Infrastructure Capacity Assessment

Town of Kindersley

60561867

April 2024

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April 9, 2024

Project #
60561867

Subject: Infrastructure Capacity Assessment
2024 Update

Dear Kim,

AECOM is pleased to the present the Town of Kindersley Infrastructure Capacity Assessment – 2024 Update. This critical document provides the Town with a holistic assessment of their state of infrastructure. The document identifies required upgrades and will allow the community to effectively make decisions in planning future infrastructure upgrades.

Sincerely,
AECOM Canada Ltd.

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Encl.

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AECOM: 2015-04-13

Quality Information

Prepared by

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Intermediate Engineer

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Revision History

Rev #	Revision Date	Revised By:	Revision Description
A	March 1st, 2024	Riley Houle	DRAFT Report
B	April 3rd, 2024	Riley Houle	DRAFT Report
1	April 9, 2024	Riley Houle	FINAL Report

Distribution List

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	✓	Town of Kindersley
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Executive Summary

The Town of Kindersley completed an initial infrastructure capacity assessment in 2014. That document has been updated to capture all upgrades made over the past 10 years, as well as identify future upgrades necessary to maintain the community infrastructure.

The Infrastructure Capacity Assessment has been divided into nine (9) discrete sections as follows:

- **Section 1** – Introduction – Project overview and background information collection.
- **Section 2** – Design Basis – Foundation upon which the analysis was carried out.
- **Section 3** – Water Supply and Treatment – Review and analysis of the existing raw water supply system, raw water pipeline, and water treatment plant, as well as recommended upgrades and capital costing.
- **Section 4** – Water Distribution System – An inventory of the existing system, review and analysis of the network, recommended upgrades, and capital costing.
- **Section 5** – Wastewater Collection System – An inventory of the existing system, review and analysis of the lift station and gravity network, recommended upgrades, and capital costing.
- **Section 6** – Wastewater Treatment – Review and analysis of the current treatment process and options for upgrading, and capital costing.
- **Section** 7 – Stormwater System – An inventory of the existing system, review and analysis of the piped network, and recommendations.
- **Section 8 –** Infrastructure Planning – Ten year capital plan
- **Section 9 –** Next Steps – How to move forward from here**.**

This report provides a "snapshot" of the Town's systems' capacity, upgrading requirements and costs and should be referenced whenever development is being proposed to see if there are impacts of the proposals on the Town's systems that need to be addressed. We recommend that the Town make this report available to developers and planners that are contemplating activity in Kindersley. We also recommend that the Town provide access to this report to staff from engineering, public works, and administration. We also recommend that the Town consider the addition of the findings and recommendations from the other studies and reports completed in the future.

This report is intended to be an ongoing resource for the Town staff and that some of the drawings, cost estimates and the Capital Plan be treated as "living" documents" subject to ongoing revision as new information becomes available.

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1. Introduction

1.1 Background Information

The Town of Kindersley (Town) hired the engineering consulting firm of AECOM Canada Ltd. (AECOM) to undertake an update to the Infrastructure Capacity Analysis completed in 2014 by AECOM and Associated Engineering Ltd. (AE). The update consists of a review of the existing water distribution system, wastewater treatment and collection system, and storm sewer infrastructure to determine existing capacities and shortfalls for future growth plans of the Town. AECOM has done multiple infrastructure projects in the town over the last several years and have a good understanding of current conditions of the infrastructure.

From 2014 to 2023 upgrades to municipal infrastructure are summarized categorically below:

Water Supply and Treatment:

- RM of Snipe Lake – EK Water System Analysis (2018)
- Waterworks System Assessment (2016).
- Demolition of Decommissioned Water Tower

Water Distribution System

- Brookhollow – Thomson Drive 250 mm Feedermain (2015)
- Queen Drive looped watermain project (2015)
- 11th Ave East – 200 mm Looping main project (2019)

Wastewater Collection System

- Danielson Lift Station Decommissioning and replacement with Industrial Lift Station (2015)
- Highway 7 & 11 Sewage Lift Station Upgrades (2015)
- Highway 7 & 11 Sewage Forcemain Upgrade (2015)
- Rosedale Sewage Forcemain Upgrade (2020)
- West Kindersley Trunk main Upgrade (2021)
- Ditson Drive Gravity Main (2019)

Wastewater Treatment

- Lagoon Cell Expansion (2021)
- Aeration (2021)
- Teo Lake Pumping Station (2021)
- Desludging (2021)

Storm Water System

- West Industrial Road and Drainage Improvements (2021)
- 13th Ave East Drainage Improvements (2018)

General

- Creation of Design and Development Standards (2018)
- Design of Colton Drive and East Expansion Servicing Design (2019)
- Contour mapping and Orthophoto
- Quest Development Servicing Design (2019)
- 11th Avenue and Ditson Upgrades (2023)
- Thomson Drive Extension (2023)

1.2 Objective

The Town's objective is to be prepared for future growth and upgrading of infrastructure required to support a moderate growth rate in the next 25 years.

1.3 Previous Reports

To complete the analysis of infrastructure capacities applicable reports and data available on the water, sanitary sewer, and storm water systems in the town was reviewed. In addition, population data and economic indicators from recent reports were required to provide an estimate of the growth projections in the future. Some of these reports and data were already in the possession of AECOM and others were requested from the Town.

Below is a list of all reports and data compiled by the Town and AECOM which were used to complete the analysis required on this assessment.

1.3.1 Data Provided by the Town

- Water Security Agency: Permit to Operate a Waterworks (2022)
- SaskWater: Eston Kindersley Administration Board Capital Improvement and Repair Plan (2022-2023)
- SaskWater: Kindersley Capital Improvement and Repair Plan (2020-2023)
- Water Security Agency: Permit to Operate a Sewage Works (2022)

1.3.2 Data Provided by AECOM

- Town of Kindersley: Infrastructure Capacity Assessment (2014) (partnered with AE)
- Town of Kindersley: Waterworks System Assessment Round 3 Final Report (2016)
- Town of Kindersley: Downstream Use and Impact Study (2017)
- Town of Kindersley: Wastewater Treatment System Upgrade Pre-Design Report (2017)
- Town of Kindersley: Lagoon and Wastewater Upgrades Post Construction- Completion Report (2021)

1.3.3 Site Visit

A site visit was conducted by AECOM in conjunction with Town representatives on December 15th, 2023. The site visit consisted of visits to each of the three (3) wastewater lift stations owned and operated by the Town. Notes and

photos were taken at each of the facilities and this information was also included in the assessment and analysis of the infrastructure.

2. Design Basis

This section will discuss the design basis for conducting the infrastructure assessment for Kindersley. Parameters including the Town's projected population growth rate and projected future water and wastewater demands will be used as a basis to determine recommended infrastructure upgrades.

2.1 Population Projection

2.1.1 Historical Population

The Town's population data was analyzed from Statistics Canada and Saskatchewan Ministry of Health (MOH) reports. The MOH population includes the residents in the surrounding area registered in the Kindersley health zone thus has a higher population estimate than the Statistics Canada (Stats Can) data. Table 2-1 summarizes the Stats Can and MOH population data in 5-year increments since 1991; and will be used to develop a population projection for future growth within the community.

Table 2-1: Historical Population (Statistics Canada vs Saskatchewan Health data)

	1991	1996	2001	2006	2011	2016	2021
Statistics Canada-Census Numbers	4,572	4,679	4,548	4,412	4,678	4,597	4,567
Saskatchewan Health Reported Population			4,736	4,730	5,321	5,439	5,207

Table 2-2 Annual Growth Rate

	1991-1996	1996-2001	2001-2006	2006-2011	2011-2016	2016-2021	2011-2021
Statistics Canada-Census Numbers	0.468%	-0.56%	-0.60%	1.20%	-1.73%	-0.7%	-2.37%
Saskatchewan Health Reported Population			Flat (no appreciable Change)	2.50%	2.22%	-4.27%	-2.31%

Table 2-3: Historical Population (Saskatchewan Health Data)

Year	Population	Annual Growth
2011	5,330	
2012	5,321	-0.17%
2013	5,349	0.53%
2014	5,515	3.1%
2015	5,345	-3.08%
2016	5,439	1.76%
2017	5,530	1.67%
2018	5,430	-3.44%
2019	5,421	1.52%
2020	5,422	0.02%
2021	5,207	-3.97%
2022	5,239	0.61%
2023	5,313	1.41%
5-year average growth rate (2013-2018)		**0.003%**
5-year average growth rate (2018-2023)		**-0.08%**
10-year average growth rate (2013-2023)		**-0.04%**

The population growth rates have varied over the years with periods of population growth and decline. From 2011-2016, Statistics Canada data showed a 1.73% decrease in population whereas the health numbers showed a 2.22% increase in population. However, from 2016-2021 there has been a decline of population with both the Statistics Canada or MOH numbers with decreases of 0.7% and 4.27% respectively. The population from 2011-2021 decreased 2.3-2.4% for both the Statistics Canada and MOH data.

