplus capacity in the southeast (Crawford, Dehart, and Bedford Roads) area of the district.

Table 3.5 South East Kelowna Irrigation District, Summary of Water System Components

ID	Description	Details
Sources		
S1	Hydraulic Creek	TWL 655m
W1	East Kelowna Road, Well No. 1	150 hp submersible, 76 L/s
W2	East Kelowna Road, Well No. 2	150 hp submersible, 76 L/s
W3	O'Reilly Road Well	100 hp submersible, 52 L/s
Balancing Reservoirs		
R1	Field Road	2,500 m^3 TWL 620 m
R2	Hayes Road	364 m^3 TWL 672 m
Booster Pumps		
B1	Hayes Road	2 @ 10 hp
PRVs		
PRV 3M	McCulloch Road	PZ 655 > 615
PRV 2M	Gallagher's Canyon on Golf Course	PZ 655 > 600
PRV 5M	Gallagher's Canyon	
PRV 1K	Reekie Road	PZ 655 > 555
PRV 1KA		
PRV 2K	McCulloch Road	PZ 655 > 555
PRV 4K	Pooley Road	PZ 555 > 510
PRV 5K	Reid Road	PZ 555 > 510
PRV 10K	Feeny Road	PZ 655 > 580
PRV 21K	Hart and Gulley Roads	PZ 555 > 524
PRV 22K	Off Hart Road at Lot 7, Plan 29282	PZ 524 > 460
PRV 23K	Off Hart Road, Lot 1, Plan 29282	PZ 524 > 489
PRV 42K	McCulloch and KLO Rd, Plan 26053	PZ 510 > 466
PRV 43K	Packers and Bewlay Roads	PZ 510 > 435
PRV 44K	Hall Road	PZ 466 > 432
PRV 1S	June Springs and McLain Roads	PZ 655 > 595
PRV 1SA	June Springs and McLain Roads	PZ 655 > 620
PRV 2S	Wallace Hill Road	PZ 655 > 570
PRV 3S	Sallows	
PRV 4S	Harvard Road	PZ 655 > 570
PRV 4IS	Bedford Road	PZ 570 > 538
PRV 5S	Saucier Road	PZ 570 > 538
PRV 6SW	Balldock Road	PZ 655 > 576
PRV 6SE	Balldock Road	PZ 655 > 596
PRV 7S	Mathews Road	PZ 655 > 641
PRV 8SE	Lancaster Court	PZ 655 > 620
PRV 8SW	Lancaster Court	PZ 655 > 601
PRV 9S		
PRV 9SA		
PRV 11S	Spiers Road	PZ 590 > 535
PRV 12S	Spiers and Hart Roads	PZ 535 > 474
PRV 22S	Off Grantham Road	PZ 570 > 518
PRV 23S	Off Todd Road	PZ 521 > 472
PRV 51S	Crawford Road	PZ 538 > 505
PRV 52S	DeHart and Crawford Road	PZ 505 > 447
PRV 53S	DeHart Road	PZ 505 > 460

3.7 OTHER SMALL WATER SUPPLIERS

Presently, there are several smaller privately owned water utilities operating within the City boundaries. This section presents a very brief overview of the larger ones.

South Okanagan Mission Improvement District (Improvement District)

This Improvement District provides irrigation water for the water systems located within the Chute Lake / Barnaby Road / Frost Road area of Kelowna. The water system supplies only irrigation water to approximately 75 hectares of agricultural lands. The water source for this system is three groundwater wells located below Lakeshore Drive. Only two of the wells are functional. The wells pump up to Fraser Lake which is a 50 ML open storage reservoir for the District. The dam for the lake has some seepage and the water storage level for the lake is recommended not to exceed 34 ML. From Fraser Lake, water is fed to the agricultural users only during the summer months. The system consists of buried AC watermains. Originally, SOMID obtained water via a flume from Jacksmith Lake and Bellevue Creek, but the flume fell into disrepair and the district became reliant on the groundwater wells.

Figure 3.15 SOMID Service Area

Source: Mould Engineering – City of Kelowna Agricultural Plan

As no domestic water is provided through this system, many of the land owners in this area were on shallow groundwater wells. In 2000, some of the SOMID residents approached the City to obtain domestic water. The issue of the reliability of irrigation supply from the wells was also in question. SOMID reviewed the opportunity to amalgamate their system into the City system and the economics resulted in the Improvement District continuing to exist in its current form.

DeMontrieul Water Utility (Private Domestic Utility)

This private utility is located in South East Kelowna at the southwest limits of the Hall Road development area. There are approximately 25 residential lots serviced by this utility. The water supply is from a groundwater well within the Mission Creek aquifer.

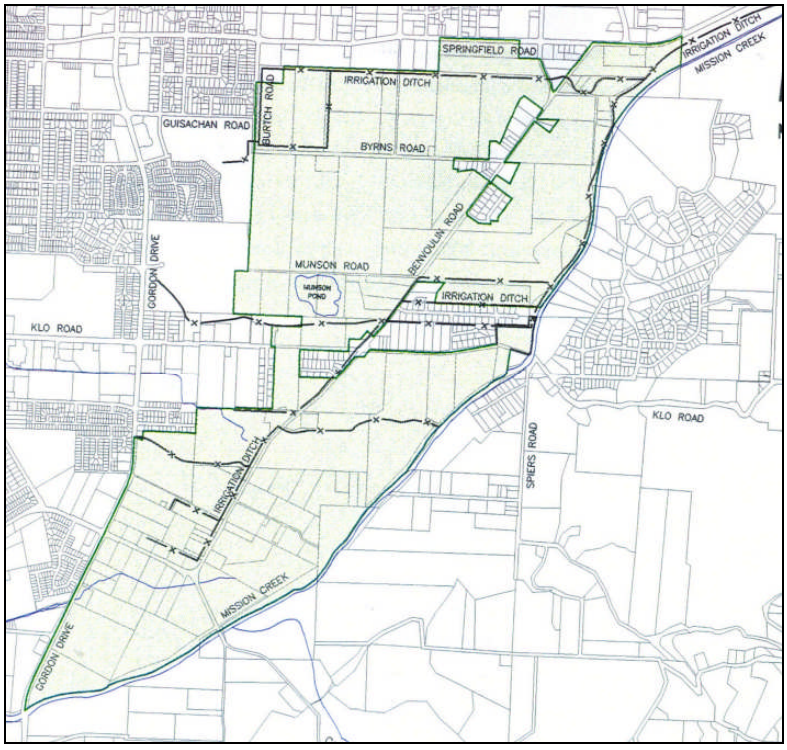
Braeloch Water Utility (Private Domestic Utility)

This water system is located along the shores of Okanagan Lake to the south of the Okaview water system along Braeloch Road. The Braeloch water system consists of a small pump which draws water directly from Okanagan Lake and services 22 residential units through 50mm and 25mm pipe. A small pressure tank assists in maintaining system pressure. In general, the existing system is marginally capable of meeting domestic water supply requirements, and does not provide sufficient flows for fire protection.

Mission Creek Water Users Community (private water users group)

Water user communities are legal entities formed under the Water Act that have less authority than Improvement Districts. These organizations are essentially groups of private licensees that operate joint water systems and share costs for operation. This Community Users Group irrigates approximately 150 ha. of agricultural land on the west side of Mission Creek as shown in Figure 3.16. There are serious problems associated with this water supply system as the system has fallen into disrepair. Many of the ditches cross private property and have been filled in, cutting off downstream users. The long term status of supplying these areas is in doubt. The provision of irrigation water to these lands needs to be studied to determine methods for servicing and the continuation of agricultural use of these lands.

Figure 3.16 Mission Water Users Service Area



Source: Mould Engineering – City of Kelowna Agricultural Plan

3.8 SUMMARY OF UTILITIES

Presently, there are several smaller privately owned water utilities operating within the City boundaries. This section presents a very brief overview of the larger ones.

Table 3.6 Summary of Water Demands

District	BMID	GEID	SEKID	RWD	City of Kelowna	TOTAL
Total Land within Boundaries (ha)	2,819	3,170	3,636	n/a	n/a	n/a
Irrigated Land Serviced (ha)	2,135	1,680	2,282	n/a	n/a	5,637
Dry land (ha)	684	1,490	1,354	n/a	n/a	n/a
Connections						
Irrigation Connections (No.)	860	811	450	0	0	
Residential Units (No.)	7,147	4,500	1,940	4,735	* 28,376	46,698
Total Connections (Irrig + Domestic)	8,007	4,644	2,390	4,735	30,027	49,823
Population Density (person/connection)	2.38	2.44	2.99	2.85	2.01	2.24
Population within City (est.)	17,000	11,000	5,800	13,500	57,100	** 108,000
Population in RDCO	1,000	1,000	0	0	0	2,000
Water Demand						
Average Day (L/s)	425	216	365	127	460	1,592
Maximum Day (L/s)	1,835	625	1,580	340	1161	5,541
Peak Hour (L/s)	2,235	725	1,560	605	1,620	6,745

* City connections = 13,221 Res. + 1,651 ICI + 3,085 Twnhse + 12,070 Apt.

