Water Treatment Plant Annual Report 2022

Prepared by Alistair D. Wardlaw, Water Quality Supervisor
March 2023

Contents

This report was completed in March 2023 in accordance with the requirements of the Ministry of Health Services and the Interior Health Authority.

1.0 Water Treatment History

In 1986 the City of Penticton experienced an outbreak of Giardia that was determined to have originated from the Penticton Creek water source. Engineering studies were conducted in 1987-1988 and a dual source, water treatment plant was determined to be the best solution for the future of Penticton. The plant was commissioned in the spring of 1996 and is located at the East end of Penticton Avenue next to Penticton Creek. In January of 1997 the City placed its new water treatment facility online and the Penticton Creek source was returned to service. Since 1997 the City has used only Okanagan Lake and Penticton Creek for its domestic water usage. The two sources are used in variable proportions from year to year. This is determined by source water quality, quantity and plant operational considerations.

In 2005 the City awarded a contract to Earth Tech (AECOM) Engineering Consultants to review the current water system and address any anticipated issues likely to arise over the next 5-year, 10-year and 15-year terms. A preliminary recommendation of this study was that Penticton Creek could be used as an alternate summer peak demand water source. Pilot studies were completed in the fall of 2007 and a high rate dissolved aeration process was identified as the preferred option to meet increased summer demands. Final design was completed in early 2008 and construction began in the fall of 2008. The project was completed in November 2009 and has allowed the City to operate a dual source variable conventional water plant. Recent changes have included the replacement of chlorine gas and Sulfur dioxide with the safer options of Sodium hypochlorite and Vitamin C.

2.0 Water Supply System

Penticton's water supply system was initially designed in the 1920s to use water from Penticton Creek. Okanagan Lake water was pumped into the system during the spring freshet due to the high colour and organics in the creek water. Water is currently supplied to the treatment plant from two sources – Penticton Creek, through a gravity system, and Okanagan Lake, through pumps and a dedicated raw water main. Okanagan Lake Pump Station was upgraded with new electrical controls, variable frequency drives, rebuilt pumps, an upgraded surge protection valve, and a cooling system for the Motor Control Centre to improve the reliability and life of key electrical equipment.

Penticton Creek Intake

City of Penticton operates a drinking water intake in Penticton Creek. The Penticton Creek Watershed covers 174 km^2 and represents 90% of the total watershed area. According to previous research by Don Dobson, the important snow-sensitive zone is 1660 m. Most of the precipitation in the watershed falls, primarily as snow, within this zone.

Penticton Creek originates from Greyback Mountain Dam approximately 10 km east of Penticton at an elevation of 1,649 meters. Many small tributaries and creeks also feed Penticton Creek, which allows water to be used at times without depleting storage.

The City of Penticton maintains Greyback Lake and Dam, which has a maximum storage volume of 10,000-acre feet, or 12.3 million cubic meters. The dam was built in 1967 under the A.R.D.A. (Agricultural Rural Development Act) program. Untreated water is diverted from Penticton Creek at the Campbell Mountain Diversion for the North agricultural irrigation system. Penticton Creek continues west towards Penticton # 2 Dam.

The intake is located at the end of Penticton Avenue and draws water from a small balancing reservoir (71,500 m^3) built in the stream channel of Penticton Creek. The creek flows over the top of the dam and onwards to Okanagan Lake.

Further upstream is the Campbell Mountain Reservoir, storing up to 31,000 m^3, which serves as a balancing reservoir for the irrigation system along the Naramata Bench.

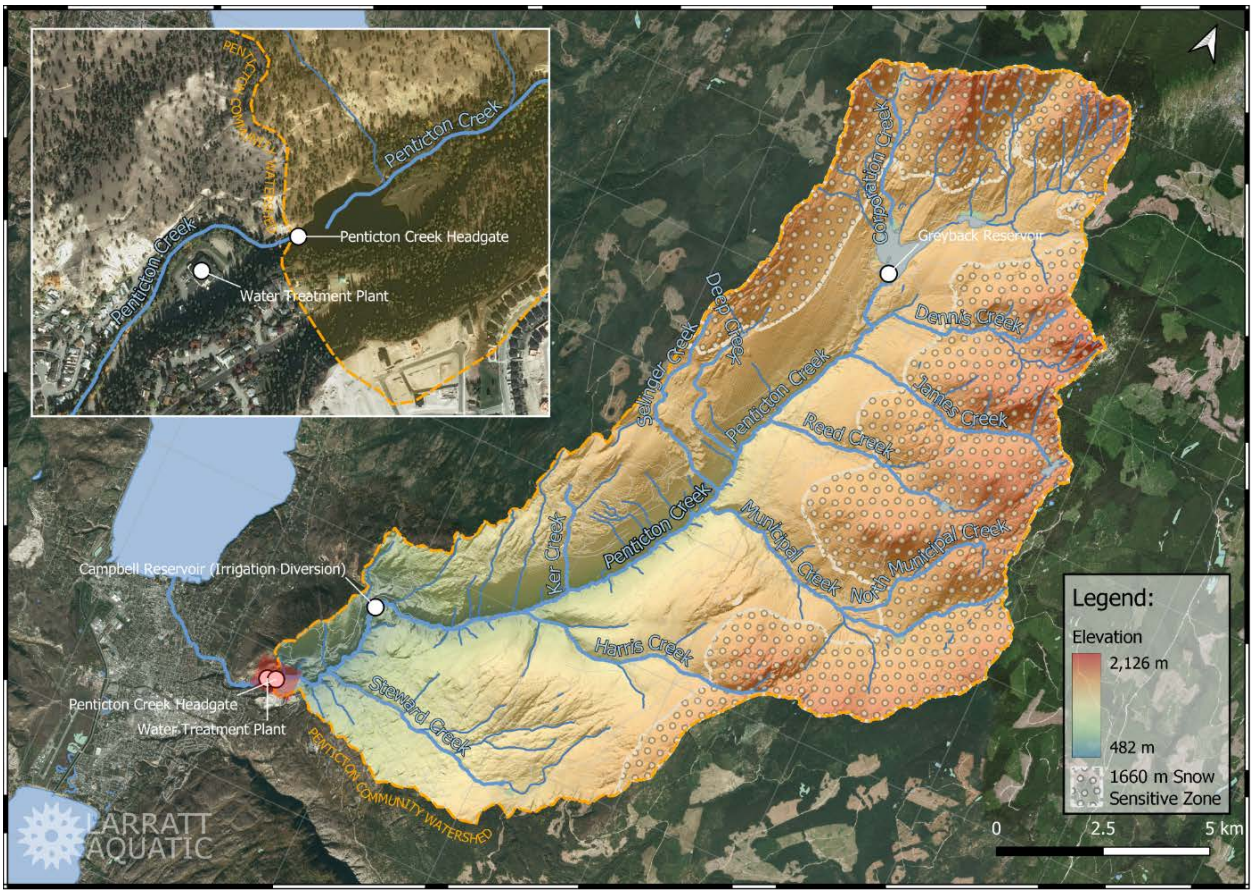
Water temperature in Penticton Creek shows strong seasonal variation ranging from 2.0 °C during January 2022, to 22.6 °C during late July 2022. Storage in Greyback Reservoir contributes to the significant summer warming observed in the creek water.