When looking at the MOH data year over year from 2011, the annual growth rate alternates between increases of 1-3% and decreases up to 4%. However, the 5- and 10-year average growth rates are less than 0.1% which show the Kindersley area population has stayed steady over the last decade.

Overall, both the Statistics Canada and MOH data show that population of Kindersley has stayed relatively stable from 2011-2021 but the MOH data for 2022 and 2023 showed modest increases of 0.6-1.4%.

2.1.2 Future Growth

The draft Official Community Plan (OCP) alludes to a future population of 10,000 persons for the Town. The OCP does not specifically delineate if the municipality will grow to 10,000 as a service center or 10,000 dwelling in the Town as 10,000 persons is mentioned in the Commercial and Industrial categories. Refer to the Future Land Use Concept Map in Appendix A. The previous 2014 Infrastructure Capacity Assessment report used a 2.56% growth rate to achieve a population of 10,000 by the year 2040. This growth rate is overestimated based on recent population data for the Town and surrounding area. The population has slightly declined with declining economic and employment conditions in the 2011-2021 period. However, the last several years have shown modest increases in population. **AECOM proposes an annual 0.5% population growth rate to be used for population projections.** The proposed population growth will provide timelines of required updates for planning purposes but will not prematurely flag said upgrades. This proposed population growth aligns with the growth rate used by SaskWater in the WTP Capital Improvement and Repair Plan.

The population projection for the next 25 years is shown in Table 4. This projection would be used as the basis for establishing future water and wastewater demands for the town. The Ministry of Health population (5,340 in 2024) will be used as a baseline for estimating the water and wastewater demand for the purpose of the report.

Table 2-4: 25 Year Town of Kindersley Population Projection

Year	Population
2024	5340
2029	5474
2034	5613
2039	5754
2044	5900
2049	6049

2.2 Recommendation Schedule

As the community grows, infrastructure upgrades are needed for expansion or replacement as lifecycles come to an end therefor a strategy to classify priority is presented herein.

Upgrades recommended in this report have a level of priority assigned. This level of priority is an opinion of AECOM based on information available at the time of the report. The prioritization matrix presented herein is to be used as a guide. Prioritizing upgrades may change as new information becomes available, based on economic conditions, available construction materials, price of labour, immediate breakdowns or failures in existing equipment, upgrade efficiencies in which for example two projects or upgrades can be simultaneously accomplished. The following prioritization schedule will be applied throughout the report.

Table 2-5: Recommendation Schedule

Level of Priority	Description
1-3 - Immediate	Recommendations to be implemented as soon as possible and are highest priority.
4-7- Moderate	Recommendations for upgrades should be budgeted for with completion within 15 years.
8-10 - Low	Recommendations based on a 15 year plus outlook, identifying upgrades is for strategic planning.

2.3 Water System

2.3.1 Existing Water Demand

Raw Water

Raw and treated water consumption for 2012-2022 were obtained using information from raw data where it was available, and information was filled from the Water Security Agency's (WSA) *2022 Community Water Consumption report.*

The historical per capita raw and treated demand is summarized for each year in Table 2-6. Detailed raw water records including total monthly and average daily demands are summarized in Appendix D. Raw and treated water demand records were used as a basis to estimate the future water demand for Kindersley.

Table 2-6 Historical Loading Summary

Year	Population	Raw Water (m^3)	Treated Water(m^3)	Raw Water Demand (Lcpd)	Treated Water Demand (Lcpd)
2022	5239	711057	583,067	372	305
2021	5207	769017	619231	405	326
2020	5422	782323	643387	395	325
2019	5421	800967	664803	405	336
2018	5430	768543	637891	388	322
2017	5530	988682	820606	490	407
2016	5439	903668	750044	455	378
2015	5345	985137	804749	596	412
2014	5515	1006820	833534	583	414
2013	5349	876000	740983	526	380
2012	5321	830926	687070	502	354
2017-2022: 5 Year Average			**629,676**	**393**	**323**
2012- 2015: 5 Year Average			763,276	533	388
2012-2022: 10 Year Average			707,760	465	360

Note: omitted 2017 data, there was a constant monthly water consumption for each month

In evaluating the data in Table 2-6, the observations from the water usage can be made:

- The average raw water demand has decreased 26% from the 2012-2017 period to the 2017-2022 period.
- The average raw water demand was 393 L/capita/day from 2017-2022. This demand will be used as a design basis for this report.
- The average treated water demand has decreased 17% from the 2012-2017 period to the 2017-2022 period.
- The average Treated water demand was 323 L/capita/day from 2017-2022. This demand will be used as a design basis for this report.

2.3.2 Precipitation Data

The seasonality and years of higher demand can potentially be correlated to precipitation data. Seasonal precipitation from May to July is important to determine as it has an impact to the Town's water demand mainly due to irrigation. The historical precipitation from 2012 to 2022 was obtained from the Kindersley airport weather station Environment Canada precipitation data. Table 2-7 shows the total precipitation for the year and the totals for May-July. The totals were compared to the 10-year averages to determine if the year and/or summer season was wet or dry. The 10-year average was obtained by taking the average total over the 10 previous years (2012-2022).

Table 2-7: Precipitation Data

Year	Total year(mm)	% of 10-year average	Total May-July (mm)	% of 10-year average	Raw Water Demand (% of 5 year averages)
2022	360.9	2.4	171.7	3.8	
2021	215.6	-38.8	85.4	-48.4	-5%
2020	357	1.3	195.2	18	-4%
2019	236.6	-32.8	99	-40.1	-2%
2018	278.7	-20.9	133.8	-19.1	-5%
2017	276.6	-21.5	102.6	-38	16%
2016	593	68.3	324.4	96.1	-14%
2015	327.1	-7.2	115.3	-30.3	11%
2014	444.6	26.2	204	23.3	12%
2013	339.6	-3.6	148.8	-10	-2%
2012	446	26.6	239.2	44.6	-7%
Average	**352.3**		**165.4**		

Note: The 10-year total average is 352.3 mm and May-July 10-year average is 165.4 mm

The following observations are made from the precipitation data:

- The wettest year was 2016 with 593 mm of precipitation, 68.3% above the historical average. The wettest May-July was also in 2016 with 324.4 mm of precipitation, 96% above the historical average.
- The driest year was 2021 with 216 mm of precipitation, 39% below the historical average. The driest May-July was also in 2021 with 85 mm of precipitation, 48% below the historical average.

Generally, increased years of precipitation corresponded to decreased years in water consumption.

2.3.3 Projected Water Demand

The estimated future raw and treated water demand will be used as a design basis to address future upgrades required for the Town's water treatment and distribution systems over the next 25 years. This estimate utilizes a population projection with a 0.5% growth rate. The demand per capita for the raw and treated water is 393 Lpcd and 323 Lpcd respectively. The population and demand used for the projection is detailed in the design basis section of the report.

The peak daily demand and peak hourly demand were calculated to be 2 and 3 times the average daily demand as per the WSA *2022 Community Water Use Records* peak factors for a municipality with a population between 3,000

and 10,000. The maximum raw peak daily demand factor from the WSA data is 1.70, so a factor of 2 for peak daily demand is reasonable.

Table 2-8: Town of Kindersley Projected Water Demand

Year	Raw Water Demand		Treated Water Demand			
	Average Day (L/s)	Maximum Day (L/s) (2xADD)	Average Day (L/s)	Maximum Day (L/s) (2xADD)	Peak Hour (L/s) (3xADD)	2x ADD (m^3)
2024	24.3	48.6	20.0	39.9	59.8	3,447
2029	24.9	49.8	20.5	40.9	61.4	3,534
2034	25.5	51.0	21.0	41.9	62.9	3,623
2039	26.2	52.3	21.5	43.0	64.5	3,714
2044	26.8	53.7	22.0	44.0	66.1	3,808
2049	27.5	55.0	22.6	45.2	67.8	3,904

2.4 Wastewater System

2.4.1 Existing Wastewater Loading

The Town is unique in that it discharges their wastewater from an aeration and facultative lagoon treatment system to an evaporation pond and eventually Teo Lake using the effluent pumphouse and pipeline. Since the upgrades in 2019 to the pumphouse monthly release data has not been documented until starting recently. Historical flow rate data from 2010 to 2013 was used to determine historical wastewater loading.