** Total population is based on Census data and City GIS information for existing Utility Boundaries. Includes 3,600 persons outside utility boundaries.

The table lists the approximate irrigated areas, number of domestic connections and number of irrigation and domestic connections for each of the five water utilities. The numbers show the different characteristics of the domestic water suppliers in comparison with those with a large agricultural component.

Regionally during the hottest summer periods, the five utilities combined can provide up to 5,540,000 m^3 of water to their ratepayers in a single day.

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4. WATER SERVICING PLANS

4.1 INTRODUCTION

Growth, as predicted in the City Official Community Plan (OCP), is presented in this section. Growth areas and an estimate of the net increase in water demand that should be expected from development are summarized.

Lands presently outside the service boundaries of any of the major water utility are illustrated in this section along with their current and expected future land use. Water demand is estimated for these lands based on typical existing agricultural demands. The expected future service provider is recommended in this section. It is noted that much of the unserviced land is in the ALR and future expected water use may be for irrigation. It is recommended that where possible, irrigation be provided from the current sources as this will lessen the impact on the existing utilities. Where possible, only domestic water should be extended into these unserviced areas.

Also presented in this section is an integrated plan for water conservation and water use efficiency, and contingency planning opportunities for the five water utilities.

4.2 SERVICING CRITERIA

A comparison of the water use criteria by the water districts is summarized in Table 4.1 on the following page. Because of the variation in the elevation, soil types, and land use, the water demand criteria is summarized only for the general land use areas. Water demand design values are presented for average daily demand, maximum daily demand, and peak hour demand. Average daily demand is used to determine licensing requirements; maximum daily water demand determines trunk main sizes, water treatment components, pumping requirements and reservoir storage; and peak hour demand determines distribution system capacity.

Presently the City and RWD are the only utilities that have the majority of their connections metered. SEKID meters their irrigation connections and all new connections. GEID metered all of its ICI and MF connections and in 2003, GEID began metering all of its new SF residential connections. BMID also in 2005 started metering all new connections. Plans to retrofit the existing connections with meters are in the earliest stages. Funding opportunities are being investigated by BMID. GEID has received federal funding for agricultural meters.

Fire Protection

All of the Districts follow the City of Kelowna subdivision bylaw and FUS guidelines for fire protection. Because the City Fire Department services the entire City area, the City owns the hydrants within each of the water supply districts. The hydrants are maintained by the water utilities at an annual cost to the City. Hydrant maintenance and coordination of a common hydrant database are projects that are underway between the KJWC and the City of Kelowna Fire Department.

Table 4.1 Summary of Water Servicing Criteria

Land Use	CITY	BMID	GEID	SEKID	RWD	Future Criteria
SF / MF low density, R-1, R-2	(L/s/lot)	(L/s/lot)	(L/s/lot)	(L/s/lot)	(L/s/lot)	(L/s/lot)
Peak Hour	[1]0.139	[1]0.139	[1]0.139	0.120	0.120	0.139
Maximum Day	0.083	0.083	0.083	0.076	0.076	0.083
Average Day	0.031	0.031	0.031	0.030	0.030	0.031
MF res. low density, R-3	(L/s/unit)	(L/s/unit)	(L/s/unit)	(L/s/unit)	(L/s/unit)	(L/s/unit)
Peak Hour	[2]0.093	[2]0.093	[2]0.093	0.06	0.06	0.093
Maximum Day	0.056	0.056	0.056	0.05	0.04	0.056
Average Day	0.021	0.021	0.021	0.15	0.015	0.021
MF res, med density R-4, R-13	(L/s/unit)	(L/s/unit)	(L/s/unit)	(L/s/unit)	(L/s/unit)	(L/s/unit)
Peak Hour	[2]0.093	[2]0.093	[2]0.093		0.03	[2]0.093
Maximum Day	0.056	0.056	0.056	n/a	0.02	0.056
Average Day	0.021	0.021	0.021		0.01	0.021
Local commercial C-1, C-2, C-3		(L/s/conn)	(L/s/conn)	(L/s/conn)	(L/s/conn)	(L/s/conn)
Peak Hour		0.240	0.240	n/a	0.12	0.240
Maximum Day		0.180	0.180		0.08	0.180
Average Day		0.060	0.060		0.03	0.060
Service commercial, C-7	n/a	(L/s/conn)	(L/s/conn)	(L/s/conn)	(L/s/conn)	(L/s/conn)
Peak Hour		0.240	0.240	n/a	0.12	0.240
Maximum Day		0.180	0.180		0.08	0.180
Average Day		0.060	0.060		0.03	0.060
Industrial, I-1	(L/s/conn)	(L/s/conn)	(L/s/conn)	(L/s/conn)	(L/s/conn)	(L/s/conn)
Peak Hour	0.280	0.280	0.280	n/a	n/a	0.280
Maximum Day	0.168	0.168	0.168			0.168
Average Day	0.056	0.056	0.056			0.056
Public Admin., P-1, P-2, P-3	n/a	(L/s/ha)	(L/s/ha)	(L/s/ha)	(L/s/ha)	(L/s/ha)
Peak Hour		0.747	0.747	1.121	0.75	0.75
Maximum Day		0.747	0.747	1.121	0.75	0.75
Average Day		-	-	-	-	-
Rural Residential, A-2, A-3	(L/s/lot)	(L/s/lot)	(L/s/lot)			(L/s/lot)
Peak Hour	[1]0.139	[1]0.139	[1]0.139	0.12		0.60
Maximum Day	0.083	0.083	0.083	0.075		0.60
Average Day	0.031	0.031	0.031	0.03		-
[4]Agricultural, A-1		(L/s/ha)	(L/s/ha)	(L/s/ha)	(L/s/ha)	(L/s/ha)
Maximum Day	n/a	0.78	0.78	0.78-1.0	n/a	0.78
						-
Peaking Factors - Residential						
Peak Hour	4.00	4.00	4.00	4	4	4.00
Maximum Day	2.40	2.40	2.40	2.5	2.5	2.40
Average Day	1.00	1.00	1.00	1.00	1.00	1.00

1 Based on 3.0 persons per connection
2 Based on 2.0 persons per connection
3 High Density multi-family
4 Varies dependent on type of soil and crop
5 Based on 40 units/ha

Conversions 1 L/s = 15.873 USgpm
1 L/s/ha = 6.424 Usgpm/acre

Table 4.1 is only for the purposes of estimating future water demands or demands from specific areas. All of the utilities meter their industrial, commercial and multi-family service connections. Some of the recommended criteria are set on an area basis as zoning will control the densities. It is noted that the existing water demand is slightly lower than the criteria numbers presented. This is to allow contingencies to be built into the estimates so that the water systems designed will have the capacity and ability to be adjusted to match unforeseen development progressions. It is also noted that planning of transmission mains and core infrastructure must look beyond the 20 year time frame as the lifespan for the new infrastructure may be up to 100 years.

4.3 OFFICIAL COMMUNITY PLAN

This section summarizes the Water Policies as stated in Section 13.3 within the Kelowna 2000-2020 Official Community Plan. The OCP set out by the City is the guiding document upon which the Capital Planning of the water utilities is based. The general policies of the City of Kelowna include:

Liaison/Co-operation/Public Relations

1. **Irrigation District Boundaries and Standards.** Support the necessary amendments to Irrigation District Boundaries to allow expansion to un-serviced areas, in accordance with the Kelowna Water Servicing Plan and overall OCP objectives and development phasing, and encourage new installations to be made to City standards;
2. **Fire Flow Protection.** Require Irrigation Districts to ensure sufficient fire flow capacity for new developments through system improvements or development of secondary sources where necessary;
3. **Private Systems.** Encourage the Mission Creek / Benvoulin Water Users groups, SOMID, and other private systems to continue to operate as suppliers of irrigation water for those areas intended to remain as agricultural;
4. **Water Management Plan.** Through the RDCO representation on the Okanagan Basin Water Board, work toward the preparation of a Water Management Plan for the Okanagan Basin, which will set out water quality objectives and a definitive strategy for achieving such objectives. Areas to be addressed include water quantity and quality, emphasizing the interrelationships between resource/land use and water quality and quantity issues (ecosystem / water based approach).