Dissolved oxygen (DO) concentrations were excellent throughout the year showing typical seasonal variation (warm water holds less oxygen), averaging 11.0 ± 2.1 mg/L during 2022.

pH also exhibited seasonal variation with higher values in winter because of larger relative groundwater contributions; groundwater is harder and has higher pH. pH in the Penticton Creek raw water averaged 7.2 ± 0.3 during 2022.

During the 2022 freshet the True Colour, which is an indicator of organic material in the water averaged 47.6 with a high of 124 and a high turbidity of 3.41. Throughout the remainder of the year, turbidity was low, averaging 0.78 ± 0.65 NTU during 2019-2022. The highest turbidity reading during 2019-2022 was 7.4 NTU on Aug 11, 2020.

Figure 1: Penticton Creek Dam 2



Creek Name	Confluence Elevation (m ASL)	Watershed Area (ha)	Terrain Zone	Within Snow-Sensitive Zone?
Corporation	1578	556	Highlands u/s of Greyback Lake	Y
Dennis	1515	978	Highlands	Y
James	1476	854	Highlands	Y
Reed	1337	903	Highlands	Y
Deep	1218	245	Canyon	Y
Selinger	1132	314	Canyon	Y
Municipal	1100	2748	Highlands into Canyon	Y
Harris	751	1386	Highlands into Canyon	Y
Steward	519	1555	Mid-elevation into Canyon	N

Figure 2: Penticton Creek Tributaries - Larratt Aquatic

In 2022, 2.35 billion litres of creek water was blended with the Okanagan Lake water and treated at the Water Treatment Plant in 2022. The total intake into the treatment plant was 7.05 Billion litres in 2022.

Figure 3 Penticton Creek North Irrigation System

Okanagan Lake Intake

Okanagan Lake is a large, deep lake with low nutrient concentrations. It is approximately 135 km long, 1-5 km wide, and has a surface area of 350 km^2. The theoretical residency time is ~52.8 years. Its maximum depth is 230 m, with a mean depth of 76 m, and it is divided into three sub-basins by underwater ridges. The intake is located within the south basin. Okanagan Lake receives water from 19 major tributaries, of which Mission Creek and Trout Creek are the largest, and discharges into Okanagan River at Penticton (a tributary of the Columbia River).

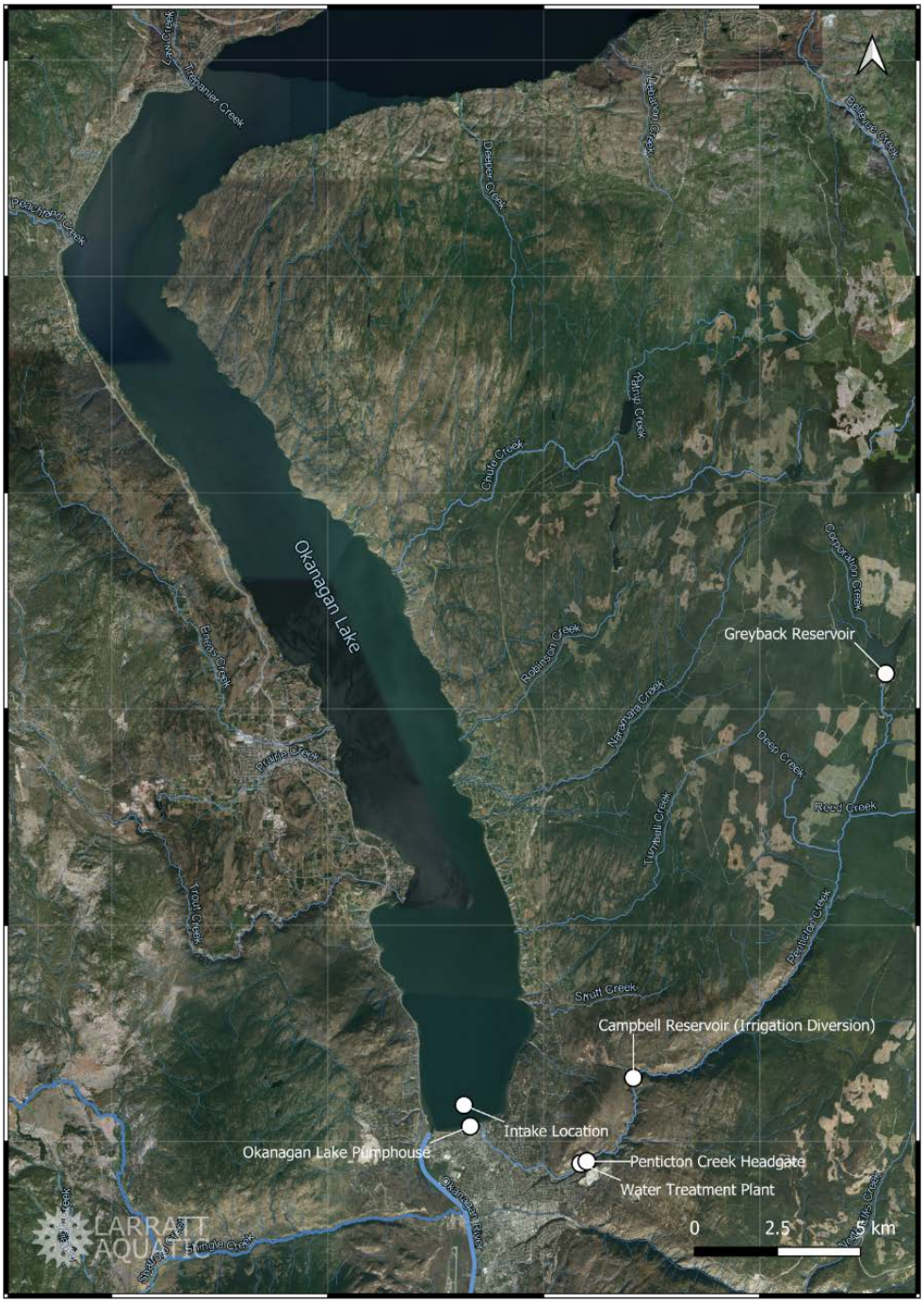


Figure 4 Okanagan Lake Water Shed -Larratt Aquatic

Every year, the single greatest effect on water quality in Okanagan Lake is the size of the freshet and its variable imports of nitrogen, phosphorus, pH, calcium, sulphates and organic/inorganic particulates.

Okanagan Lake is monomictic, forming distinct water temperature layers during the spring and remains stratified through the summer. The water layers erode during the fall until a windstorm mixes the water column, usually in November. The lake becomes one temperature top to bottom and remains fully mixed throughout the winter until stratification commences again in early May

Dissolved oxygen concentrations were excellent throughout the Okanagan Lake water column, averaging 10.0 ± 0.8 mg/L during July-October 2022. pH in the Okanagan Lake raw water averaged 8.12 ± 0.12 during 2019-2022

Turbidity in the Okanagan Lake raw water averaged 0.28 ± 0.24 NTU from 2019-2021. From 2019-2022 freshet caused seasonal 1 NTU exceedances of turbidity. There was a clear freshet effect on turbidity with seasonal exceedances of 1 NTU in each year from 2019-2022.

Figure 5: Okanagan Lake Pump Station

Okanagan Lake water is pumped to the treatment plant from the Okanagan Lake pump station via a 5 KM dedicated main.

In 2022, the City of Penticton pumped 4.71 billion litres from the Okanagan Lake pump station to the Penticton Water Treatment Plant. The total intake into the treatment plant was 7.06 billion litres.