Table 2-9: Total Monthly Wastewater Release

Month	2010 (m^3)	2011 (m^3)	2012 (m^3)	2013 (m^3)	Average (m^3)
January	14,961	102,245	42,604	66,646	56,614
February	25,938	32,968	28,544	101,361	47,203
March	66,539	0	120,548	17,246	51,083
April	63,995	110,852	56,956	23,179	63,746
May	37,372	31,532	41,335	44,412	38,663
June	69,236	70,659	70,529	74,403	71,207
July	53,329	0	28,213	91,690	43,308
August	85,414	84,567	76,963	8,644	63,897
September	84,326	4,609	29,638	61,636	45,052
October	11,776	109,027	49,161	0	42,491

Month	2010 (m^3)	2011 (m^3)	2012 (m^3)	2013 (m^3)	Average (m^3)
November	51,622	0	4,584	79,366	33,893
December	31,989	71,802	50,667	16,563	42,755
Total	**596,497**	**618,261**	**599,742**	**585,146**	**599,912**
Average Discharge (m3/ Day) (Over 365 Days)		**1,693 (19.5 L/s)**	**1,643 (19.0 L/s)**	**1,603 (18.6 L/s)**	**1,646 (19.1 L/s)**

Note: The flow meter data provided is assumed to require a factor of 10 applied. The above readings have been multiplied by 10 from the original records on this assumption (this needs to be confirmed with the Town and the flow meter units/calibration).

By utilizing a Town population of 5285 for 2022 and a total discharge of 599,912 m3/year this results in 311 L/capita/day. This is a reasonable value when compared to the ADWF from the Water Treatment Plant and also when compared against typical values for Saskatchewan Communities of this size.

The average of the wastewater data in Table 2-9 (Annual release of 599,912 m^3) when compared to the average Annual potable water demand of 629,676 m^3 results in, approximately 87% of potable water reaching the wastewater lagoon. Of course, there are many variables such as:

- Water distribution leaks
- Sewage collection leaks (cracks in pipe)
- Evaporation at the wastewater lagoon
- Exfiltration at the wastewater lagoon
- Infiltration and inflow from groundwater/rainfall into sewage collection system.

2.4.2 Projected Wastewater Loading

The wastewater loading of the entire community utilizes a population projection with a 0.5% growth rate and the historical wastewater loading records generating a loading rate of 311 L/capita/day.

Table 2-10: Projected Wastewater Loading

Year	Population	ADWF (m^3/day)
2024	5340	1661
2029	5474	1702
2034	5613	1746
2039	5754	1789
2044	5900	1835
2049	6049	1881

3. Water Supply and Treatment

3.1 Introduction

This section discusses the Town's existing water supply and treatment system including the raw water supply and the water treatment plant (WTP), including the distribution pumps. The current treated water quality regulations will be used to determine any WTP upgrades required to meet the quality requirements. The raw and potable water demand for the next 25-year design period was calculated using the earlier population and demand section. The projected demand was compared to the current water supply and treatment capacity to determine any upgrades required over the next 25 years. The WTP as well as its raw water supply pipeline underwent significant upgrades in 2011-2013 (Water West Infrastructure Project) to meet a future regional water demand of 69.6 L/s.

3.2 Permit to Operate

The Water Security Agency issues a permit to operate a waterworks to any person/permittee, in this case the Town of Kindersley, that operates a water treatment and/or water distribution facility. The permit ensures that the permittee provides water that is safe for water consumption. The waterworks system for the town includes a Class 3 water treatment plant and a Class 2 water distribution facility for the purpose of the permit. The current permit expires in January 2024 and the permit number is 00002274-08-00.

The permit to operate specifies parameters that are required to be measured, the treated water sampling locations and the minimum sampling frequencies. The permit also specifies the water quality limits for the measured parameters. Table 3-1 summarizes the bacteriological, chlorine, turbidity, fluoride and ultraviolet (UV) disinfection parameter requirements. Figure 3-1 has details on the turbidity limits in the permit.

Other parameters that require testing include chemicals (general and health), trihalomethanes, haloacetic acids, microcystins and manganese. The full permit to operate is shown in Appendix B.

Table 3-1: Water Quality Parameter Requirements from the Town of Kindersley Permit to Operate

Parameter	Location and Frequency	Limit
Bacteriological (Total coliform and *Escherichia Coli*)	– Two samples per week from representative locations in the distribution system	Total coliforms: 0/100ml *Escherichia Coli*: 0/100ml Background Bacteria: <200 organisms/100 ml
Chlorine Residual	– Once per day for free residual from water entering in distribution system – At the same frequency and locations as for bacteriological sampling, for free and total residual	Entering Distribution system: Free: > 0.3 mg/L Throughout Distribution system: Free:>0.1 mg/L Total: > 0.5 mg/L
Turbidity	– Continuous from each filter – Once per day for water entering distribution system – At the same frequency and locations as for bacteriological sampling – Once per week from raw water entering the water treatment facility	See Figure 3-1
Fluoride	– Once per day in water entering the distribution system	Maximum allowable concentration: 1.5 mg/l

	– Once per week from representative locations in the distribution system	
Ultraviolet disinfection	– Once per day for UV dosage, transmittance and flow rate in the water entering the UV disinfection system	UV dosage: > 12 mJ/cm^2 Maximum flow rate: 69.4 L/sec UV transmittance: > 90%

Requirements by Source/Treatment type:

Source/Treatment	Routine Standard	Max. Allowable Exceedance Duration	Absolute Maximum
Surface water [1,2] source with monthly average source turbidity greater than or equal to 1.5 NTU, employing chemically assisted filtration	Not to exceed 0.3 NTU, in more than 5% of discrete measurements, each calendar month OR more than 5% of the time each calendar month, if continuous monitoring employed	Not to exceed 0.3 NTU for more than 12 consecutive hours, if continuous monitoring employed	Never to exceed 1.0 NTU
Surface water [1,2] source with monthly average source turbidity less than 1.5 NTU and employing chemically assisted filtration.	Not to exceed 0.2 NTU, in more than 5% of discrete measurements, each calendar month or more than 5% of the time each calendar month if continuous monitoring employed.	Not to exceed 0.2 NTU for more than 12 consecutive hours if continuous monitoring employed	Never to exceed 1.0 NTU
[1] Includes surface waters and groundwater under the influence of surface water [2] Turbidity value measured from each filter effluent			

Figure 3.1: Turbidity Limits from Permit to Operate

3.3 Existing System

The existing system consists of a raw water supply, a water treatment plant (WTP) and a distribution network to provide water for the town of Kindersley. The components of the system are discussed in the sections below.

3.3.1 Existing Raw Water Supply

The raw water supply system consists of river wells, pumping stations, a reservoir, and a raw water pipeline. Figure 3-2 outlines the locations, capacity, and pipe diameters for components of the raw water supply system.

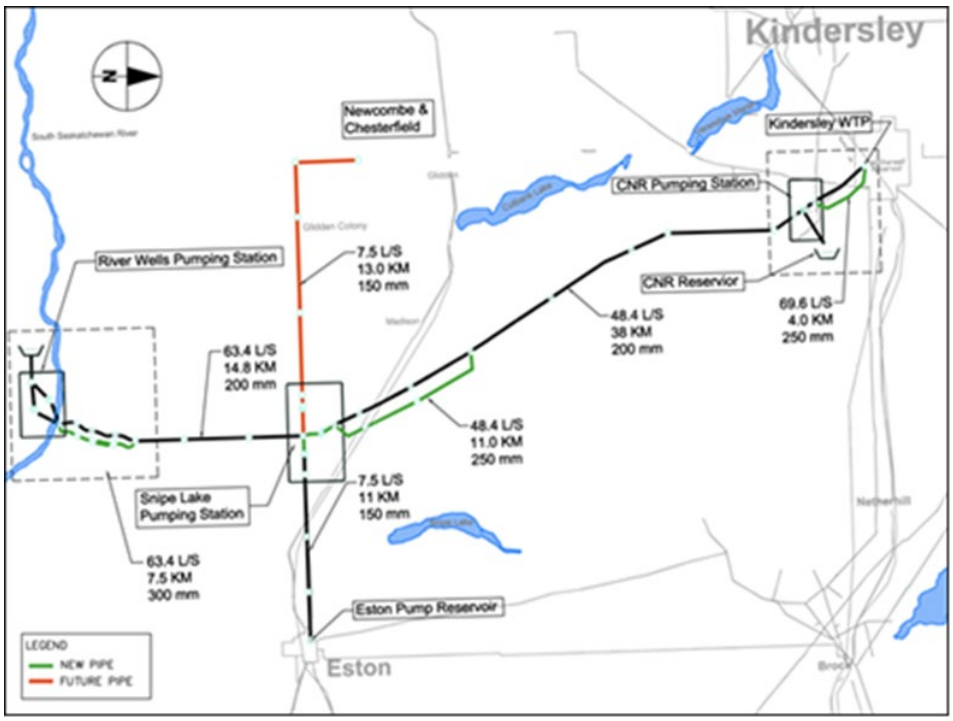


Figure 3.2: Raw Water Supply System

3.3.1.1 River Wells

The main raw water supply source is from induced surface water infiltration wells located along the north shoreline of the South Saskatchewan River approximately 55km from the Town of Kindersley.

Currently, four production wells are in service: three duty and one standby providing a theoretical flow of 20.0 L/s each. However, the reported capacity of all three of the wells operating simultaneously has a range of 45.0 L/s to 69.0 L/s (testing done by Beckie Hydrogeologists). This variable flow rate range and capacity is caused by fluctuations in river level. Raw water is pumped from the infiltration wells via 15 hp pumps and is discharged to the River Pump Station (RPS) via 150 mm diameter pipes. Each well has individual pipes that have their own flow meter and isolation valve. There are three spare pipes going into RPS available for connections to new production wells. The operator can change the configuration of the production wells weekly to equalize the operating hours for each well.