Further Studies/Reviews

5. **Treatment.** Continue to investigate future water treatment alternatives;
6. **Replacement Program.** Investigate and assess the existing infrastructure to develop an affordable leak detection and replacement program.

Future Civic Initiatives

7. **Meters.** Continue to curtail unnecessary water use through the existing water meter installation program and equitable user pay billing system;
8. **Water Availability.** Encourage decisions about water availability and quality to be made with the interests of the agricultural community as a priority;
9. **Education.** Continue with a comprehensive customer education program on how to reduce water consumption.

10. **Quality.** Strive to preserve drinking water quality by controlling the quality of storm and creek waters impacting water supply sources that are under the City's direct control. Use comprehensive water quality monitoring programs and deviation response plans to ensure a high level of water quality monitoring in order that public notification can be achieved when deviations occur.

When the sections in the OCP related to water supply were developed, the water districts were contacted for their input. The future growth area data was developed utilizing the information within the Kelowna 2020 OCP (*Table 8.1*). There are 19 areas of growth illustrated in Figure 4.1. The corresponding number of SF and MF housing units are tabulated in Table 4.2. Note that some of the OCP growth areas straddle water district service boundaries. An estimate of the additional average annual water demand and the maximum daily water demand from the additional development at the end of 20 years is presented.

Table 4.2 OCP Growth Areas / Forecasted Water Demand

		20 - Yr Development Est.			Residual Potential			Total	20 yr MDD	20 Yr Annual
ID	DESCRIPTION	SF Units	MF Units	Sub total	SF Units	MF Units	Sub total	Buildout	(L/s)	Demand (ML)
1	Clifton	35		35			0	35	1.82	19.16
2a	Glenmore Highlands (City)	2,000	200	2,200	125	375	500	2,700	108.80	1,146.10
2b	Glenmore Highlands (GEID)	173	814	987		275	275	1,262	27.85	302.69
3	South Glenmore	660	110	770			0	770	36.92	389.46
4	Inner City / Waterfront		4,157	4,157		3,514	3,514	7,671	96.23	1,062.11
5	South Pandosy		1,510	1,510		1,052	1,052	2,562	34.95	385.81
6	Guisachan		332	332		186	186	518	7.69	84.83
7	North Mission infill	251	723	974	430		430	1,404	29.81	322.15
8	Southwest Mission	3,082	709	3,791	1,139	1,636	2,775	6,566	176.93	1,868.54
9	Southeast Kelowna	654	50	704			0	704	35.22	370.84
10	Black Mountain	1,778		1,778	142		142	1,920	92.60	973.46
11	Dilworth Mountain	314	231	545			0	545	21.70	230.94
12	Highway 97 / Springfield		1,653	1,653			0	1,653	38.26	422.34
13	Rutland Infill	267	1,932	2,199		785	785	2,984	58.63	639.81
14	Tower Ranch	691	111	802			0	802	38.56	406.68
15	University South	1,005	590	1,595		400	400	1,995	66.00	700.98
16a	University North	101	406	507		295	295	802	14.66	159.03
16b	Kelowna Airport			0			0	0	0.00	0.00
17	North McKinley			0			3,500	3,500	0.00	0.00
18	South McKinley			0			3,500	3,500	0.00	0.00
	Secondary Suites	1,000		1,000			0	1,000	52.08	547.50
	TOTALS	**12,011**	**13,528**	**25,539**	**1,836**	**8,518**	**17,354**	**42,893**	**939**	**10,032**

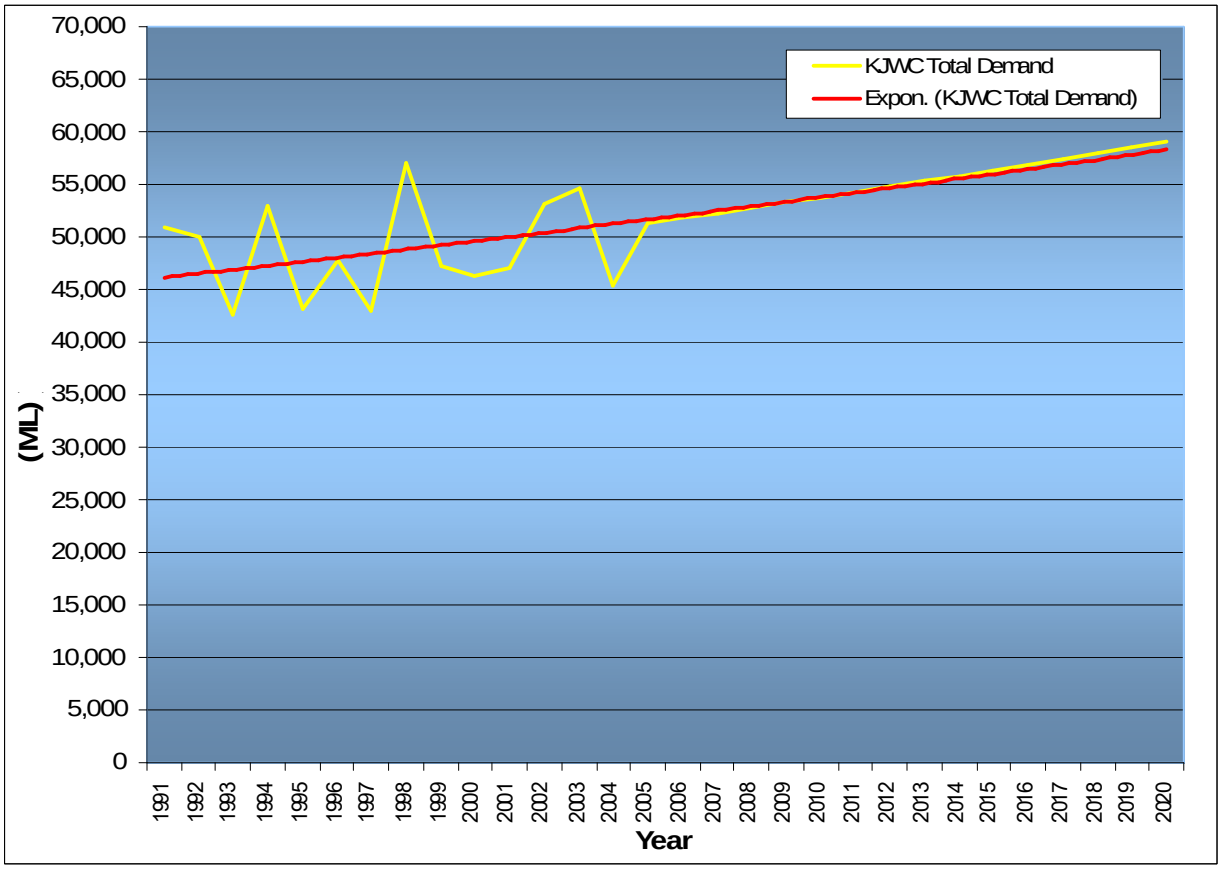
Criteria	Density	Ave Demand	Max Day demand
Single Family	3	500 L/ca/day	1500 L/ca/day
Multi family	2	350 L/ca/day	1000 L/ca/day

The long term water supply is expected to be manageable for the following reasons:

1. The implementation of water meters and demand management tools will help to monitor and better manage water consumption;
2. Future development will be more multi-family type housing which uses less water than single family type development;
3. There will be less "dry" land to irrigate;
4. The value of water will increase making it more valuable and;
5. Irrigation practices will become more efficient as has been the case in the past 10 years.

It is noted that both the annual average demand and maximum day demand per person is expected to be reduced due to the mechanisms in place for water conservation. The numbers used in Table 4.2 are lower than the City subdivision bylaw and should be considered for use in long range planning purposes only. Utilization of the existing bylaw numbers for immediate design leads to a safer more flexible water system.

Figure 4.1(a) - KJWC - Projected Annual Average Water Demand



The projected average annual water demand for the next 15 years due to development is set out in Figure 4.1(a). The demand numbers utilized result in an estimated water demand growth rate of 0.94% in comparison to the population growth rate which is projected to be 2.40%. Population figures from BC Census are included in Appendix C of this report.

It is noted that within the planning of the individual water utilities, a longer time frame than 20 years is required on certain projects. These projects are the large transmission mains and the key infrastructure components. As the lifespan of these facilities are to service the utility indefinitely, they must be built to a further horizon than 20 years.

In discussions with Mr. Gary Stephen, Long Range Planner for the City of Kelowna, the numbers presented in Table 4.3 are for the first four years of the 2020 Kelowna OCP. The growth rate is estimated to be 3.20% which is above the projected rate of 2.40%.