On June 6 the Okanagan Lake raw water supply main had a major break on upper Penticton Ave. and the Water Treatment Plant operated on 100 % Penticton Creek raw water until the Lake line was returned to service on July 17. This occured during freshet at the same time as the highest true colour and turbidity levels were measured. Staff made major adjustements in the process and were able to successfully opearate the WTP during this period on 100% Penticton Creek water. Investigations are ongoing on possible remote inspection techniques of the 26 year old pipeline as the failure was due to corrosion.

Warren Avenue Well

Warren Avenue Well was installed by the City of Penticton in 1982, and is 92.9 m deep, completed in a confined and flowing artesian aquifer encountered at a depth between 52.1 and 87.5 m. The Warren Avenue Well has not supplied water since 1995. It is not in operational condition and is slated to be de-commissioned in 2023 or 2024.

Figure 6: Warren Ave Well

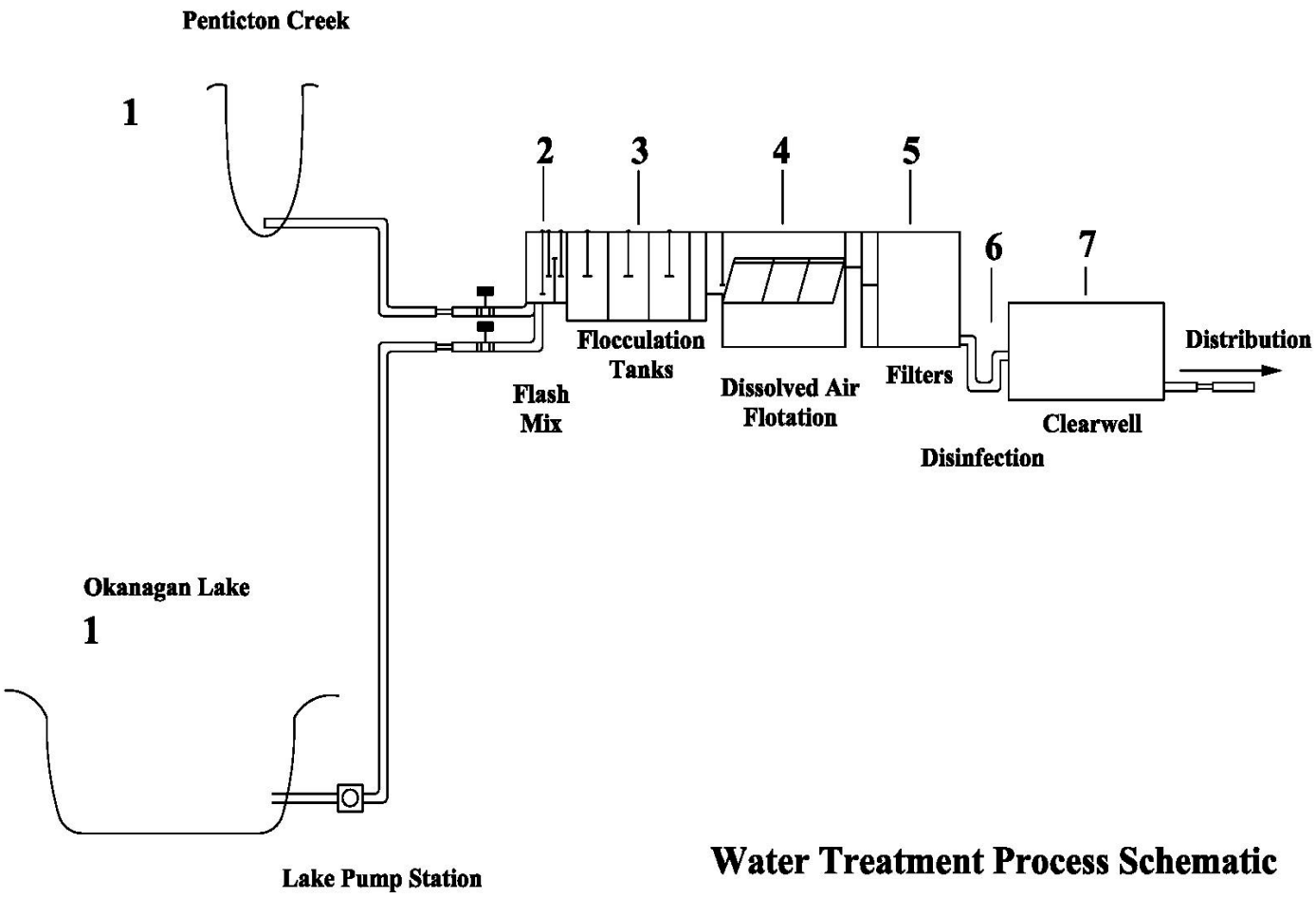


Figure 7: Penticton Water Treatment Schematic

2.0 Water Treatment

The City of Penticton's Water Treatment Plant is an 88 million litres per day plant that uses a multi-barrier system designed to treat water in a single or blended format from two sources; Okanagan Lake and Penticton Creek. The water quality of the two sources is distinctly different and requires different protocols for successful treatment. The objectives of treatment for the two sources are to meet Guidelines for Canadian Drinking Water Quality on a consistent basis.

The Water Treatment Plant was commissioned in 1996 and upgraded in 2008, which included the installation of the following processes; high rate dissolved air flotation, new pump station and dedicated main for the Ridgedale Reservoir system, incline plate thickeners for the residuals process and increased clear well storage.

In 2020 the chemical systems including Chlorine and SO_2 gases were removed and replaced with Sodium Hypochlorite and Vitamin C.

Blend Chamber

The water arrives at the treatment plant into the blend chamber, water from a single source or from both sources in the desired percentage is blended together and coagulants (chemicals that cause fine particles to clump together, forming "floc") are added. This mixing disperses the coagulants throughout the water and starts the coagulation process.

Figure 8: Penticton Blend Chamber

Chart 1: Monthly Chemical Record 2022

Month	In Flow	Out Flow	ACH	Floc Aid	Mid Poly
2022	Million Litres	Million Litres	mg/L	mg/L	mg/l
January	332.56	331.32	13.33	1.3	0.42
February	294.88	294.28	13.8	1.3	0.52
March	344.20	341.89	18.49	1.48	0.51
April	435.27	429.11	24.5	2.17	0.52
May	621.05	616.44	30.76	2.38	0.56
June	712.36	699.98	50.83	2.16	0.76
July	999.11	976.59	46.39	2.40	0.72
August	1021.36	1011.82	33.53	2.00	0.55
September	764.30	762.01	21.81	1.86	0.35
October	550.61	546.19	14.06	1.43	0.34
November	460.82	458.69	12.35	1.54	0.31
December	518.33	517.89	9.78	1.5	0.30
Average	**587.90**	**582.18**	**24.13**	**1.79**	**0.48**
Total	**7054.85**	**6986.25**			

- Average ACH dosage for the year 24.13 mg/L
- Average floc aid polymer (WF 2551 A) dosage for the year 1.79 mg/L
- Average mid poly (WF 7220 A) dosage for the year 0.48 mg/L

Coagulation & Flocculation

Water passes through the flocculation tanks where it is gently mixed. Tapered energy mixing is employed in the flocculation process. The particles will come in contact with each other and form larger floc. It is in this stage of the process that the majority of the impurities and harmful bacteria are captured within the floc particles and will later be captured in the DAF float or the filter.