In addition, there are two working shield wells as part of the river well system to provide protection for the production wells from groundwater intrusion from the nearby Tyner Aquifer. Raw water quality deteriorates if one of the shield wells is offline. Should a shield well shut down, its associated production well should also be shut down to prevent the delivery of relatively poor quality raw water into the transmission system. Water is pumped from the shield wells through individual 100 mm pipes using 3.7 kW (5 hp) pumps. The water is then discharged through a common 200 mm gravity pipe to the South Saskatchewan River.

Table 3-2 summarizes the production and shield well capacities.

Table 3-2: Production and Shield Wells

Well Type	Well Identifier	Well Capacity/Pumping Rate
Production Well	PW3A-1997	20 L/s
Production Well	PW4A-2001	20 L/s
Production Well	PW6A-2002	20 L/s
Production Well	PW8-2003	20 L/s
Shield Well	SW5A-2003	6.0 L/s
Shield Well	SW7-1986	Decommissioned
Shield Well	SW7A-2012	6.0 L/s

3.3.1.2 River Pump Station

The River Pumping Station (RPS) is located immediately adjacent to the river wells and along the South Saskatchewan River. The RPS can be accessed by vehicle by driving 55 kilometers south of the Town of Kindersley and access the South Saskatchewan River Valley. The RWPS is located 6.2 kilometers west of the Lancer ferry crossing through a private all weather access road through ranchland. The RPS was constructed in 2003 and replaced the original pumping facilities that were built at the site in 1964.

Raw water is pumped from the production wells to the River Pump Station (RPS) through individual 150 mm diameter pipes (between the well and the RPS). Each incoming raw water supply pipeline has an individual flow meter and the raw water is discharged into a reinforced concrete pumpwell located beneath the RPS. The pumpwell measures 8.8m by 7.0m by 5.25m in depth for a working volume in the pumpwell of 325 m3. Three incoming pipes were installed in the pump station for future connection to new production wells as demands and capacity in the system warrants it. The pump station has three 300 hp vertical turbine high lift pumps, two as duty and one as standby, each with a variable frequency drive.

The raw water is pumped from the facility through a 300 mm diameter common header. The common header connects a dual raw water supply line outside the facility that consists of a 200mm diameter pipeline and a 300mm diameter pipeline. The 200mm raw water pipeline extends for 14.8 kilometers between RPS and Snipe Lake Pumping Station (SLPS) and was originally constructed in 1964 under the original E-K water system. The 200mm diameter raw waterline is a steel pipeline with a cement mortar lined internal coating. In the Water West (2011 – 2013) project a 300mm steel pipeline with an HDPE liner was installed adjacent to the existing 200mm pipeline (twinning) for a distance of 6.2 kilometers. The twinned pipeline provided additional capacity in the system to transfer raw water from RPS to SLPS.

The 2022 E-K Raw Water Pipeline Twinning project included twinning an additional 1.6 km of 300 mm steel pipeline resulting in an increased pump capacity at the river pump station. At the end of the twinned 300mm line it connects back into the original 200mm pipeline for the remaining distance to Snipe Lake Pump Station.

Based on the parameters outlined in the E-K Water System analysis from 2018; The existing pumps, when operated together are capable of 71.7 L/s (at 520 psi discharge pressure). However, the E-K operators are very conscious of power consumption and maximum pipeline pressure (the condition of the CML Steel pipe installed in 1964 is unknown). The analysis recommended that discharge pressures should not exceed 550 psi, however E-K operators would not typically get anywhere near that as they try not to exceed the existing discharge pressure of 489 psi in an effort to keep operating costs down. The increase in capacity resulting from the project; considering the pressure objective described above; is 67.5 L/s. The flow rate of 67.5 L/s assumes that the discharge pressure remains the same at 489 psi.

3.3.1.3 Snipe Lake Pump Station

The SLPS is located 12 kilometers west of the Town of Eston and 3.25 kilometers south of Highway No. 44. It was constructed in 2013 as a component of the Water West project. The current SLPS facility replaced the original two pumping facilities that were built to provide raw water pumping service to Eston and Kindersley in 1964 as part of the E-K Water System. Adjacent to SLPS building is an earthen reservoir which was previously used in the E-K Water system as raw water storage to supplement high demand periods at both municipalities that exceeded the pumping capacity between RPS and SLPS. The earthen reservoir storage originally provided some storage in the event of a pipeline break or facility problem at RPS.

The earthen reservoir is not part of the raw water supply for the system once the Water West project was completed. The reservoir has been converted to a surge pond to protect SLPS from a building flood in the event of a pumping or instrumentation problem within the facility. Concerns over contamination of the raw water stored in the earthen reservoir was a major factor to its discontinued use within the supply of the system. There is also a secondary overflow from the pumpwell beneath the SLPS to provide protection from the pumpwell exceeding its maximum supply level.

The SLPS consists of structural steel building complete with metal cladding. A reinforced concrete pumpwell is located below the building with dimensions of 9.6m by 4.6m by 4.45m in depth for a maximum working volume of 196 m3. There are three groups of raw water distribution pumps located within the facility, one duty and one standby in each group. There are two 300 hp vertical turbine high lift pumps which convey the raw water to the CN Pump Station (CNPS) and is the supply to the Town of Kindersley. This group of pumps has a capacity of 48.4 L/s at a maximum discharge pressure of 3240 kPa (470 psi). Another group of 7.5 hp pumps deliver raw water to the Town of Eston at a capacity of 7.5 L/s. The final group of future pumps will provide future raw water supply to the RM's of Chesterfield and Newcombe at a capacity of 7.5 L/s. It should be noted that this future supply was paid for by the Town of Kindersley during the Water West project and could be reallocated to the Town if their needs warrant in the future.

There is a raw water truckfill located on the south exposure of the facility. The truckfill utilizes a single 3 hp pump to provide the necessary service. Users in the area can utilize the truckfill by purchasing water cards from the Town of Eston. The facility is monitored and controlled through the SCADA system with the main computer located in Kindersley WTP.

Raw water is pumped from SLPS to CNPS through dual raw water pipelines (200mm diameter and 250mm diameter). The 200mm diameter pipeline was originally built in 1964 as part of the E-K Water system and consists of a steel pipeline complete with a cement mortar lining internal coating extending 34 km in length from SLPS to CNPS. A second 250mm diameter raw water pipeline was constructed in 2011 as part of the Water West project and consists of a steel pipeline complete with an HDPE internal liner and this pipeline parallels the original 200mm pipeline (twinning) for 11.6 km. At the end of the twinned 250mm line it connects back into the original 200mm pipeline for the remaining distance to CNPS.

3.3.1.4 CN Reservoir and Pump Station

The CN Reservoir (CNR) and CN Pump Station (CNPS) is located approximately 5.6 km southeast of Kindersley and access is provided through local RM grid roadway network. The CNPS was constructed in 2013 as a component of the Water West project. The current CNPS replaced the previous pumping station facility which was constructed in the 1990's. The CNR site was developed in 1923 when water storage was required for steam engines during development of the railways in Western Canada. An earthen dam was constructed across the coulee to dam off surface runoff water collected in the coulee or drainage run. A second dyke was constructed east of the main dam to provide a compartment for storage and management of the raw water, it is unknown when this secondary east dyke was constructed.

In the Water West project another dyke was constructed in 2012 between the dam and the east dyke to provide a smaller, more defined and manageable raw water storage for the Town. In addition to this new dyke an area on the northern edge of the reservoir was excavated to provide a raw water intake area adjacent to the new pumping station. 300mm diameter piping was installed between the pumpwell (located beneath the pumping station) and the new intake area of the reservoir. A stainless steel intake screen was installed on the intake structure which is located on the floor of the reservoir. There are no fish present in the reservoir however the screen prevents the entry of debris and other rodents such as muskrats and beavers into the pumpwell. The new raw water storage compartment has a useable storage volume of 71,000 m^3 between the normal water level and low water level.

The raw water storage provided at CNR is required to address the high water demand periods in the summer the Town of Kindersley encounters. As described in Section 3.4.2 the maximum pumping capacity between SLPS and CNPS is 48.4 L/s, however the Town of Kindersley has a current raw water MDD of 5,106 m3/day (Table 2-8) or 48.6 L/s. The storage cell in the CNR is an active part of the raw water delivery system during all periods (not just high demand) and is continually cycled and supplied to maintain as good raw water quality as possible. The 71,000 m^3 storage volume will provide 21.3 L/s (338 USgpm) for a maximum of 38 days to the Town of Kindersley WTP (assuming the CNPS is operated at 70 L/s (1110 USgpm) continuously).