Table 4.3 City of Kelowna Building Permit Data (2001-2004 inclusive)

SECTOR	SF Units	Twnhouse	Apartment
McKinley	36		
Highway 97 North	235	32	118
Glenmore Valley / Clifton / Dilworth	464	95	199
Central City	203	48	1,136
Rutland	185	35	211
Black Mountain	218		
South Pandosy / KLO	398	24	323
S.E. Kelowna	279	18	
N. Mission / Crawford	154	14	178
S.W. Mission	651	24	
TOTALS	**2,823**	**290**	**2,165**

4.4 WATER DISTRICT EXPANSION BOUNDARIES

This section presents in detail, recommended water district boundaries for all lands within and adjacent to the City limits that are not serviced by a major water supplier. Figure 4.2 presents an overview of these lands and a numbering designation that corresponds to Table 4.4.

Table 4.4 in this section describes the reasons for the recommended service boundaries. The areas are consecutively numbered starting with the outlying areas, then areas at the north end of the City and progressing southwards. The expected land use at the end of 20 years is listed as is the recommended Water District the land will be within. It is expected that each of the water utilities will integrate the information developed within this report into their Capital Plan documents.

The following factors were considered in determining service boundaries:

- trunk mains in the vicinity
- physical constraints
- long term plans of the Districts
- the size and elevation of the parcels
- HGL of the adjacent pressure zone
- water demand

Physical constraints that affect the servicing of lands along the Highway 97 and Benvoulin Road corridors include the CPR Railway, Highway 97, Kelowna Creek, Mission Creek, and the elevation of the higher lands. The primary constraint on the outlying lands is the elevation to be serviced in relation to the adjacent water district system operating pressure.

Twenty-nine (29) parcels of land are identified in Table 4.4. The information should act as a guideline for future servicing of water.

Table 4.4 Dry Land Service Provider

ID. No	Land Description	OCP Land Use	Area (ha.)	Demand L/s	Recom. Service District
1	**South Mission** Defined as a development area, 3,000 SF units and 700 MF units are proposed in the 20 year OCP horizon. Water supply would be through a new pump station on Okanagan Lake.	Res.	n/a	323	**City**
2	**Benchlands above SEKID** Expansion area is beyond the 20 year time horizon of this report. Pumping is required for all lands above 600m. The area is also outside the City boundaries.	O.S	n/a	-	**SEKID**
3	**Gallagher Canyon Lands, South Side of Mission Creek** Area is not identified in the OCP 20-year time frame and much of it is outside the City boundaries.	O.S.	n/a	-	**SEKID**
4	**Gallagher Canyon Lands, North Side of Mission Creek** Area is not identified in the OCP 20 year time frame and much of it is outside the City boundaries. Water supply to all lands above 610m requires pumping.	Res.	n/a	-	**BMID**
5	**McKenzie Benchlands** Water can be supplied by gravity to the 600m elevation. Development of lands on the bench east of the District is subject to District expansion and improvement of trunk main capacity. The Tower Ranch development consisting of 455 SF and 400 MF residential units is proposed above Day Road.	Res.	n/a	54	**BMID**
6	**Ellison Benchlands and North Flatlands** All lands north of Scotty Creek are in this area presently serviced by the GEID. Expansion in this area is not identified as a growth area in the OCP.	Agr. Res.	n/a	-	**GEID**
7	**North Glenmore** This area encompasses lands north of the City above Highway 97 and Glenmore Road on Duck Mountain. The area is not shown as being developed in the 20 year OCP horizon. Service would eventually be provided by GEID.	Res.	n/a	-	**GEID**
8	**McKinley Landing** The OCP shows this as a development area beyond the 20 year time horizon. Water supply would be from Okanagan Lake from the pump station and reservoir proposed by the GEID. 5,000 residential units are identified for this area but this is expected to occur beyond the 20 year time frame.	Res.	n/a	-	**GEID**
9	**Glenmore Highlands** This includes all lands on the west side above the Glenmore valley to the high ridge south of McKinley Road. Service would be through the Skyline system or a new booster station on the Lake. Approximately 2200 residential units are proposed in the City serviced area of of the Highlands as well as 780 residential units in the GEID serviced area	Res.	n/a	120	**CITY/ GEID**

ID. No	Land Description	OCP Land Use	Area (ha.)	Demand L/s	Recom. Service District
10	**Lands East of CPR** With GEID and BMID in the vicinity, the CPR tracks and Kelowna Creek form a likely boundary between the two districts.	Agr.	59.1	59	**BMID**
11	**East of Highway 97, West of CPR** This is the dry land between the Highway and the CP tracks. GEID has higher pressure and a well in the immediate vicinity.	Res.	25.4	57	**GEID**
12	**Lands West of Adams Road** This area rises to the 540m elevation and is above the hydraulic grade line of BMID and GEID. GEID surrounds the area and should eventually provide service. A booster station will be required to service the highest areas.	Res.	188.1	188	**GEID**
13	**Lands West of Campion Road** The elevation here rises to as high a 415m which is still well within the servicing capability of both the BMID and the GEID.	Res./ Ind.	23.3	87	**GEID**
14	**Bald Hill** This hill rises to above the 500m elevation and is above the servicing capability of the adjacent utilities. Much of the hill is too steep to develop. Boosting of system pressure would be required to service the highest elevations.	Res. O.S.	~20/ 59.3	20	**GEID**
15	**East of Dilworth, North of Home Depot** The North End Connector Roadway is proposed through this area. Eventually there may be requirements for fire protection along the road. The City has water supply above on Dilworth Mountain but terrain is steep down to the creek. It is recommended that BMID service the lower area.	O.S.	10/ 24.0	22	**RWD**
16	**Dilworth Mountain** Presently serviced by City. The remainder of this development will continue to be serviced by the City. An interconnection has been made to improve service to Golf View subdivision on the west side of Dilworth from Dilworth Mountain. Remainder includes Selkirk neighbourhood at the top of the mountain.	Res.	~80/ 145.1	53	**City**
17	**Mission Creek Regional Park** Area is an open space, recreational area. Water demands of any significance are not expected in the next 20 years. SEKID presently services the top end of Mission Creek Park with a domestic connection as well as providing water for the ponds under an agreement with RDCO. The City services the facilities on the north side of the Creek. Mission Creek provides a natural boundary.	O.S.	0/ 39.2	0	**SEKID**
18	**Springfield / Byrns Road** Presently agricultural use. Will stay agricultural as long as the ALR protects it and City zoning remains in place. If not, it is a likely area for higher density residential development.	Agr./ MF	43.4	98	**City**

ID. No	Land Description	OCP Land Use	Area (ha.)	Demand L/s	Recom. Service District
19	**Flat Land South of Byrns Road** Large area that will likely stay agricultural. Service is by wells and/or from Mission Creek. No watermains from the Districts are near this area. In the long term service is by either SEKID or the City.	Agr.	181.2	181	**City**
20	**Fischer Road Residential** Area is presently serviced by individual wells. In the long term, service is by either SEKID or the City. SEKID would have to install a watermain across Mission Creek.	Res.	43.9	44	**City**
21	**DeMontrieul Utility/Adjacent Land to Mission Creek** This private utility services approximately 60 SF units. There is unserviced land between the DeMontrieul Utility Lands and Mission Creek. Eventually it should be part of the SEKID system in the Hall Road area.	Res.	16.8	5	**SEKID**
22	**Spiers Road to Mission Creek** In the long term service is by either SEKID or the City. Most of the area is low enough to be served on the main City pressure zone but no mains are in the vicinity.	Agr.	110.9	111	**City**
23	**Southeast Portion of Casorso Road** In the long term service is by either SEKID or the City. Most of the area is low enough to be served on the main City pressure zone. Area should be in the City service area.	Agr.	75.7	76	**City**
24	**Swamp Road and Gordon Drive** In the long term service is by either SEKID or the City. The City surrounds these lands. The area should be in the City servicing area.	Agr.	52.8	53	**City**
25	**Mission Creek Golf Course** In the long term, the area should be in the City service area although water demand for irrigation may still come from the creek or wells.	Rec.	40.0	30	**City**
26	**Area North of Casorso Road** City service area.	Agr.	150.7	151	**City**
27	**Area South of Casorso Road** City service area.	Agr.	51.8	52	**City**
28	**Gravel Pit in South Mission** City service area.	Res.	10.4	10	**City**
29	**Lands Presently Within SEKID** The lands identified are presently within the boundaries of and serviced by SEKID. Consideration should be given to these lands being transferred to the City so that dry lands above SEKID could receive water. Compensation by SEKID to the City would have to be negotiated.	Agr.	~65	65	**City**
	North East Industrial Lands (not identified on map) Lands presently within the City boundaries services on contract basis by Lake Country. This is limiting growth and expansion of the industrial lands.	Ind.			**GEID**

4.5 WATER SERVICING PLANS

The existing long term servicing plans for the water utilities are listed in this section. The major expansion items are highlighted in red on the drawings. The water system improvements needed to service areas beyond district boundaries are not identified as the expanded boundaries must first be adopted by the Districts.