Figure 9: Penticton Water Treatment Floc Tank Mixers

Dissolved Air Floatation

The water enters the dissolved air flotation basin where a saturated dissolved air/water stream is mixed with the process stream allowing the floc particles that have formed in the previous process to rise. The float rises to the top of the basin removing impurities from the water.

This float is processed by the onsite centrifuge or diverted to the sewer system to aid in the wastewater treatment process. The water then proceeds to the filtration stage.

Figure 10: Penticton Water Treatment Dissolved Air Floatation

Filtration

Six deep bed, mono medium filters are utilized at the Penticton Water Treatment Plant. The filter material used is anthracite coal at a depth of 1.80 meters. As the water passes through the filter, impurities are removed. The number of filter washes required is directly related to the amount of water processed through the filter and its quality. Filter backwashes are regulated by three different factors.:

the time the filter has been online, turbidity or particle counts and head loss. The number of filter washes increases dramatically in the months of May - August. This is related to the amount of water processed during the increased summer water demands. In 2022 three of the filters received new butterfly valves and electric actuators. The remaining three filters will be upgraded in spring 2023.

Figure 11: Penticton Water Treatment Mono Media Filters

Residuals Handling

There were no unauthorized discharges to Penticton Creek during 2022. The City of Penticton is constantly evaluating and making improvements to its treatment of the backwash stream. Ministry of Environment permit # PE-13491 which monitored the discharge was cancelled in 2011 due to changes in regulations.

Capital upgrades to the residuals process were constructed in 2009 as part of the Water Treatment Capacity Upgrade. These upgrades consisted of a new pump station and two new gravity thickeners to process backwash residuals.

In 2020 a Vitamin C dechlorination system replaced the SO_2 gas to remove the backwash water chlorine residual. Testing of the backwash water indicates that the improvements made to the backwash handling system have considerably improved the discharge quality in comparison to pre-upgrade results. The Residuals Handling control system was upgraded in 2022.

Figure 12: Penticton Water Treatment Residual Handling Building

Disinfection

Once impurities have been removed from the water, liquid sodium hypochlorite is added as a disinfectant. This ensures the water is safe and prevents bacteria from developing as it travels from the treatment plant to the customer. The water treatment plant uses hypochlorite pumps that adds a 6 -12% sodium hypochlorite chlorine solution at pre flocculation, and post filtration to achieve the required 1.35 mg/L residual leaving the facility.

Chart 2: 2022 Chlorine Dose and Residual

Month	Out Flow	Clearwell Average Residual
2022	Million Litres	mg/L
January	331.32	1.40
February	294.28	1.38
March	341.89	1.36
April	429.11	1.35
May	616.44	1.34
June	699.98	1.46
July	976.59	1.51
August	1011.82	1.45
September	762.01	1.37
October	546.19	1.36
November	458.69	1.43
December	517.89	1.45
Average	582.18	1.41
Total	6986.25	

- Average 2022 chlorine residual at the clear well discharge was 1.41 mg/L

4.0 Water Distribution System

The City of Penticton water system consists of six reservoirs, five main pressure zones, two pump stations, three booster stations, 256.3 km of distribution mains, 1,082 fire hydrants and approximately 10,467 water service connections serving a population of 36,885 people.

These reservoirs establish different pressure zones to service a particular area of the distribution system. The reservoirs are filled during periods of decreased water usage and are used to buffer the system when water demands are high.

Total reservoir capacity excluding the treatment plant clear well is 13.72 million litres and (22.22 million litres including water plant clear well). All reservoirs are remotely controlled via the SCADA system located at the Water Treatment Plant.

Water System Pressure Zones

- **1420** zone. The supply reservoir for this zone is the **Duncan Avenue Reservoir**, which has a capacity of 5.90 ML and the Water Treatment Plant clear well. Water to fill this reservoir and zone originates at the Treatment Plant and is controlled via a pressure reducing valve located near the reservoir. This zone supplies the lower areas of Penticton and Westbench.

- **1620** zone. The supply reservoir for this zone is the **Evergreen Reservoir**, which has a capacity of 2.30 ML. This zone supplies the southern middle bench lands of Penticton. The water to fill this reservoir is gravity fed from the 1650 Ridgedale Reservoir via an automatic control valve.

- **1650** zone. The supply for this zone is the **Ridgedale Reservoir,** which has a capacity of 2.35 ML. Water for this reservoir is pumped from the Penticton Avenue water treatment plant clear well. This zone supplies the middle bench lands of Penticton.

- **1820** zone. The supply for this zone is the two **Carmi Reservoirs** and the **Gordon Avenue Reservoir**, which have a capacity of 1.14, 1.35 and 0.53 ML respectively. This zone supplies the upper level areas of Penticton and is supplied by the Ridgedale Reservoir and pump station.

- **2020** zone. The supply for this zone is the **Sendero Reservoir**, which has a capacity of1.5 ML. This zone supplies the new subdivision located in the upper Carmi region. Water to fill this reservoir is supplied from the Ridgedale Reservoir and pump station.

Water Plant Staffing

The water plant is staffed by Environmental Operators Certification Program (EOCP) certified operators seven days per week, 365 days per year. The current compliment of staff is:

Chart 3: 2022 Staff Compliment

Name	Position	Certification Level	Years of Experience
Alistair Wardlaw	Water Quality Supervisor	EOCP IV	33
Don Mortimer	Water Plant Forman	EOCP III	16
Brent Baskott	Operator III	EOCP III	23
Robert Phillips	Operator III	EOCP III	14
Matt Finlayson	Operator II	EOCP III	7
Jesse Repchuk	Operator II	EOCP I	2
Jerod Hudson	Electrician/Instrumentation	Journeyman	9

All EOCP certified operators are mandated to receive annual 2.4 continuing education units of training every two years to maintain their certified operator certification.

6.0 Water Quality Monitoring Program

The raw water quality program is designed to compare seasonal trends that may impact treatment parameters and economic outcomes of using the source. The program includes parameters that are easily tested and linked to changes such as turbidity, temperature, pH, conductivity and microbiological results. The source monitoring program is conducted daily for each water source at the water treatment laboratory.

In addition to the common laboratory tests conducted daily on each water source, the city samples both raw water sources weekly for Total Coliform and E. coli using the Colilert test method.

The City of Penticton maintains and operates Ten dedicated sample stations located within the distribution system. The treated water within each pressure zone is continuously monitored for chlorine residual by an online residual analyzer connected to the water treatment SCADA via our fibre optic or radio network. Chlorine dosage is adjusted at the treatment plant to maintain free chlorine residuals within the distribution system. The Works Department maintains two automatic flush systems at the system extremities to help keep residuals fresh.

Microbiological Testing

Four hundred and fifty three microbiological tests were sampled for E. coli and Total Coliform in the treated water supply in 2021. Biological tests were collected from 45 different locations within the city distribution boundaries. The results from the bacteriological tests indicated that 449 samples were negative for bacteriological contamination. There were 4 samples taken from a sample station at the end of Naramata Road that showed total coliforms present at a low level. This sample station was disassembled and inspected and removed from service as found to be corroded severly. It is being replaced in 2023.

In 2022, a commercial lab tested the treated water and source waters 4 times annually. These scans test for disinfection byproducts, metals, nutrients, total organic carbon and organic pesticides. Samples are collected at the PRV Station, Okanagan Lake sample tap, Penticton Creek sample tap, and a rotating sample location in the distribution system.