The CNPS building was constructed of a steel building complete with exterior metal cladding. A reinforced concrete pumpwell is located beneath the building structure with dimensions of 7.0m by 7.0m by 6.6m depth for a maximum pumpwell volume of 323m3. There are two low lift raw water distribution pumps (RWP 502, 503) in the facility configured in a one duty and one standby configuration. Each pump has a 50 hp motor and a duty point of 70 L/s at a discharge pressure of 414 kPa (60 psi). The facility is also equipped with a KMnO4 dosing system. The dosing system injection points are located on each of the raw water lines just prior to exiting the facility. The KMnO4 dosing system consists of a dry chemical feeder hopper and auger, large automated mixing tank and two dosing pumps which operate as duty and standby. The KMnO4 dosing system is intended to contact and oxidize iron and manganese in the raw water as it is pumped between CNPS and the Kindersley WTP (KWTP). The KMnO4 dosing system had not been utilized by the waterworks staff from time of facility commissioning (2012) until the system was put into service in May 2016.

3.3.2 Raw Water Pipeline – Snipe Lake to Kindersley

The raw water supply from Snipe Lake to the Town is also divided into two sections, which are from Snipe Lake to CNPS and from CNPS to the Town. The section of pipe from Snipe Lake to the CNPS which is designed for the raw water flow of 48.4 L/s and the section from CNPS to the Town is designed for a peak raw water demand of 69.6 L/s. In order to deliver 48.4 L/s water from Snipe Lake to CNPS, approximately 11.6 km of 250 mm steel pipe was twinned with the existing pipeline on the north side of SLPS.

The working pressure along the sections of these lines can reach up to 3,620 kPa (525 psi) due to the extreme fluctuations in the topography of the surrounding area as seen in Figure 3-2. The main objective of the original twinning was to reduce the pressure in the existing pipe to provide the design flow.

Raw water is pumped from CNPS to the Kindersley WTP through dual 200mm and 250mm pipelines. The 200mm pipeline was originally constructed in 1964 and consists of a steel pipeline with a cement mortar lining internal coating extending 4.0 kilometers to the Kindersley WTP. An additional 900m section of the 200mm pipeline was built in 2011 as part of the Water West project which consists of an HDPE DR11 pipeline. The second twinned pipeline between CNPS and Kindersley WTP is a 250mm HDPE DR11 pipeline that extends 4.8 km and was constructed in 2011 as part of the Water West project. Raw water enters the Kindersley WTP through a common single 400mm header where the dual 200mm and 250mm pipelines come together in the parking lot just south the facility.

Once further upgrades are complete and the pipe is completely twinned, the twinned pipes will provide convenience in repair and maintenance and increase the flexibility in the raw water system operation. The idea is that when the existing pipeline within any section is out of service, the whole system will still be able to deliver 63.0 L/s raw water from the RPS to the SLPS, 47.5 L/s raw water from the SLPS to the CNPS, and 69.6 L/s raw water (utilizing a blended supply from the CNR) from the CNPS to the Town WTP. A flow diagram of the existing raw water supply can be found on Figure 3-6 later in this section.

Figure 3.3: Installation of Raw Water Supply Pipeline (2011)

3.3.3 Existing Water Treatment Plant

The WTP is located on the north side of Thomson Drive at the intersection with Ditson Drive. The site is completely fenced as of summer 2015. The WTP was originally constructed in 1958 at its current location and consisted of two rapid sand filters and a clarifier. Further upgrades occurred to the facility in 1972 when a 2,400 m3 circular reinforced concrete treated water storage reservoir was added to the north of the WTP building. In 1986 three additional rapid sand filters were constructed to replace the two smaller existing filters that had been in service since 1958. The upgrades in 1986 included a major building expansion including: expansion and upgrading of the administration area, new clarifier, addition of chemical storage and feed systems, new electrical room, raw water aerator and distribution pumping area. Additional clearwells and pumpwells were also added in the lower level of the facility.

From 2010 to 2013 the WTP went through another major upgrade whereby the 1986 clarifier was replaced with the ACTIFLO™ clarification system, the three 1986 filters were upgraded and rehabilitated with new undrains and media, a UV disinfection system was added and other chemical and instrumentation feeds were modernized and/or replaced. The facility is a mix of era's dating from 1958 to 1986 and then finally a mix of 2010 to 2013.

The building envelope consists of three levels in the facility:

- The main level consists of the administration area, the clarification system, filter controllers, electrical and control rooms and mechanical room
- The lower level (beneath the main level) consists of the pumping area and associated distribution piping, UV reactors and filter piping and valving located next to the filter banks.

- The lowest level includes clearwells, east and west pumpwells and associated transfer piping.

3.3.3.1 Flocculation and Clarification

Raw water from the CNPS enters the WTP via a 400mm header located south of the facility. Turbidity, flow rate and pressure are measured, and alum is dosed in the header before it splits into 2-200mm diameter feed pipelines. The pipelines supply water to a separate Actiflo™ unit making the system redundant with two treatment trains. The redundancy will decrease the time the plant is shutdown should one of the Actiflo™ units require maintenance. In addition, the two trains can be run simultaneously during high demand periods. Each train has the processing capability to treat up to 31.5 L/s. Table 3-3 shows the existing Actiflo™ design parameters.

The Actiflo™ unit manages both the flocculation and clarification processes. Firstly, the flocculation process removes particulate matter present in the water by binding the particles into heavier masses known as 'floc.' The clarification process then removes the particulate matter by allowing the floc to settle. As raw water enters the Actiflo™ unit, coagulants, micro-sand and polymer are mixed into the water in a series of chambers designed to enhance floc formation. The micro-sand provides a surface area that enhances flocculation and acts as a weight to aid in the rapid settlement of captured particles, which are removed in a clarification chamber. Clarified water is collected at the surface through perforated water pipes.

Table 3-3: Existing Actiflo™ Design Parameters

Parameters	Value	Units
No. of units	1/1	duty/standby (@ avg. demand)
Unit Capacity	31.5	L/sec
Rise Rate	40	m/h
Recirculation Rate	3	%
Sludge Production	5	%

3.3.3.2 Filtration

Clarified water from each train is collected into a channel at the end of each Actiflo™ unit where 300mm diameter piping takes the water to the filters. There are three filters currently in service, numbers 3, 4 and 5, all the same size with a filtration area of 12.6m^2 each and use AWI Phoenix underdrains. The filters are dual media containing a 450mm layer of anthracite over a 450mm layer of sand. The filters were upgraded and rehabilitated between 2010 and 2013.

The filtered water is collected into 200mm diameter piping which discharge into Clearwell 2A located beneath the filters. The three filters have separate effluent piping with turbidimeters, particle counters and flow meters monitored on SCADA and displayed on the HMI. The control valves are butterfly valves controlled by direct mount electric actuators.

The backwash system consists of a backwash pump and an air scour system. Backwash water is supplied by a single vertical turbine pump, thus there is no redundancy for completing backwashes if the pump fails. The air scour system includes a rotary positive blower installed in a separate enclosure. The air supply is regulated by electric actuated butterfly valves controlled through SCADA. The town has a spare blower stored in the WTP as a backup in case the current one fails.

The operation of the filters, including the backwash process, is controlled semi-manually by the operators through the SCADA system.

Figure 3.4: Existing UV Disinfection

3.3.3.3 Disinfection

The WTP uses both chlorine gas and ultraviolet (UV) as methods of disinfection.

Previously, the WTP used only chlorine gas for disinfection of the filtered water. Chlorine gas is added to the post-filtered water prior to entering the clearwells. If sufficient contact time is provided, chlorine is an effective disinfectant against bacteria, Giardia lamblia, and viruses. Despite this, chlorination is not effective against Cryptosporidium which is more readily deactivated using ultraviolet light. To address this concern, two ultraviolet disinfection reactors were installed at the WTP to provide greater disinfection capability.

The UV system consists of two Trojan UVSwift™ reactors operating in a duty/standby configuration. The treated water from the clearwells is pumped through the UV reactors by the high lift distribution pumps prior to discharging to the Water Tower and distribution system. The UV system has a capacity of 31.3 L/s to 69.6 L/s with one reactor operating. The UV design parameters include:

- A dosage rate of 5.8 MJ/cm^2
- A minimum UV transmittance (UVT) of 90%
- Achieving 2.0-log inactivation of cryptosporidium

Daily maximum, minimum and average UV dosage rates, flow rates and UVT values are recorded by the SCADA system.

3.3.3.4 Treatment System Chemical summary

There are multiple chemicals used in the treatment process and are listed below. The dosage locations, dosage rates and maximum use levels (MUL) are shown in Table 3-4.