CITY OF KELOWNA – WATER SERVICING PLANS

The water servicing plans for the City water utility were provided by City staff along with budgets for the works. Expansion areas as identified within the OCP include: completion of Dilworth Mountain, development at Clifton North and the Glenmore Highlands, the South Mission, and densification throughout much of the City.

Water Sources

The City obtains all of its water from Okanagan Lake. This is not planned to change in the next 20 years. The intakes at Poplar Point and at Cedar Creek will likely see a steady growth in water demand in the time period. There is sufficient licensing from Okanagan Lake for and indefinite time period. Increased water demand is expected at the two largest intakes.

Water Distribution

The City's water distribution grid is generally well interconnected and, as a result, has good supply capacity. The system is the oldest of the water utilities as the piped systems were not renewed during the late 1960s and early 1970s as were the Improvement District systems. A significant list of upgrades is presented for the City in this section. Renewal will form a notable component of the water distribution improvements in the next 20 years for the City water utility. The City is currently working to providing 60% standby pumping capacity at all major pump stations in the event of a power failure.

Water Quality

Currently, the City is constructing a UV disinfection system on their intakes on Okanagan Lake at Cedar Creek pump station, Poplar Point Pump Station and at Eldorado Pump Station. This is being done to provide protection against *Cryptosporidium* and *Giardia* in the raw water supply. Should higher quality be required by the regulating authorities, there is room at the two primary sites, Poplar Point and Cedar Creek, for the addition of a membrane filtration plant.

Water Conservation

The City has several water conservation initiatives underway. They implement a Watersmart Program to educate their ratepayers on the benefits of saving water. The program success of the program, in conjunction with the water meter program, has yielded a measurable decrease in water demand within their service area. Just recently, the City revised their water pricing structure to an inclining block rate that results in those using an unacceptably high amount being charged.

The proposed City improvements for the next 10 years are illustrated in Figures 4.3 and 4.4 and tabulated in Table 4.5.

Table 4.5 - City of Kelowna - Water System Projects

ID	Target Year	DESCRIPTION	Total Capital Cost
1	**Comp**	Skyline/High Booster Pumps	607,020
2	**2005**	1,066 mm intake - Poplar Pt	801,360
3	**2005**	Upgrade Power Supply Poplar Pt	408,984
4	**2005**	2x 500hp Turbines - Poplar Pt	444,150
5	**2005**	Upgrade Valve Chmbr Poplar Pt	499,052
6	**2006**	New Cedar Cr. PS - 2 Pumps & Bldg.	7,915,135
7	**2007**	Skyline - new 500hp pump	310,905
8	**2007**	Skyline Suction Trunk 450 mm	621,381
9	**2007**	Skyline Valve Chamber	153,155
10	**2009**	Broadway Trunk 1350 mm	1,845,354
11	**2009**	Broadway Valve Chamber	204,207
12	**2009**	Cambridge Valve Chamber	204,207
13	**2009**	Knox Trunk 1200 mm	3,458,291
14	**2009**	Knox Valve Chamber	204,207
15	**2009**	Trench Place Trunk 900 mm	2,498,126
16	**2010**	Broadway - P. Pt. Drive	706,480
17	**2010**	125 hp Pump-Daon PS	529,853
18	**2010**	Twin Dilworth Trunk-300mm pipe	576,114
19	**2010**	Eldorado Pump Stn Refrbsh	296,100
20	**2010**	Skyline Trk - 200mm to 350mm	413,601
21	**2010**	Skyline Trk - 200mm to 300mm	655,197
22	**2010**	Summit PH Extension	74,025
23	**2010**	2- 50hp pumps @Summit PS	163,891
24	**2010**	Weddel Valve Chamber	255,259
25	**2011**	Clement Ave pipe -(Ethel-Richter)	339,098
26	**2011**	Ethel St Trunk-(Weddel-Clement)	510,691
27	**2011**	1085 m 300 mm pipe-Richter	908,448
28	**2013**	Hwy 97-Gordon -Chandler-Pipe	482,273
29	**2014**	Crawford - 3x100 hp Pumps	550,894
30	**2014**	Crawford 2 Trunk 300 mm pipe	594,240
31	**2014**	Crawford Trunk - 300mm pipe	301,641
32	**2014**	Expand Crawford Reservoir	336,814
33	**2014**	North Ellis - Pipe 500 mm	384,686
34	**2016**	Mission - 2 x 800 hp pumps	1,223,011
35	**2016**	Lakeshore Trunk - PRV Station	204,207
36	**2016**	Lakeshore Trunk 500 mm	5,337,001
	Annl	Annual Oversizing Component	1,200,000
		Engineering/Administration	220,915
		TOTAL	**36,439,973**

This schedule is conceptual and is subject to revision to meet future needs and conditions.

BMID – WATER SERVICING PLANS

Water servicing plans for BMID were supplied by Agua Consulting as excerpts from the upcoming Capital Plan Update. Expansion areas as identified within the OCP include: the Black Mountain lands which include the Bell Mountain, Kirschner Mountain and Mine Hill developments. In addition, Tower Ranch is now beginning construction and densification is occurring throughout the Rutland flats area of Rutland.

Water Sources

BMID presently obtains water from several sources. This will change in the future as more reliance will be placed on the water obtained from Mission Creek and less domestic use will be drawn from Scotty Creek due to the contamination in the creek from multiple uses. There is sufficient licensing for the foreseeable future. Increased storage is planned for BMID with the proposed construction of Black Mountain Reservoir and the rebuilding of Crescent Lake Dam proposed at the headwaters of Mission Creek.

Mission Creek during Freshet

Water Distribution

The BMID water distribution system is not well interconnected due to the extended service area size and gravity feed from source. The majority of the distribution system is in excellent shape as it was renewed during the late 1960s and early 1970s. The AC pipe is wearing very well and appears to have at least an equivalent lifespan remaining within for the watermains. A significant list of upgrades is presented for BMID in this section. Renewal is not expected to form a large component of these improvements in the next 10 years.

Water Quality

BMID is looking to continue to improve water quality and reduce health risks to their customers. One of the higher priority projects is the conversion of domestic customer use off of the Scotty Creek water system and onto the main distribution. This is due to the poorer raw water quality from Scotty Creek.

BMID is looking to carry out two major water quality improvement projects in the next 10 years. These include UV disinfection to provide protection against *Cryptosporidium* and *Giardia* in the raw water supply. The other project is to construct Black Mountain Reservoir which should improve water quality through better management of water supplied from Mission Creek. After the construction of these two projects, BMID is considering the installation of a filter plant at the new reservoir site to filter all of the BMID domestic component for the 7 months when irrigation is not underway by the agricultural community.

Water Conservation

BMID has several water conservation initiatives underway. Through the KJWC, they contribute to the City's Watersmart Program to educate their ratepayers on the benefits of saving water. As of January 1, 2005, BMID required that all new connections be metered. BMID has a relatively tight water system with minimal leakage.

Improvements for the BMID are illustrated in Figure 4.5. The major expansion item is the Black Mountain Reservoir. Costs for projects are summarized in Table 4.6.

Table 4.6 - Black Mountain Irrigation District - Water System Projects

ID	Target Year	DESCRIPTION	Total Capital Cost
9	2005	600mm East Bench Trunk Main - Swainson to Day Road	$ 945,588
4	2006	Conduit Protection	$ 25,300
10	2006	450mm McCurdy Road Watermain - Day Road to McKenzie	$ 328,900
12	2006	Day Road PRV	$ 107,525
21	2006	PRV 1 Rehabilitation	$ 253,000
27	2006	TOC On-line Monitors	$ 37,950
20	2006-07	Scotty Creek - Water Quality Improvement	$ 531,300
28	2006-07	Bulk Fill Water Stations	$ 212,520
8	2006-09	750mm East Bench Trunk Main - Black Mtn Reservoir to Swainson	$ 2,333,925
29	2006-12	Security / Instrumentation Upgrades	$ 316,250
22	2007	PRV 2 Rehabilitation	$ 284,625
25	2007	Chlorinator Roof Replacement	$ 6,325
1	2007	Water System Assessment as per DWPA	$ 18,975
16	2007-09	Black Mountain Subdivision - 5 acre parcels	$ 3,778,922
13	2007-10	BMID Black Mountain Reservoir	$ 11,935,275
2	2008	Wells #4 AND #5 - Well Head Protection	$ 12,650
3	2008	Decommission Wells No. 1, 2 AND 3	$ 18,975
11	2008	400mm McCurdy Road Watermain - McKenzie to Gibson Road	$ 247,940
17	2008	WTP - Building over Flocculators	$ 151,800
23	2008	PRV 3 Rehabilitation	$ 94,875
5a	2009	Graystoke Dam - Radio Repeater and Remote Monitoring and Controls	$ 139,150
14	2010	Black Mountain Reservoir - UV Disinfection	$ 5,344,625
18	2010	Black Mountain Reservoir - On-Site Sodium Hypochlorite Generator	$ 1,834,250
5b	2012	Fishhawk Dam - Radio Repeater and Remote Monitoring and Controls	$ 139,150
24	2012	Mission Creek - Ellison Aquifer Protection Plans	$ 12,650
5c	2015	Belgo Dam - Radio Repeater - Remote Monitoring and Controls	$ 139,150
6	2015	Crescent Lake Dam Reconstruction	$ 581,900
7	2015	Stevens Reservoir - Baffling for Circulation Improvement	$ 126,500
15	2015	Filtration Plant (12 ML/day) - Black Mountain Reservoir	$ 4,554,000
26	2015	WTP Clarifier - Fencing	$ 21,505
19	2025	On-Site Chlorine Generation at Surge Tower	$ 721,050
		TOTALS	**$ 35,256,550**