In 2022 Giardia and Cryptosporidium testing was performed on Okanagan Lake and Penticton Creek, and algae testing on Okanagan Lake.

7.0 Water Use and Licenses

Domestic

The City of Penticton holds domestic water licenses for Penticton Creek, Ellis Creek and Okanagan Lake water sources for the purpose of Waterworks Local Authority.

Penticton Creek (license C014229), (license C005729)
Ellis Creek (license C005731), license (C005732), and license (C025234)
Okanagan Lake (license C116809), (C116810), (C116811), *(C130923), * (C130920)
* Westbench operations

The total yearly capacity of these licenses is 250.9 billion litres. In 2022 the City pumped or diverted 7.05 Billion litres from Okanagan Lake and Penticton Creek for domestic waterworks use.

Irrigation

The City of Penticton holds irrigation water licenses for Penticton Creek, Ellis Creek and Okanagan Lake water sources for the purpose of Irrigation.

Penticton Creek (license C035678), (license C005729)
Ellis Creek (license C0241819), license (C0241803)
Okanagan Lake (license C130923)

In 2022 the City diverted 598.38 million litres from the Ellis system for irrigation use.

In 2022 the City diverted 1.156 billion litres from the Penticton Creek system for irrigation use.

These licenses are renewed each year and reviewed by the Water Stewardship Division within the Ministry of Environment.

Chart 4: 2022 Raw Water Diversion for Domestic and Irrigation

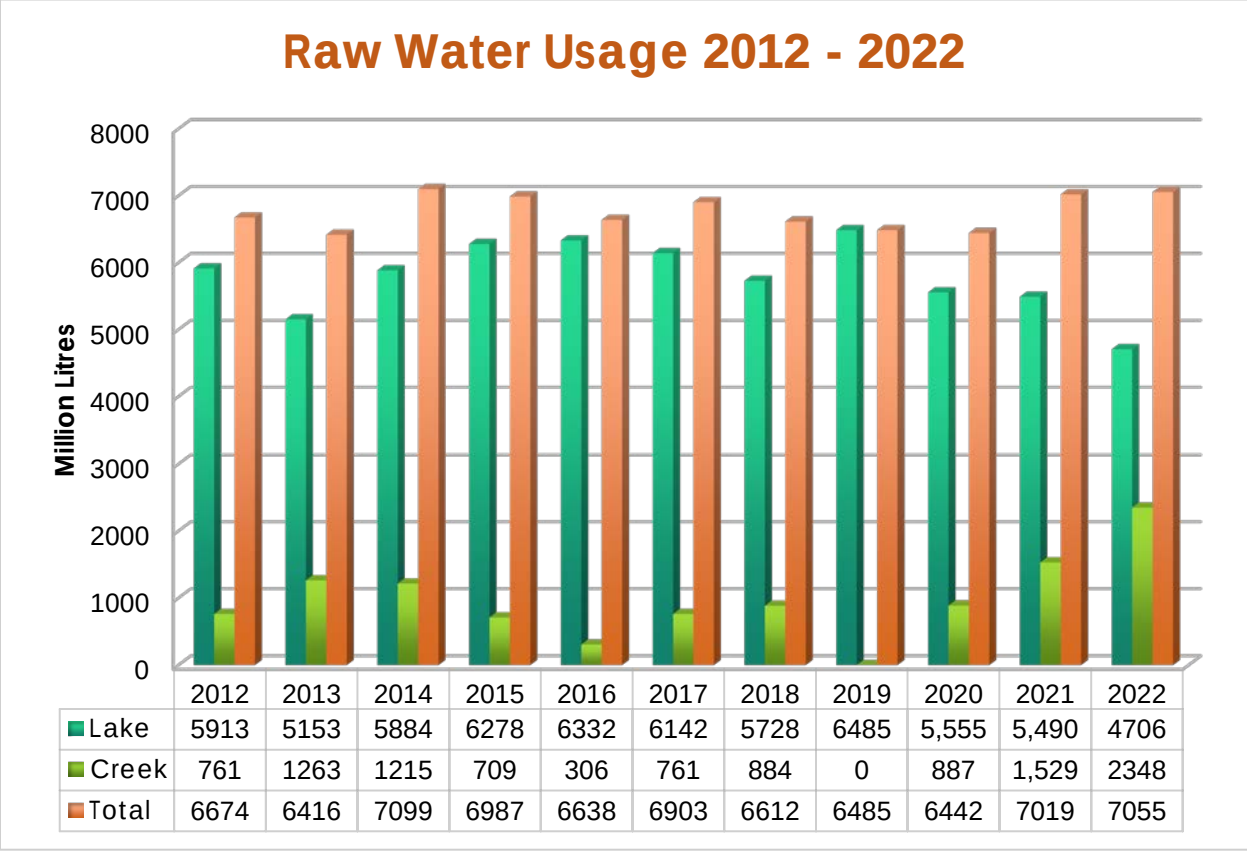
Month	Penticton Cr.	Ellis Cr.	Ok Lake	Total
2022	Million Litres	Million Litres	Million Litres	Million Litres
Domestic	2348.34		4706.51	7054.85
Irrigation	1156.10	598.38		1754.48

8.0 Water Use Monitoring

The volume of water pumped from the Okanagan Lake Pump Station and Penticton Creek is continuously monitored by flow meters located at the Water Treatment Plant. Treated plant discharge water into the distribution system is also continuously monitored to determine peak days and unusual usage.

Over the past ten years, the City of Penticton's water usage has actually decreased slightly. The population of Penticton has grown slightly over these years and consumption has decreased. This would indicate that the citizens of Penticton are practicing water conservation. In 2022, total distribution was 6.986 billion litres.