- Potassium Permanganate ($KMnO_4$) is dosed at the CNRPS and used for oxidation of organics, iron and manganese.
- Copper sulfate is manually added to the reservoir at CNRPS to limit algae growth
- Liquid Alum is added to the raw water as it enters the WTP, prior to the Actiflo™ units
- Microsand is added to the Actiflo™ clarifier to create floc particles

- Chlorine is added to the post filtered water prior to entering the clearwells
- Fluoride is injected downstream of the UV reactors prior to entering the distribution system

Table 3-4: Summary of Chemicals and Dosage Rates

Chemical	Application Point	Feed Pump Type and Rated Capacity	Dosage Rates (1) (mg/L)	Maximum Usage Level (2) (mg/L)
Potassium Permanganate	200 & 250 mm raw water piping at CNRPS	Two positive displacement diaphragm pumps: max flow of 42 L/hr (per pump) min flow of 2 L/hr (per pump)	N/A	50
Liquid Aluminum Sulfate	400mm raw water header - prior to static mixer and prior to ACTIFLO™ clarification.	Two peristaltic dosing pumps: Max flow of 34 L/hr (per pump) Min flow of 0 L/hr (per pump)	5.0	200
Polymer (polyacrylamide)	At hydrocyclone injection point in clarifiers	Three progressive cavity pumps: Max flow of 38 LPH (per pump) Min flow of 1 LPH (per pump)	0.2	1
Sodium Fluoride	Post UV on treated water distribution header	One pump: Max Flow of 29.2 LPH Min Flow of 1.0 LPH	0.7 – 1.2	2.3
Chlorine Gas	Post Filtration – single discharge point into Clearwell 2B	Two primary chlorinators: Primary chlorinator: Rotameter capacity of 1 kg/ hour	1.2	30

Note:

(1) Dosage rates are taken from WTP records from 2015. The potassium permanganate was not utilized until May 2016.

(2) Values obtained from the http://www.nsf.org/Certified/PwsChemicals/ website.

3.3.3.5 Distribution Pumps and Potable Storage

Two high lift pumps are used to distribute water from the WTP to the town and are installed in a duty/standby configuration. Each pump has a capacity of 70 L/s at 490 kPa. Pump 327 operates at the primary duty pump while Pump 104 acts as the standby; the pumps are not designed to run simultaneously. The current operating average day demand is 49.6 L/s.

In addition, there is a diesel fire pump available if the two main distribution pumps are not available, for example during a power outage, and for fire protection.

There are four clearwells and a pumpwell used to store treated water within the WTP. The total storage of all the clearwells and pumpwell is 2,667 m^3 assuming a 3 m water depth in the reservoirs. The town also has a water tower used for treated water storage and to maintain pressure in the distribution system. The capacity of the water tower is 3,300 m^3. The total treated water storage capacity is 5,967m^3. However, the total usable storage capacity is lower due to low level interlocks and provision for fire flow demands making the bottom estimated 1 m of the reservoirs unusable under normal conditions. The usable storage capacity for the town is calculated to be 5,078 m^3.

3.4 Water Treatment Effectiveness and Capacity

The area of Kindersley is subject to frequent droughts, limited groundwater and variable run-off therefore the Town's goal is to continue to provide and secure a safe, clean and reliable water supply. This section will discuss if the current water treatment system is meeting water quality standards. In addition, the capacity of the treatment system to meet the 10-year projected demands will be determined.

3.4.1 Raw and Treated Water Quality

The existing WTP was designed to meet both the permit to operate and Saskatchewan Drinking Water Quality Standards and Objectives (SDWQSO). Table 3-5 and Table 3-6 summarize the raw and treated water quality compared with the acceptable water limits. The water quality tests results are from 2022 and were obtained from the SaskWater *2023 Kindersley Capital Improvement and Repair Plan*.

Table 3-5: 2022 Raw Water Data (Obtained from SaskWater (*2023 Kindersley Capital Improvement and Repair Plan*)

Parameter	Units	Average	Min	Max	SDWQSO	
					Criteria[1]	Value
Alkalinity (as $CaCO_3$)	mg/L	178	148	234	AO	500
Colour	TCU	11	0	116	AO	15
Fluoride	mg/L	0.36	0.05	0.84	MAC	1.5
pH	pH units	7.74	-	-	AO	7.0 to 10.5
Hardness (as $CaCO_3$)	mg/L	390	-	-	AO	800
Turbidity	NTU	2.53	0.21	86.4	MAC	0.3 to 1.0
Iron, Fe	mg/L	0.44	0	50.25	AO	0.3
Manganese	mg/L	0.35	0.01	68.25	AO	0.05

(1) MAC= Maximum Acceptable Concentration, AO= Aesthetic Objective

Table 3-6: 2022 Treated Water Data (Obtained from SaskWater (*2023 Kindersley Capital Improvement and Repair Plan*)

Parameter	Units	Average	Min	Max	SDWQSO/Permit to Operate	
					Criteria[1]	Value
Alkalinity (as $CaCO_3$)	mg/L	154	120	200	AO	500
Colour	TCU	2	0	61	AO	15
Fluoride	mg/L	0.38	0.05	0.77	MAC, PTO	1.5
pH	pH units	7.62	-	-	AO	7.0 to 10.5
Hardness (as $CaCO_3$)	mg/L	223	-	-	AO	800
Turbidity	NTU	0.06	0.02	1.24	MAC, PTO	0.3 to 1.0
Iron, Fe	mg/L	0.03	0	3	AO	0.3
Manganese	mg/L	0.02	-	0.34	AO	0.05
Free Chlorine	mg/L	1.32	0.46	2	PTO	>0.3
Total Chlorine	mg/L	1.48	0.49	2.58	PTO	>0.5

(1) MAC= Maximum Acceptable Concentration, AO= Aesthetic Objective, PTO: Criteria from WSA Waterworks Permit to Operate

The treated water quality generally meets the water quality standards and objectives. The treated water quality had max values above the Aesthetic Objective (AO) for colour, iron and manganese, however the average value is within the limits. The maximum turbidity value is above the limit, but the average is well within the limits.

3.4.2 Current Water System Capacity

This section will detail the capacity of the raw water, treatment, and distribution components of the water treatment system. The capacities will be compared to the projected raw and treated water demands to determine any water plant upgrades needed to meet demands in the next 25 years. The table below was developed in the 2016 WSA Assessment by AECOM and the demands have been updated based on the projected population described in this report.

Table 3-7: Waterworks System Capacity Assessment (From Waterworks Assessment)

Equipment	Capacity		Demand Condition	2029 Demand	2039 Demand	2049 Demand	Year When Demand Exceeds Capacity
Raw Water Supply System							
River Wells	PW3A-1997	69 L/s(1)	MDD(Raw)	49.8 L/s	52.3 L/s(2)	55.0 L/s(2)	>2049(2)
	PW4A-2001						
	PW6A-2002						
	PW8-2003						
River Wells Pumping Station (RWPS)	RWP 1311	63.4 L/s	MDD(Raw)	49.8 L/s	52.3 L/s(2)	55.0 L/s(2)	>2049(2)
	RWP 1321						
	RWP 1331						
Snipe Lake Pumping Station (SLPS)	RWP 101	48.0 L/s	MDD(Raw)	49.8 L/s	52.3 L/s(2)	55.0 L/s(2)	2024
	RWP 102	48.0 L/s					
CN Reservoir	71,000 m^3						
CN Reservoir Pumping Station (CNRPS)	RWP 502	70 L/s	MDD(Raw)	49.8 L/s	52.3 L/s	55.0 L/s)	>2049
	RWP 503	70 L/s					
Treatment and Disinfection System							
Actiflow System	Train A & B	57.7 L/s(3)	MDD(Raw)	49.8 L/s	52.3 L/s	55.0 L/s	>2049(3)
Dual Media Filters	Filter 3	58.3 L/s	MDD(Raw)	49.8 L/s	52.3 L/s	55.0 L/s	>2049
	Filter 4						
	Filter 5						
Ultraviolet Disinfection (4)	UV-1 & 2	69.6 L/s	PHD(Treated)	61.4 L/s	64.5 L/s	67.8 L/s	>2049
Potable Water Storage and Distribution System							
Clearwells	1A	66 m3	2 x ADD(Treated)	3,533 m^3	3714 m^3	3904 m^3	>2049(5)
	1B	107 m^3					
	2A	228 m^3					
	Circular	2,093 m^3					
Pumpwells	2B	173 m^3					
Water Tower	WT	3,300 m^3					

Equipment		Capacity	Demand Condition	2029 Demand	2039 Demand	2049 Demand	Year When Demand Exceeds Capacity
Total Potable water storage		5,967 m^3					
Total useable potable water storage[5]		**5,078 m^3**					
Potable Water Pumps	TWP 327	70 L/s	PHD(Treated)	61.4 L/s	64.5 L/s	67.8 L/s	>2048
	TWP 104	70 L/s	PHD(Treated)	61.4 L/s	64.5 L/s	67.8 L/s	>2048
	Diesel Fire Pump - 103	Unknown	N/A	N/A	N/A	N/A	N/A

Note:

(1) Capacity is reported with 3 wells running simultaneously. Individual well capacity is 20 L/s, Combined capacity has also been reported as low as 45 L/s (South Saskatchewan River level dependant)

(2) Demand is report for Town of Kindersley only. This portion of the system is currently jointly operated with Town of Eston (E-K water System) – Eston could draw 7.5 L/s for supply to their system. 48 L/s is the maximum rate that water can be transferred to CNPS presently and is the governing factor in determining capacity of this portion of the system.