GEID – WATER SERVICING PLANS

Water servicing plans for GEID were supplied by Agua Consulting from the 2004 Capital Plan Update report. Expansion areas as identified within the OCP include: part of the Glenmore Highlands, infilling in the Glenmore Valley, development at the new University of British Columbia Okanagan, industrial development at the Airport and commercial works at the Kelowna International Airport. Quail Ridge development is nearing completion and water supply will also be required for the proposed Vintage Landing Wellness Resort north of McKinley Landing and to service the City's North Industrial park northeast of Ellison Lake.

Water Sources

GEID presently obtains water from several sources including Kelowna Creek and five groundwater wells. This will change in the future as more water will be required to meet the expected additional demand. GEID is looking to Okanagan Lake to meet these future demands. Sufficient licensing is in place from the creek source: however, an additional water license has been applied for on Okanagan Lake.

Water Distribution

The GEID water distribution system has portions that are well interconnected and other areas where there is a single supply main feeding an area. The majority of the distribution system is in excellent shape as it was renewed during the late 1960s and early 1970s. The AC pipe is wearing very well with significant lifespan expected for the watermains. A list of upgrades is presented for GEID in this section. Renewal is not expected to form a large component of these improvements in the next 10 years.

Water Quality

GEID is looking to improve water quality and reduce health risks to their customers through a staged approach. The initial objective is to improve water quality, taste and aesthetic concerns related to the Kelowna Creek water source. This issue will be improved through mixing of creek water, well water and a new pump station to convey Okanagan Lake water into McKinley Reservoir.

Site for Future UV reactors and WTP (GEID)

Beyond source changes, GEID is looking to carry out two major water quality improvement projects in the next 10 years. These include UV disinfection to provide protection against *Cryptosporidium* and *Giardia* in the raw water supply. Another major project is to construct a Water Treatment Plant below McKinley Landing to treated water to the domestic customers of the District. Reduction of this supply

and the size of the plant is being considered through splitting off certain portions of the service area and feeding these with lower quality creek water.

Water Conservation

GEID has several water conservation initiatives underway. Through the KJWC, they contribute to the City's Watersmart Program to educate their ratepayers on the benefits of saving water. As of October 1, 2003, GEID required that all new connections be metered. GEID has obtained funding for agricultural metering and all agricultural properties must be metered by March, 2008. GEID also has very low leakage in their water distribution system (3.5 L/s for the entire system).

Improvements for the GEID are illustrated in Figure 4.6. The major expansions include a pump station from Okanagan Lake and a water treatment plant below McKinley Reservoir. The estimated project costs are summarized in Table 4.7.

Table 4.7 - Glenmore-Ellison Improvement District - Water System Projects

ID	Target Year	DESCRIPTION	Total Capital Cost
3	**2005**	Airport Well No. 2 (completed to be commissioned)	$ 258,060
1	**2005-06**	Tutt Pump Station Rebuild	$ 450,000
8a	**2005-06**	UBCO Balancing Reservoir	$ 3,200,000
2a	**2006-07**	Okanagan Lake Pump Station and Intake	$ 2,327,600
2b	**2006**	Water Transmission Main, Okanagan Lake to McKinley Res.	$ 2,759,724
11b	**2006**	Tutt to Quail Bst Stn Watermain Upgrade	$ 396,261
10	**2006**	Bullach Pump Station upgrade	$ 55,660
8b	**2006**	Watermain Expansion to OUC North and Kelowna Airport	$ 411,758
5	**2007**	District Wide Metering Program	$ 1,534,919
8c	**2007**	Watermain Expansion to OUC South	$ 426,938
6a	**2008**	Scenic Road Generator	$ 170,775
13	**2008**	Walker Road PRV (Ellison Area)	$ 50,600
6b	**2008**	Scenic Road Pump Station Upgrade	$ 50,000
11c	**2009**	McKinley Reservoir Pump Station (Low Head, High Cap.)	$ 417,450
9	**2009**	Countryview Estates Pump Station Upgrade	$ 12,650
7a	**2009**	McKinley, UV Disinfection Plant (for water leaving McKinley)	$ 2,137,850
7e	**2009**	McKinley Reservoir Roadside Barriers	$ 145,336
4	**2010**	Sexsmith Well Rehabilitation	$ 240,350
7b	**2010**	McKinley UV feed for McKinley Waterworks	$ 159,390
7c	**2011**	Dedicated Pipeline through McKinley Reservoir	$ 447,810
12	**2014**	McKinley Water Treatment Plant	$ 18,532,250
7d	**2016**	On-Site Chlorination Generator	$ 437,690
11a	**2017**	NE Transmission Main	$ 3,265,724
		TOTALS	**$ 37,888,794**

RUTLAND WATERWORKS DISTRICT – WATER SERVICING PLANS

Water servicing plans for RWD were supplied by Mould Engineering and from RWD from their 2004-2014 Capital Plans. Expansion areas as identified within the OCP include densification within the Rutland Town Centre and MF zoned areas.

Water Sources

Rutland Waterworks District presently obtains all of its water from the Kelowna aquifer. This is not expected to change in the future as only a moderate amount of water is expected to be required to meet the future demands. Ground water from the Kelowna aquifer is usually of very good quality and is well protected from surface contaminates.

The District has plans to construct a new 5.7 million-litre reservoir off the proposed Hollywood Road extension south of Mission Creek. This reservoir will provide a more dependable supply of water for peak flows and worst case fire flows. The reservoir will also relieve potential pressures on short-term well operations and will help with water source selection.

Water Distribution

The Rutland Waterworks District water distribution system is generally well interconnected. Major improvements include a new Pump Station No. 14, upgrading of Pump Station No. 7 to 151 L/s and construction of the balancing reservoir for the lower zone.

The majority of the distribution system is in good condition and is regularly upgraded in developing areas. Some areas have AC pipe which is over fifty years old, but shows minimal deterioration. The District has found that some replacement is required as surrounding projects force rehabilitation of the pipelines. Other than the odd maintenance requirement, the District does not expect any significant pipe renewal projects in the next ten years. Continuous modeling and planning will be required to assess pipe sizing and fire flow requirements into the future, based on the latest levels of development in Rutland. A list of upgrades is presented for RWD in Table 4.8.

Water Quality

RWD has a variety of water qualities from their well sources. They currently utilize their SCADA system to provide water from the best available groundwater sources to meet the system demands. RWD is one of only four utilities in the Okanagan that meets the IHA 4,3,2,1,0 requirement. This rating is a clear recognition of the safety of the RWD supply.

In late 2003, RWD commisioned Kerr Wood Leidal to complete a Groundwater Treatment Feasibility Study. The object of the study was to review feasibility and costs for providing treatment, primarily for the removal of iron and manganese. Both iron and manganese are primarily an aesthetic concern. Regular reviews are made of technological advances in this field of treatment and pilot projects are anticipated once viable options are identified.

Additional disinfection is planned for the system when the second reservoir is built for the lower zone.

Water Conservation

Rutland Waterworks has several water conservation initiatives underway. RWD is a metered system and has been for 30 years. Through the KJWC, RWD contributes to the City's Watersmart Program to educate the ratepayers on the benefits of saving water. The district has been using an increasing block toll rate for the past 9 years, which has proven to be effective in controlling unnecessary over-consumption. Improvements for the RWD are tabulated in Table 4.8.