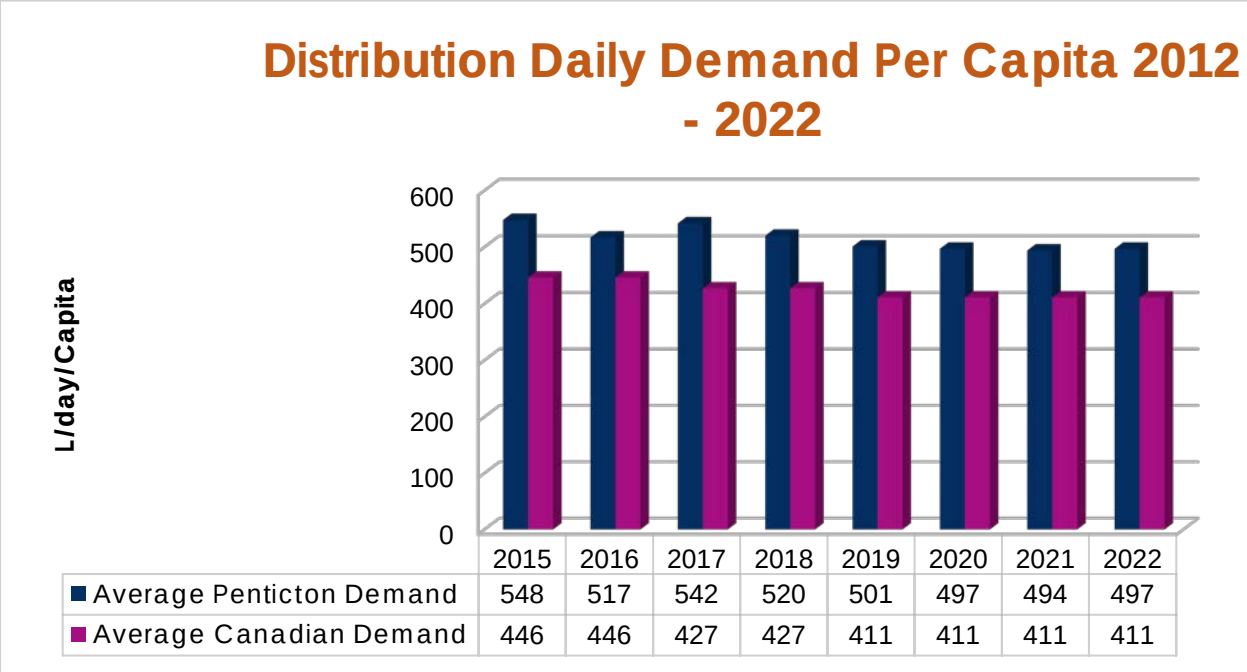
Chart 5: Raw Water Usage 2011 – 2021



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Lake	5913	5153	5884	6278	6332	6142	5728	6485	5,555	5,490	4706
Creek	761	1263	1215	709	306	761	884	0	887	1,529	2348
Total	6674	6416	7099	6987	6638	6903	6612	6485	6442	7019	7055

Chart 6: Average Daily Demand 2012-2022

Year	Total Distribution ML	West Bench ML	Penticton Distribution Net	Population	Penticton Per Capita	Canadian Per Capita
2022	6986.2	296	6690.2	36885	497	411
2021	6988.4	339.6	6648.8	36885	494	411
2020	6422.1	293.6	6128.5	33761	497	411
2019	6484.8	305	6179.8	33761	501	411
2018	6699	296	6403	33761	520	427
2017	7024	346	6678	33761	542	427
2016	6748	375	6373	33761	517	446
2015	6977	402	6575	32877	548	460



Average Penticton per capita demand based on net distribution (Total – West Bench)

- Average Canadian demand from Statistics Canada

Chart 7: Maximum Daily Demand ML 2012-2022

Year	Population	Max Daily Demand	Max Day	Date
		Litres/Day/Capita	Million Litres	
2012	32877	1107	36.4	Aug 20/12
2013	32877	1186	39.0	July 29/13
2014	32877	1286	42.3	July 14/14
2015	32877	1268	41.7	July 6/15
2016	33761	1063	37.2	June 6/16
2017	33761	1241	41.9	July 4/17
2018	33761	1220	41.2	July 25/18
2019	33761	1241	41.9	August 06/19
2020	33761	1084	36.6	August 18/20
2021	36,885	1217	44.9	July 1/21
2022	36,885	1114	41.4	August 8/22

***based on the 2011 census 32,877 population**

***based on the 2016 census 33,761 population**

***based on the 2021 census 36,885 population**

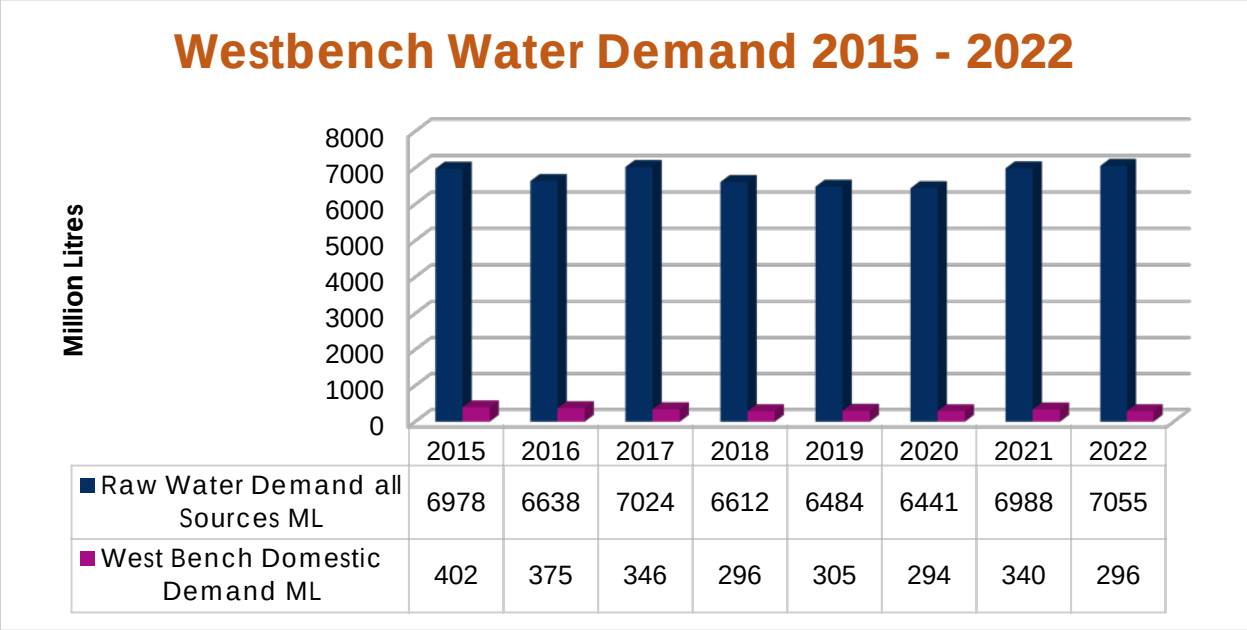
Chart 8: Water Consumption City of Penticton 2022

Month	Lake Supply	Creek Supply	Warren Ave Supply	Total Intake	Total Distribution
2022	Million Litres	Million Litres	Million Litres	Million Litres	Million Litres
January	203.5	129.1	0.0	332.6	331.32
February	180.7	114.2	0.0	294.9	294.28
March	210.9	133.3	0.0	344.2	341.89
April	344.7	90.6	0.0	435.3	429.11
May	560.1	61.0	0.0	621.1	616.44
June	103.6	608.8	0.0	712.4	699.98
July	327.1	672.0	0.0	999.1	976.59
August	723.4	298.0	0.0	1021.4	1011.82
September	689.4	74.9	0.0	764.3	762.01
October	496.5	54.1	0.0	550.6	546.19
November	427.1	33.8	0.0	460.8	458.69
December	439.7	78.6	0.0	518.3	517.89
Daily Average	12.9	6.4	0.0	19.3	19.1
Monthly Average	392.2	195.7	0.0	587.9	582.1
Total	4706.5	2348.3	0.0	7054.8	6986.2
		Flow	Population	Per Capita Flow	
		Million Litres		Million Litres/Capital/Day	
Max Day 2022	Aug-8	41.4	36,885	1122.4	
Min Day 2022	Jan-27	9.83	36,885	266.50	

9.0 Water Demand and Water Conservation

In 2014 an extension of the distribution system was constructed to supply domestic city water to the West Bench Irrigation System. This system is owned and operated be the Regional District and is supplied water by a bulk purchase water agreement. In 2022 296 million litres of water was supplied to the West Bench Irrigation System.