(3) Capacity is based on 22 hour maximum daily operational time. 24 hour run time is 63 L/s but has been de-rated as it is not realistic to run Actiflo consistently 24 hours per day.

(4) Capacity is 69.6 L/s with one reactor in service. UVT > 90% and 2.0-log inactivation of cryptosporidium.

(5) As per Section 5.3.2 the useable treated water reservoir capacity has been determined to be 5,078 m

The Snipe Lake pumping station currently doesn't meet the raw maximum day demand for Kindersley; however, the CN reservoir adds additional storage capacity to meet these demands. The CN reservoir pumps can meet the projected MDD past 2048.

Upgrades to the Actiflow system and dual media filters are estimated to be required within the next 15 years to meet the projected water demand for Kindersley. Other upgrades will be needed to the river well pumps, potable water pumps and UV system before 2048 to meet the projected demand.

3.5 Infrastructure Upgrades

The existing WTP was designed in 2011 for a peak day raw water demand of 69.6 L/s and the average day demand of 31.5 L/s for the projected design year of 2033 for the Town of Kindersley and RM of Kindersley. As the population projection had increased significantly, the 2014 infrastructure capacity report proposed a future staged approach to upgrades to meet the demand. The proposed upgrades only include the increase in flow demand for the Kindersley WTP. It has been assumed that the Town of Eston and the future flow demand for Chesterfield remains as per the existing flow demands of 7.5 L/s per community. These flow demands have been taken into account at the River wells.

The upgrades recommended in the 2014 infrastructure capacity assessment remain the same, however, are described in a stages as demand exceeds the capacity of the system. The current system has a total raw water capacity of 69.6 L/s to the Town of Kindersley. Full implementation of Stage 1 upgrades will result in a total raw water capacity of 87 L/s, and Stage 2; 104.2 L/s. Table 3-8 describes the capacity of the raw water system at each proposed stage. Due to the complexity of the raw water system, it is recommended that all partial implementation of the staged upgrades be analyzed with respect to the overall impact on the system.

Table 3-8: Kindersley Raw Water System Upgrades

Water Usage and Source of Supply	Existing Maximum Day Flow Capacity (L/s)	Stage 1 Proposed Maximum Day Flow Capacity (L/s)	Stage 2 Proposed Maximum Day Flow Capacity (L/s)
Town of Kindersley	69.6	87.0	104.2
From SNLPS/ CNRPS	48.4/21.2	65.8/21.2	83.0/21.2
Town of Eston, Newcombe and Chesterfield	15.0	15.0	15.0
Total (From South Saskatchewan River PS)	63.4	80.8	98.0

It is proposed that the raw water demand be re-visited regularly to confirm projected demands. When projected raw water demand of Kindersley, Eston, or Chesterfield exceeds the current capacity, upgrades to the system will be triggered. As the raw water demand of the Town of Kindersley grows, upgrades are triggered, the staged approach of upgrades are described herein based on the projected growth of Kindersley.

To achieve a raw water supply greater than the existing 69.6 L/s, a waterfall effect of upgrades is required; pump upgrades are required at the CNRPS, additional supply is required from the High lift snipe lake pump station, additional capacity is required from the River Pump Station, and from the wells.

A conceptual staged approach of the upgrades is presented due to the complexity of the system. Full implementation of the staged approach will provide the Town of Kindersley 104 L/s.

3.5.1 Raw Water - Stage 1 Upgrades

The existing SNLPS can provide 48.4 L/s (767 USgpm) of raw water to the CNRPS and paired with the 21.2 L/s from the CN reservoir can supply a total 69.6 L/s. The primary flow rate which will trigger the need for implementation of stage 1 is when the projected raw water demand exceeds 69.6 L/s at the Kindersley WTP.

The pump upgrade in stage 1 is recommended to consider design requirements in stage 2 so upsizing pumps is not required twice; and the full twinning of the SLPS pipeline can be completed over time.

A hydraulic analysis to increase the raw water flow to 65.8 L/s from Snipe Lake was performed and is the basis of the Stage 1 upgrades. Upsizing the pumps and partial twinning the snipe lake to CNRPS is proposed; this increase paired with supply from the CN reservoir will result in a capacity of 87 L/s of raw water for the Town of Kindersley. The hydraulic analysis was conducted with the assumption that the two existing pumps at the SLPS will be upgraded to VFD equipped pumps capable of meeting the design capacity of 104 L/s (1648 USgpm) @ 330 TDH. With the updated pumps, the system requires the twinning of approximately 12 km of 250 mm diameter steel pipe in order to provide the target flow of 65.8 L/s (1043 USgpm) at a maximum pressure at the SLPS of 3,700 kPa (537 psi) (directed towards CNRPS and ultimately Kindersley WTP).

One additional production well and one shield well, will be require making a total of five production wells each with 20 L/s (317 USgpm) capacity and will operate as four duty and one standby configuration in order to meet the target flow of 80.8 L/s (1281 USgpm). In addition, the system will require extending the twinning from the 2011 upgrades of the 300 mm steel line by an additional 2.2 km of steel pipe (300 mm diameter) to the SLPS, as 1.6 km was recently twinned in 2022. No pump upgrades are required in the existing River Pump Station. Refer to Figure 3-6 for a summary of the proposed Stage 1 Upgrades.

Table 3-9: Water System Upgrade Capital Cost (Stage 1)

Sections	Update Components	Capital Cost	Priority
From River Pump Station to Snipe Lake Pump Station	One new production well One new shield well Twin additional 2.2 km of 300 mm steel line	$250,000.00 $250,000.00 $1,600,000.00	Low
From Snipe Lake Pump Station to CNR Pump Station	Upgrade two existing pumps Twin additional 12 km of 250 mm steel pipe	$200,000.00 $4,500,000.00	Low
From CNR Pump Station to Kindersley WTP	Add new pump at CNR Pump Station	$150,000.00	Low
TOTAL		$4,850,000.00	

3.5.2 Raw Water - Stage 2 Upgrades

When raw water demand at Kindersley exceeds 87 L/s, Stage 2 upgrades is triggered. One more production well will be required making six total wells each with 20.0 L/s capacity and will operate as five duty and one standby configuration in order to meet the target flow of 98.0 L/s. In addition, the system will require extending the twinning of the 300 mm steel line by approximately an additional 3.8 km of steel pipe to the Snipe Lake Pump Station.

To meet the projected flow of 83.0 L/s at Snipe Lake, with stage 1 pump upgrade, the system will require the additional twinning of approximately 10.6 km of 250 mm diameter steel pipe between Snipe Lake and CN Reservoir) at a maximum pressure at the Snipe Lake Pump Station of 3,250 kPa.

Currently the complete length of raw water pipeline has been twinned from the CNRPS to the Town WTP. The system can provide a maximum 77.0 L/s of raw water to the Kindersley WTP, with the maximum pressure at the CNRPS of approximately 360 kPa. In order to provide the Stage 1 and Stage 2 design flows of 87.0 L/s and 104.2 L/s, the CN pumping system needs to be upgraded accordingly. A further hydraulic analysis was conducted assuming a new pump (same capacity as the existing pump), is added to the system. The maximum flow that can be pumped to the Town WTP is 100.0 L/s, and maximum pressure at the pump station is increased to 520 kPa. Considering this flow is not projected to occur within a 25 year outlook, no upgrades are recommended to accommodate for the additional 4.0 L/s.

The raw water pipelines include approximately 4.7 km of 250 mm diameter, HDPE DR11 pipe; approximately 0.8 km of 200 mm diameter, HDPE DR11 pipe between the new CNRPS and the 200 mm diameter CML steel pipe, and approximately 4.0 km of the existing 200 mm diameter, CML steel pipe. Refer to Figure 3-6 for a summary of the proposed Stage 2 Upgrades.

Table 3-10 Water System Upgrade Capital Cost (Stage 2)

Sections	Update Components	Capital Cost	Priority
From RPS to SLPS	One new production well One shield well Twin additional 3.8 km of 300 mm steel line	$250,000.00 $250,000.00 $2,000,000.00	Low
From SLPS to CNPS	Twin additional 10.6 km of 250 mm steel pipe	$4,200,000.00	Low
From CNPS to Kindersley WTP	Add new pump at CNPS	$150,000.00	Low
TOTAL		$6,850,000.00	

3.5.3 Water Treatment Plant Upgrades

The water treatment plant will require upgrading when the maximum day demand (potable) exceeds 70 L/s. Potable water demand is not expected to hit 70 L/s within the 25-year design outlook herein.

The existing two Actiflo™ units each treat an average flow of 31.5 L/s but the system is very robust and they could actually treat to a high flow of 34.7 L/s. Except during peak flow demand, these units operate in duty/standby mode.The proposed upgrade would include expansion of the existing building to the east in order to accommodate one new Actiflo™ unit and one additional filter system. Currently, the air handling unit is located on the east side of the building. Preliminary discussions with our mechanical engineers conclude that this unit can be easily relocated. Refer to Figure 3-8 for the proposed WTP general arrangement.