Table 4.8 - Rutland Waterworks District - Water System Projects

ID	Target Year	Description	Total Capital Cost
Distribution System			
1	2005	Highway 33-97 Intersection	$150,000
2	2005	Froelich Road	$125,000
3	2006	Hollywood Road	$55,000
4	2006	Benchview Road	$14,000
5	2007	Cactus Road	$18,000
6	2007	Dougall-Asher – Sewer Zone E	$200,000
7	2006-2025	Miscellaneous, undefined Pipelines	$488,000
		Sub Total	**$1,050,000**
Water Supply Works			
8	2008	Pump Station No. 14W	$170,000
9	2008	Reservoir (5.7ML) and Pipeline	$2,600,000
10	2009	Pump Station No. 14 E	$140,000
11	n/a	Disinfection and Treatment	$300,000
12	ongoing	20 Year Planning	$190,000
13	2007-2025	Miscellaneous Well Upgrades	$350,000
		Sub Total	**$3,750,000**
		TOTAL	**$4,800,000**

SOUTH EAST KELOWNA IRRIGATION DISTRICT – WATER SERVICING PLANS

Water servicing plans for SEKID were supplied by SEKID staff and Mould Engineering from their 2004 - 2014 Capital Works Program. Expansion areas as identified within the OCP include Gallaghers Canyon and the areas identified as the South East Kelowna development lands.

Water Sources

SEKID presently obtains water from two sources, groundwater and the Hydraulic Creek watershed and diversion areas. This is not likely to change in the future as there are no local high capacity sources with the exception of Mission Creek. SEKID is not currently looking for additional sources. They are in the process of developing additional storage on Turtle Lake. Sufficient licensing is in place from the creek sources.

Water Distribution

The SEKID water distribution system is not well interconnected due to the large volumes of water supplied and the cost to interconnect the distribution system. The majority of the distribution system is in very good shape as it was renewed during the late 1960s and early 1970s. The AC pipe is wearing very well with significant lifespan remaining for these watermains. A list of upgrades is presented for SEKID in this section. Renewal is not expected to form a large component of these improvements in the next 10 years.

Water Quality

SEKID is seriously looking to improve water quality and reduce health risks to their customers through a staged approach. Their current plan involves the development of a water treatment plant that is capable of providing treated water to the entire District for 7 months of the year and treated water to the domestic customers in the McCulloch Road corridor for the entire year. Pilot testing has been completed on a DAF clarification process with filters.

Water Conservation

SEKID has several water conservation initiatives underway. Through the KJWC, they contribute to the City's Watersmart Program to educate their ratepayers on the benefits of saving water. For the past 10 years, they were the only water district in the Okanagan Valley that metered their irrigation connections. The successes they have achieved during this time were sufficient to expand the supply abilities of the SEKID to sell water to currently "Dry" lands. Inclining block volumetric pricing was implemented in 2003 and showed significant reductions in water usage.

Improvements for the SEKID are illustrated in Figure 4.8. Table 4.9 provides a summary of the proposed projects in year 2005 dollars.

Table 4.9 - South East Kelowna Irrigation District - Water System Projects

ID	Target Year	DESCRIPTION	Total Capital Cost
1	2005	Saucier Road Watermain	$ 70,000
2	2006	Gallaghers Fairway South - Mahonia Drive watermain	$ 110,000
3	2006-08	Turtle Road Reservoir (2,100 ML)	$ 1,700,000
4	2012	Ballock Road / Luxmore Road Watermain	$ 160,000
5	2013	PRV 32M Upgrading (Carter Road)	$ 100,000
6	2015-20	Water Treatment Plant (12.5 ML/day capacity)	$ 5,500,000
		TOTALS	**$ 7,640,000**

4.6 WATER SYSTEM REDUNDANCY AND EMERGENCY SUPPLIES

Emergency Response Plans

Emergency response plans are a requirement of the Operating Permits of the water utilities. These plans set out procedures for how emergencies are to be responded to by utility staff personnel. In considering emergency supply procedures, the utility managers were contacted to determine the risks present with respect to loss of supply.

For this assessment, the utility risk is assessed as a loss of supply due to an event such as an extended electrical failure, a slide in one of the watershed creeks, a break in a major transmission main, or where water service would be interrupted for an extended period of time.

Emergency Materials

All utilities should consider a shared emergency materials list for the purposes of large diameter breaks. As a water utility cannot afford to stock replacement parts for all possible emergencies, they should as a minimum know where the materials can be quickly obtained. A useful parts inventory should include large diameter watermain pipe and repair couplings for the full variety of watermain materials in the ground.

If all of the utilities kept their less common materials inventories up to date and shared, there would be possible improved service in the event of a main break. The benefits of access to a large, shared emergency materials list should increase with the number of participants. The number of utilities could be expanded from just KJWC members to WJWC members, District of Lake Country, Greater Vernon Water, District of Summerland and the City of Penticton. An example materials list is provided in Appendix D.

Emergency Measures

In the event of loss of electrical power, the utilities may be able to continue to supply water, provided there is a gravity supply and there is sufficient back-up power to run the disinfection and/or water treatment equipment. Where there is gravity supply, water can be provided without the implementation of major infrastructure. It may also be possible to obtain water across the pressure zones from a higher source.

Where interconnection requires pumping of water across pressure zones, emergency measures in which to accomplish this are not easily accessible. Diesel generator driven pump systems are available in the Lower Mainland, but cannot be ordered, delivered or installed in a short time frame. Consideration should be given to the development of a transportable emergency generator system with substantial capacity. These systems would be secure, mobile and would be delivered to a specific location in the distribution grid of a utility. Their purpose would be to lift a reasonable volume of water up one or two pressure zones. The key component would be to provide significant electrical power in the event of an extended power failure. For the station to be able to work, transfer switching would have to be in place at the facility.

Consideration of a mobile emergency generator is recommended as a joint project for the KJWC. This work could also be coordinated with potential contribution from other water suppliers in the region.

Emergency Interconnections

For a water system interconnection to be feasible, at least one water district would benefit in the event of a major loss of source water. The cost of interconnection should be covered by the benefiting district or apportioned between the two water suppliers that benefit. Table 4.10 provides a summary and comments for the Districts related to interconnections.

Table 4.10 Summary of Interconnections

Receiving Water Utility	Supplying Water Utility	Comments
City	GEID	3 existing interconnections with City (not automatic)
	SEKID	Potential for interconnection in Crawford area
	RWD	2 interconnections with City (not automatic)
	BMID	No potential for interconnection. Utilities do not have common boundary.
BMID	City	No potential for interconnection. Utilities do not have common boundary.
	GEID	One interconnection at Sexsmith Road, one at Ellison Firehall
	RWD	2 feeds up to BMID. Pumping is in place from low PZ
	SEKID	No interconnections. Two possible future possibilities, both expensive
GEID	City	3 interconnections from City. Pumping is required and not in place.
	BMID	Two interconnections. Feed from BMID at Sexsmith is very weak.
	RWD / SEKID	No potential for interconnection. Utilities do not have common boundary.
RWD	City	2 interconnections. City HGL is lower. Pumping is required.
	BMID	6 interconnections in place. One is automatic, others are manual
	GEID	No potential for interconnection. Utilities do not have common boundary
	SEKID	At location of future water reservoir for RWD
SEKID	City	Potential for interconnection at Crawford. Limited capacity. Pumping required from City
	BMID	No interconnections. Two possible future possibilities, both expensive
	GEID	No potential for interconnection. Utilities do not have common boundary.
	RWD	Potential for interconnection at East Kelowna Road at Mission Creek.

5. SUMMARY

5.1 INTRODUCTION

This section provides a summary of the major conclusions and recommendations of this Strategic Plan.