Chart 9: 2015 – 2022 Raw Water Demand / Including West Bench Irrigation District

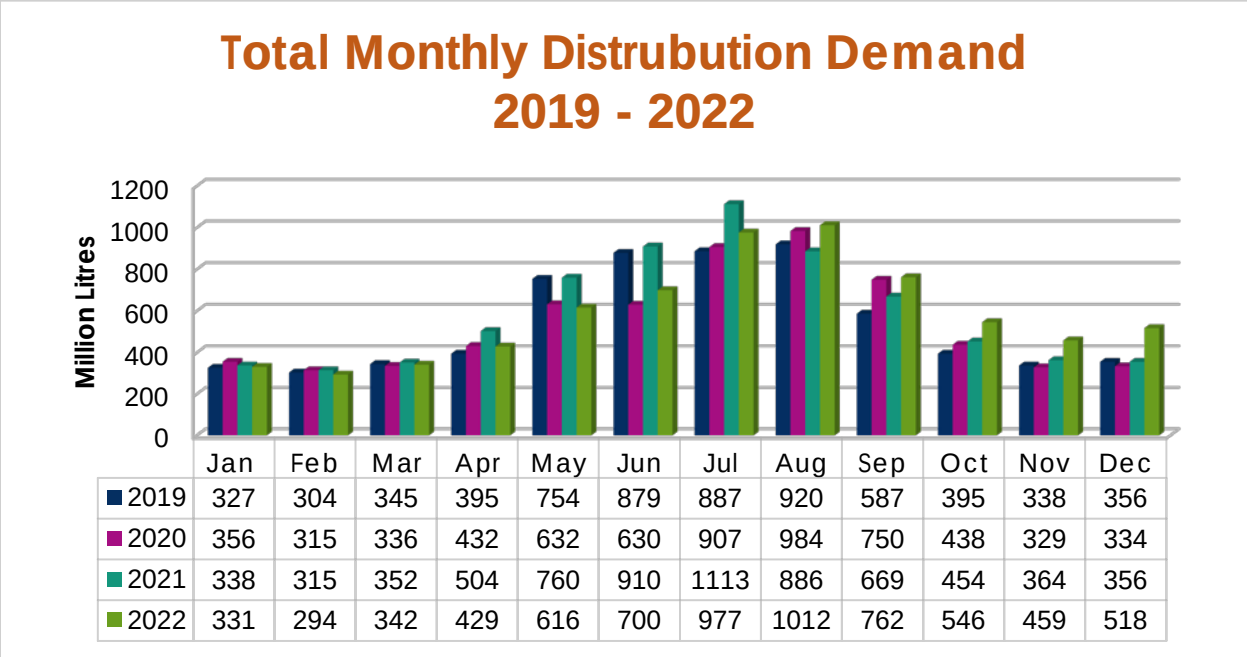


	2015	2016	2017	2018	2019	2020	2021	2022
Raw Water Demand all Sources ML	6978	6638	7024	6612	6484	6441	6988	7055
West Bench Domestic Demand ML	402	375	346	296	305	294	340	296

Demand has a direct impact on existing water infrastructure as well as community planning. In 2022 peak day was 41.4 million litres, which occurred on August 8. This includes water supply to the West Bench Irrigation System.

Average Yearly Daily Demand per person was 582 litres per capita per day based upon a population of 36,885. Demands, which are based on distribution flow meter records excluding backwash and other operational uses of water within the treatment process.

Chart 10: Total Distribution Demand by Month 2019 – 2022



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2019	327	304	345	395	754	879	887	920	587	395	338	356
2020	356	315	336	432	632	630	907	984	750	438	329	334
2021	338	315	352	504	760	910	1113	886	669	454	364	356
2022	331	294	342	429	616	700	977	1012	762	546	459	518

2021 Water Conservation Goal and Objectives

1. Reduce Peak Day Demand and Average Daily Demand.

Purpose – minimize the impact of our growing community on water resources. Effectively monitor programs, which aim at reducing Peak Day Demand and Average Daily Demand.

2. Update Water Conservation Webpage

Purpose – provide relevant solutions to reducing water waste as well as timely information on water consumption in order to promote the cause and effect of turning off the tap. Every drop counts! The City web page has links to the Okanagan Basin Water Board and valley wide information supporting water conservation.

3. Promote Canadian Drinking Water Week and BC Drinking Water Week

Purpose – distribute posters and information regarding local activities including contests thru OBWB and BCWWA. Numerous posters and handout information was available for the public at city buildings. This material is developed and supplied by the Okanagan Basin Water Board Make Water Work Campaign.

10.0 Drought Management

In 2021 City completed work with a consulting engineer to develop and update a drought management plan. The purpose of the plan is to provide the city with a professional report that identifies our water supply and looks at water demands historically and for the future. The identified drought resilience for each source and the requirements to mitigate an extended drought. The report identifies trigger points and provide decision making guidelines for each level of drought. The Penticton Water System was in a Stage 2 restriction during most of July and Aug 2022

Irrigation Systems

Two creeks within the City of Penticton boundaries are used as sources of water for irrigation systems. The South Okanagan Development Company initially developed the Penticton Creek irrigation system in 1906. Ellis Creek irrigation system was developed in the late 1960's. Penticton Creek Irrigation System is of high significance to the City as we also hold licenses for domestic water works on this source.

Penticton Creek Irrigation System

Records indicate that Penticton #1 Dam was built prior to 1921, although the exact year of construction is not known. It is located approximately 22 km northeast of Penticton. The dam has a live storage capacity of 1.48 million m^3 and empties into the reservoir of Greyback Dam. A dam safety study identified seepage and stability issues and recommended the structure be updated or decommissioned. In September of 2006, upon final review of the Knight and Pie sold dam study, Penticton #1 dam was breached and removed from service.

The Greyback Dam is located at the head of the Penticton Creek watershed, approximately 19-km northeast of Penticton. The dam is used by the City of Penticton to supply and control water for their domestic water and north irrigation system. The dam has a live storage capacity of approximately 12.33 million m^3 Greyback Dam is a zoned earth fill embankment designed by the Canadian Department of Regional Economic Expansion with construction completed in 1967. The dam is approximately 35 meters in height and 610 meters in length. An emergency spillway is located on the east abutment. Greyback Reservoir covers an area of approximately 300 acres and empties into Penticton Creek flowing into Campbell Mountain Diversion Dam followed by Penticton #2 dam.

Penticton Creek Irrigation System

A.C. McEachern Ltd. of Vancouver constructed the Campbell Mountain Diversion Dam in 1966-1967. The purpose of this project was to divert water from Penticton Creek via a tunnel to the north irrigation system. The diversion dam has a storage capacity of 31,000 m^3 of water. Method of construction is earth filled embankment with a side discharge concrete channel spillway and chute located on the right abutment. Previous to the construction of this diversion, irrigation water for farms and orchards located on the north bench was via flume and open ditch. Water that is not diverted flows into Penticton Creek and Penticton #2 dam.

Penticton # 2 Dam is a concrete arch dam originally constructed in about 1930 and raised by 3 meters in 1939. The current dam is approximately 16 meters in height and spans 22 meters between abutments. The dam has a storage capacity of 71,500 m^3 of water. The flooded area behind the dam is approximately 5 acres. Current use of the dam is to supply water to the Water Treatment Plant located immediately downstream. Flow data is monitored daily.

Total daily City allotted capacity for irrigation from Penticton Creek is calculated to be 46.26 million litres per day. 2022 peak day for Penticton Creek irrigation system was 16.3 million litres recorded at the Randolph Rd flow meter on July 28 Total demand on Penticton Creek Irrigation system in 2022 was 1.156 billion Litres

Ellis Creek Irrigation System

The Ellis Creek Diversion dam was constructed in 1966 by Interior Contracting Ltd. of Penticton, and has been in operation since the spring of 1967. The diversion dam is a small earth fill embankment with a concrete channel weir that spills over the crest and downstream face of the dam. The dam has a relatively minor storage capacity of approximately 6,200 m^3 of water. The flooded area behind the dam is less than 1 acre. The diversion dam receives water from the Ellis #2 and Ellis #4 dams. Maintenance of the diversion dam is the responsibility of the City Works Division.