5.2 CONCLUSIONS

The major conclusions generated during the development of this plan include the following:

Water Source Review

- As shown in the aerial photograph on the front cover, a significant area of the City in both the agricultural and residential areas is green and is dependant on water for irrigation. The aerial photograph taken in 2003 shows the contrast between the arid surrounding lands and those that are irrigated;
- The present annual average water demand for the five large water utilities making up the KJWC is estimated to be in the range of 50,000 ML. The compiled data for water demand had to be "normalized" to create an annual average demand as the characteristic of water use and the climatic factors are constantly changing;
- The current licensed volume of water available to the KJWC utilities is 131,850 ML meaning that in an average water use year, the water suppliers are utilizing only 33 % of their licensed allotment.
- During a hot and dry year such as 1998, water demand is estimated to increase by almost 14% to 57,000 ML. This results in the utilities using 38% of their licensing;
- The five Kelowna water utilities obtain water from the following sources:

Okanagan Lake supply	29 %	(14,500 ML)
Watershed / creek supply	57 %	(28,675 ML)
Groundwater supply	14 %	(7,025 ML)

- With 57% of the source water coming from multi-use Crown watersheds, protecting source water quality and quantity is beyond the authority of the KJWC. IHA, RDCO, MoE and the MoAL have statutory authority over watershed land-use and should be encouraged to develop pro-active source water protection policies.
- The average amount of water supplied on an annual basis by each of the five Kelowna utilities, and their percentage of the total supply is summarized as follows:

City of Kelowna	14,500 ML	29%
Black Mountain Irrigation District	13,400 ML	27%
Glenmore-Ellison Improvement District	6,800 ML	13%
Rutland Waterworks District	4,000 ML	8%
South East Kelowna Irrigation District	11,500 ML	23%
TOTAL	**50,200 ML**	**100%**

- Although the City of Kelowna utility provides water to over half the population, they supply only 29% of the total water volume for the City;
- It appears that sufficient water licenses are held by the Kelowna water utilities for the foreseeable future;

Impact of Growth on Water Supply

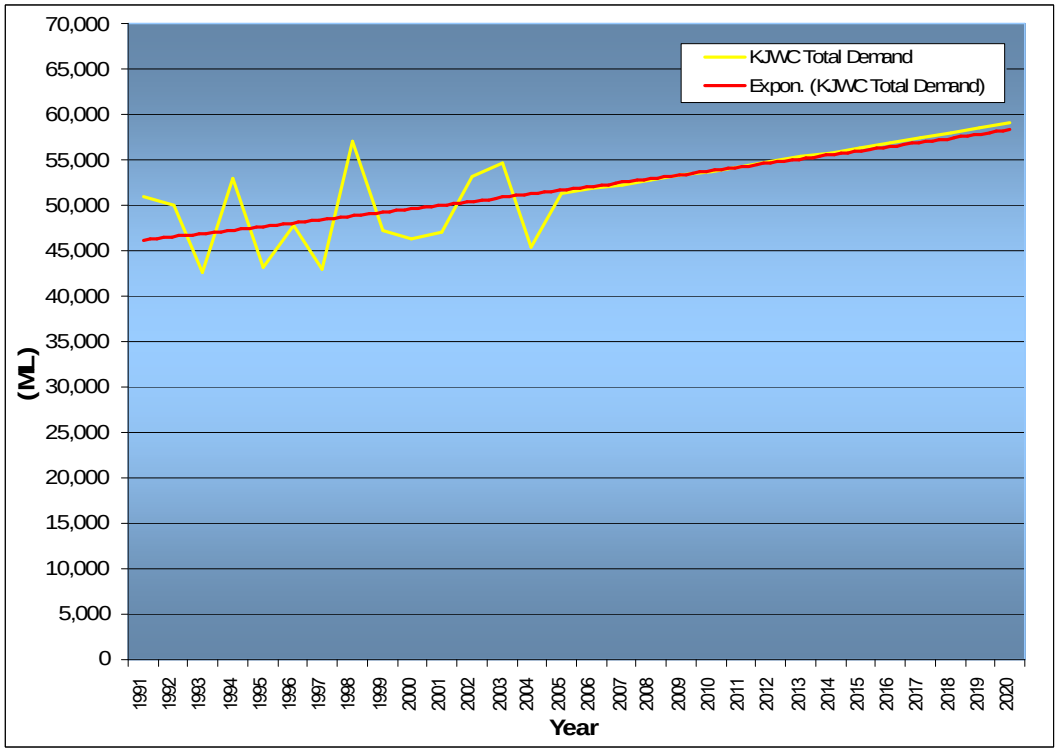
- The population growth over the last 8 years according to BC Census data shows that Kelowna has increased from 92,860 persons in 1996 to 105,620 persons in 2004 or a growth rate of 1.62%;
- The OCP predicts a growth rate of 2.40% over the 20 year time frame from 2000 to 2020. This would result in a population in the range of 150,000 people by the year 2020;
- Annual water demand is closely related to the climatic factors of temperature and precipitation. The climatic factors have a much more prominent impact than the impact of growth and development in the region as shown in the figures in Section 2 of this report;
- The City of Kelowna and GEID are the only water utilities currently accessing water from Okanagan Lake. GEID has plans to utilize this source to a greater extent in the near future;
- The long term water supply is expected to be manageable for the following reasons:
    1. The implementation of water meters and demand management tools will help to monitor and control water consumption;
    2. Future development will be more multi-family type housing which uses less water than single family type development;
    3. There will be less "dry" land remaining to irrigate;
    4. The value of water will increase making it more valuable and;
    5. Irrigation practises will become more efficient as has been the case in the past 10 years.
- The highest growth rates for the five water utilities are expected to be within the GEID and the City water utilities;
- From the trend line on Figure 5.1, it appears that water demand is increasing very slowly in the region. The last 14 years of data shows only 1,000 ML of increased demand or a water demand increase over that time period of only 0.15%;

Water Conservation Considerations

- The highest water use year in the last 14 years for the five water utilities was 1998 with 57,000 ML of water used. Although 2003 was as hot and dry and there was additional development, water use has been significantly controlled through the management practises of water meters, education and effective rate structures. It was noted historically that the utilities with meters experienced a lower impact from climatic conditions than those without meters;
- Recent Global Warming studies specific to the Okanagan suggest a decrease in precipitation in the next 50 years. If this data proves to be true, it is predicted that total volume of supply from the watersheds would be reduced in the range of 15% by the year 2050 and 30% by the year 2080;

- Groundwater is currently utilized to supplement source water capacity for three of the water systems, however it may be available as an alternative source to reduce the utility reliance on the valley watersheds;

Figure 5.1 - KJWC Projected Annual Average Water Demand



- There is over $120,000,000 in capital expenditures planned for the KJWC utilities in the next 20 years.
- Of the total expenditures planned, water treatment forms approximately half of the total expenditure. Major treatment and water quality improvement projects are planned for BMID, GEID and SEKID;
- As water treatment forms a significant portion of the overall water improvement projects, the water utilities must plan how to move forward on these financial issues. Water quality and renewal initiatives will have the largest impact on utility rates in the next 20 years.

5.3 RECOMMENDATIONS

The major recommendations of this Strategic Plan are as follows:

- Based on the information assembled, it appears that no major actions are required for the KJWC related source capacity and licenses as these appear sufficient for the foreseeable future. The utilities that rely on upland watershed storage are more susceptible to drought cycles. Drought management plans in place in draft form for BMID and GEID and will soon be passed as bylaws. SEKID has meters in place with which to manage drought conditions.
- Water rates must increase at a rate equal to or slightly above the construction inflation rate, otherwise the ability for the utilities to implement upgrading and renewal projects becomes extremely limited;
- With water quality regulations becoming more stringent, the implementation of water treatment will result in higher water rates for both domestic and irrigation users. Maintaining a low rate for irrigation water helps to maintain the green space and high quality of life enjoyed within Kelowna. A significant issue facing three of the KJWC utilities will be treatment and/or separation of the agricultural water supply;
- The KJWC should continue to develop common policies for water supply in the Kelowna area. Meeting occasionally with the Westside Joint Water Committee should yield benefits including the creation of common objectives, shared contributions to public education on water, shared advertising, common policies for water management, and common standards and practises;
- The use of water meters forms the most effective means of controlling water-use during drought years as demonstrated by the utilities with meters. All of the utilities should be working towards implementation of a education and metering program and adjusted rate structure to encourage responsible water-use;
- Local and senior governments must continue to work on expansion of the water quantity and quality monitoring as well as work on a Basin-Wide approach to assess, expand and improve water management in the Okanagan Valley. Once the Provincial work related to the Okanagan Basin capacity and the groundwater inventory are completed, the KJWC should move forward on groundwater protection issues.
- Land use planning and monitoring will be a component of protecting the groundwater resource and the City and RDCO organization must both be involved at a land use level. Their bylaws should be integrated to help protect the watersheds and groundwater resources;
- KJWC utilities should plan for expansions of their water systems to service the unserviced lands as identified in Section 4 of this report;
- KJWC should open discussions with the RDCO to inform them of the plans within this report. The RDCO has the tools by which to manage land use within the watersheds. The formation of small new utilities in the surrounding areas should be avoided. In accordance with Provincial direction, all new small scale development should be connected to the nearby larger existing water utilities where it is practical to do so. This allows for qualified operators and better redundancy and capacity to service the population;

- Emergency Response Plans for the KJWC utilities, which are currently being updated with IHA, should be circulated to the other utilities so that involvement and /or support will be made available in times of emergency.
- The members of the KJWC should work to refine their interconnections and develop policy for system interconnection that is documented and understood well in advance of an emergency;
- The KJWC should develop a shared emergency materials list as set out in Appendix D. The materials list will to provide an inventory of difficult to obtain watermain parts and fittings during an emergency.