Total daily city allotted capacity for irrigation from Ellis Creek is calculated to be 9.99 million litres per day. Peak day for Ellis Creek irrigation system occurred on July 22 when 14.5 million-litre demand was recorded by the Ellis Creek Irrigation flow meter. Total demand on Ellis Creek Irrigation system for 2022 was 598.4 million litres.

Chart 11: Irrigation Water Use 2012-2022

Year	Penticton Creek Irrigation	Ellis Creek Irrigation
	Million Litres	Million Litres
2012	3126	330
2013	3015	263
2014	3208	297
2015	3228	397
2016	3113	754
2017	3340	886
2018	1318	764
2019	1252	690
2020	1246	644
2021	1591	863
2022	1156	598

11.0 Cross Connection Control

A cross connection refers to any actual or potential physical connection between a potable water line and any pipe, vessel or machine containing or possibly containing a non-potable fluid, gas or solid, such that it is possible for the contaminant to enter the water system by backflow.

The City of Penticton's Cross Connection Control program has approximately 2,542 testable assemblies. These testable assemblies refer to Double Check Valve Assemblies and Reduced Pressure Backflow Assemblies isolating moderate and high hazards. The program is managed by the City of Penticton Building Department.

A secondary component of the Cross Connection Control Program entails performing site surveys and plan reviews of proposed building projects which identify actual or potential cross connections and their remedies. In some cases, the solution incorporated a non-testable device such as a Hose Bib Vacuum Breaker, an approved air gap or the elimination of the backflow hazard altogether.

These measures are in place as a means of providing safe drinking water and meeting one of the City of Penticton's conditions on the Interior Health Permit to Operate.

12.0 Source Water Protection Assessment and Plan

The objective of this drinking water source assessment was to quantify the source water quality, identify hazards, and make recommendations on protecting the source water quality of the City of Penticton's Okanagan Lake and Penticton Creek intakes.

Specific recommendations and action plans were developed with the aim of providing the best water quality. Key recommendations include:

- applying best management practices for shoreline protection
- creating a legal framework for the intake protection zone
- improving the condition of Penticton Creek's watershed drainage infrastructure
- educating recreators on how to operate safely near the intakes.

This assessment characterizes natural and man-induced hazards to drinking water quality as physical, chemical, or biological. As these risks change over time, revisions of this document may be needed. Existing research was augmented by a 2021 survey of the Penticton Creek watershed, field study of water currents, water quality profiles, and algae sampling in Okanagan Lake near the intake. In 2022 Okanagan lake and Penticton Creek were sampled 4 times for cryptosporidium and Giardia. Okanagan lake was also tested for algae.

13.0 Water Capital Improvements

Water Operational and Capital projects completed in 2022

1. Ok Lake pump station electrical upgrade – HVAC upgrade for Motor Control Centre Completed.

2. WTP Filter valve and actuator replacement – 50% complete, to be completed fully in 2023

3. Source water Protection Plan – Completed

4. Water Treatment Plant Roof replaced.

5. Two Roof Top HVAC units replaced. Further units to be replaced in 2023

6. Upgraded Residuals Handling Programable Logic Controller (PLC)

7. Penticton PRV Replacement – Predesign, design and start of construction in 2023.

8. 110 Metres of 150 mm Watermain installed.

9. Hydrant maintenance program A and B services – All 1050+ fire hydrants received their appropriate service level in 2022 as per previous year. Upgrading to Stortz adapters continued in 2022 with 80 Storz adapters installed. All this work will be ongoing for 2023.

10. Irrigation Meter program. Internal crews were able to install 18 units in fall of 2022. Ongoing for 2023.

11. Ellis #4 Upgrade. IFC drawings completed and provided to Ministry for review and approval along with PIB and environmental. Grant application submitted and waiting on review and award. Waiting on grant funding and ministry approval has postponed tender and construction to 2024. Package to be shelf ready for 2024 construction window .

12. Complete Dam Safety Review on all active dams. All three extreme consequence dams Ellis #4, Penticton #2 and Greyback Dam completed and submitted to Ministry for review and acceptance. The three high consequence dam safety reviews are planned and budgeted for completion in 2024.

13. Develop leak detection program and train in house staff on new equipment. have attended multiple training course on new equipment Further equipment(noise loggers) were purchased and received during 2022. Field staff trained and now utilizing in field for determination of potential leaks. Development of program ongoing, currently focusing program on risk based criteria.

Water Capital projects anticipated for 2023

1. Complete WTP Filter valve and actuator replacement – 50% complete
2. Penticton PRV Replacement – Predesign, design and start of construction in 2023
3. Complete WTP PLC upgrade and conversion project
4. Start and complete WTP Energy Audit and proceed to design remaining HVAC upgrades.
5. WTP Safety upgrades for access to confined spaces and rooftops.

For more Information please contact the Water Treatment Plant at wtp@penticton.ca

Appendix A Quick Facts 2022

2022 Lab Data

Lake	High	Low	Avg
Alkalinity	120	102	109
Colour Apparent	20	2	6.9
Colour True	15	1	3.4
Hardness	128	104	122
pH	8.37	7.70	8.12
Turbidity	1.12	0.143	0.284

Creek	High	Low	Avg
Alkalinity	24	2.0	13.38
Colour Apparent	146	21	57.2
Colour True	124	17	47.6
Hardness	24.4	2.6	12.6
pH	7.75	6.53	7.11
Turbidity	3.410	0.370	0.783

Distribution	High	Low	Avg
Alkalinity	112	4.6	72.4
Hardness	122	5.4	80.68
pH	9.32	6.96	8.05
Turbidity	0.311	0.020	0.042

2022 Raw Source Water Volumes

Flows	Million Litres
Ellis Creek Irrigation	598.4
Penticton Creek Irrigation	1156.1
Penticton Creek Domestic	2348.3
Okanagan Lake	4706.5
Warren Ave Well	0
Total Plant Intake	7054.9

2022 Distribution Quick Facts

Quick Facts 2022 Parameter	Result	Unit	Date
Total Distribution	6986.2	ML	2022 Total Distribution
Maximum Day	41.4	ML/d	2022 Max Day
Minimum Day	9.8	ML/d	2022 Min Day
Average Daily	19.1	ML/d	2022 Average
Average Daily / Capita	519	L/d/c	2022 Average
Maximum Daily / Capita	1122	L/d/c	Aug 8 2022
Minimum Daily / Capita	214.9	L/d/c	Jan 27 2022
Average Alkalinity	72.4	mg/l CaOH3	2022 Average
Chlorine Avg. @ Plant	1.41	mg/l	2022 Average
Hardness Average	80.7	mg/l CaOH3	2022 Average
pH Average	8.05	pH Units	2022 Average
Turbidity Avg.	0.042	NTU	2022 Average

Appendix B – Water Quality Lab Reports

- February 17, 2022 – City Wide Sampling – Caro Labs
- June 3, 2022 – City Wide Sampling – Caro Labs
- July 18, 2022 – City Wide Sampling – Caro Labs
- November 28, 2022 – City Wide Sampling – Caro Labs