3.5.3.1 Actiflo™ Clarifier

Flow will be split between the three Actiflo™ units upstream of the existing magnetic flow meter installed on the 400 mm common header inlet pipe prior to the two existing units. The flow split between the existing and the proposed will occur below grade outside the WTP as the proposed unit will be installed in the new building expansion. Refer to Figure 3-7 for the proposed treated water flow diagram.

As there are currently two units installed successfully at the WTP, the operators are familiar with the process and operation. Actiflo™ clarifiers are compact units that operate with microsand as a seed for floc formation. The microsand provides a surface area that enhances flocculation and also acts as a weight to aid in rapid settlement. Figure 3-5 shows the Actiflo™ flow diagram. The sequence of steps for the clarification process is as follows:

- Coagulant is injected into the raw water supply inlet pipe prior to entering the pre-coagulation basin. Rapid mixing occurs in this basin.
- Microsand and polymer are added simultaneously to the water in the flocculation tank and mixed.
- Settling then occurs in the lamella clarifier. Clarified water is collected at the surface through perforated clarified water pipes.
- The ballasted floc is extracted from the bottom of the clarifier via a recirculation pump. The sludge is separated from the microsand with a hydrocyclone and the sand is reused.

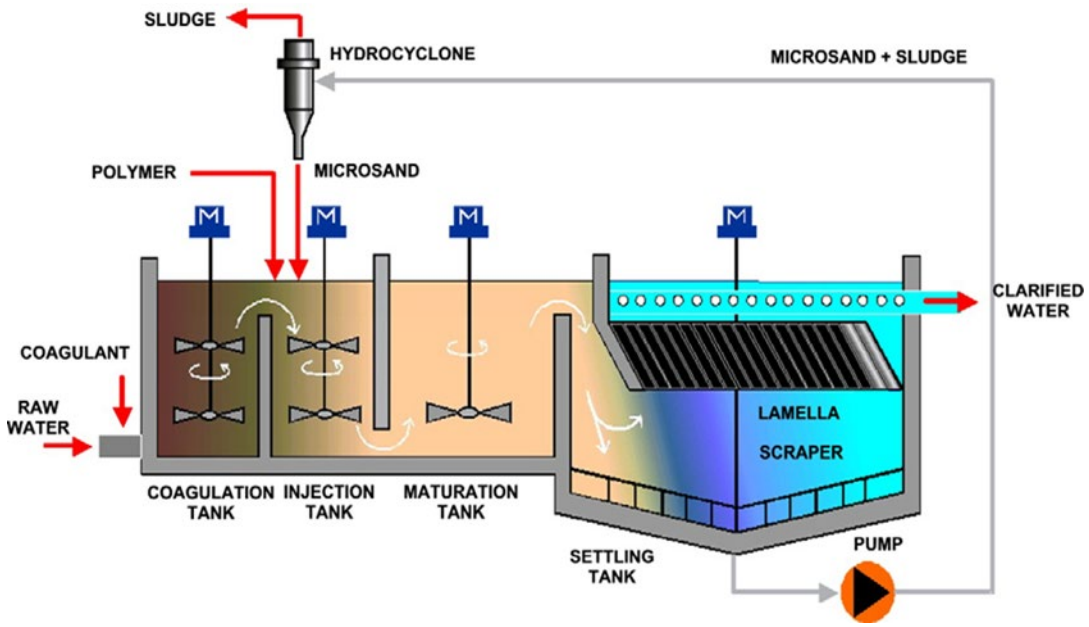


Figure 3.5: Actiflo™ Schematic

The existing chemical dosing system appears to be sufficient to accommodate the proposed design flows and will not require upgrading; however, the dosing rate would increase.

3.5.3.2 Filter Upgrade

There are currently three filters (No. 3, 4, 5) in operation at the WTP that received upgrades in 2011. Filters 1 and 2 are part of the 'old' treatment train however could be used during construction and tie-in if required. It is proposed that the new filter (Filter 6) be installed as per Table 3-11.

Table 3-11: Proposed Filter Design Criteria

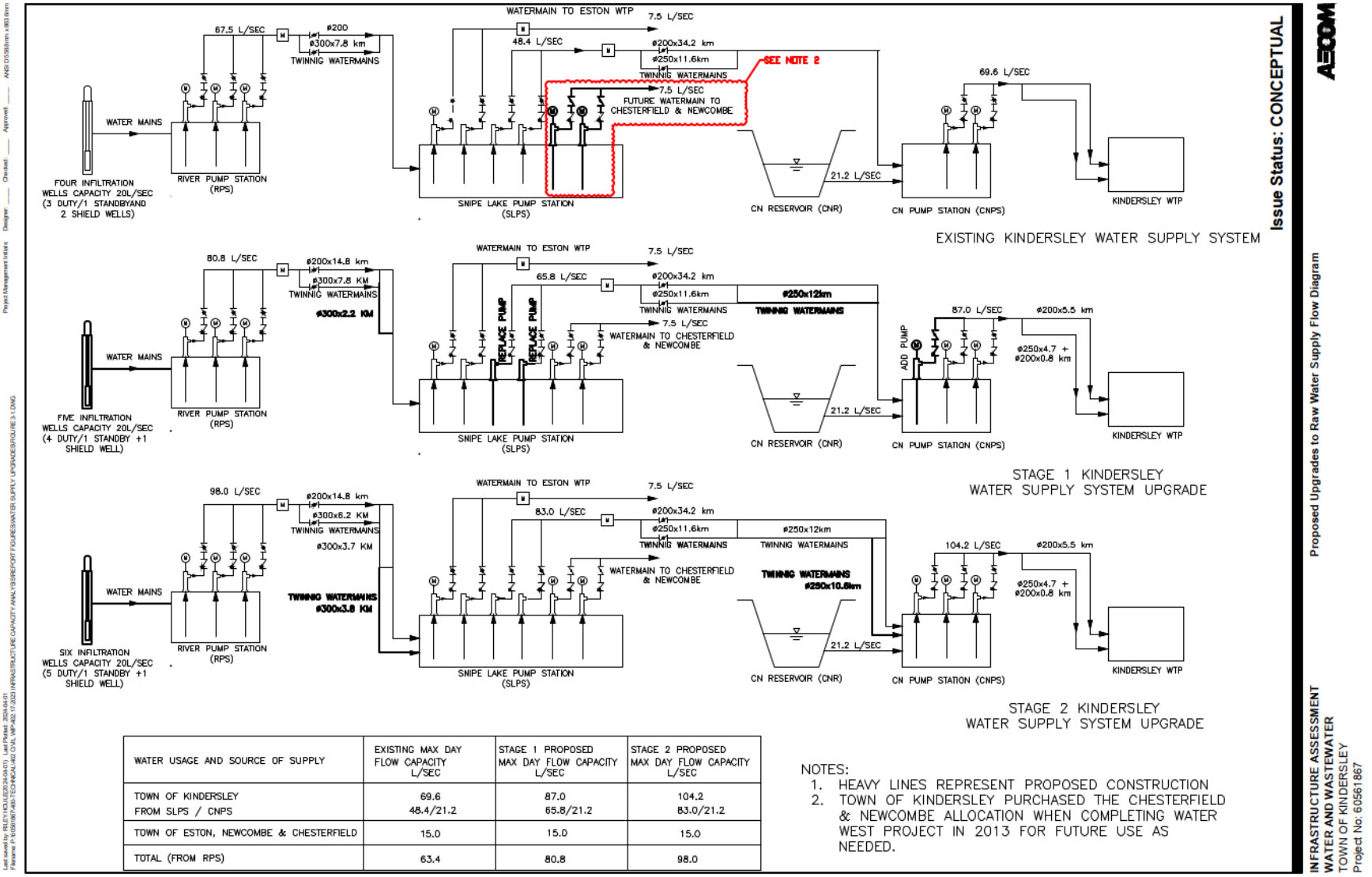
Parameters	Units
Underdrain system	Low profile 304L laterals c/w separate backwash and air scour channels
Air scour system	100 mm Sch 10 304L piping
	VFD unit for motor
Filter media	450 mm angular quartz filter sand, 450 mm filter anthracite
Backwash trough	304L c/w weir plates and inlet/outlet flow adaptor box

3.5.3.3 Reservoir Upgrades

In 2011, baffling was installed in the underground reservoir to prevent short circuiting. The flow between these reservoirs is now optimized to maximize the disinfection contact time. An additional reservoir may be required to meet the future storage requirements; this would mean that the chlorine dosing system may also require adjustment.

3.5.3.4 Control Systems Upgrade

The control systems for the WTP will need to be updated to meet new process objectives and to improve reliable and maintainable performance. This will include process sensors, communication systems and controlled devices. Measurements and controls will continue to be set in a fail-safe manner and critical components will also employ redundant components or strategies as required to ensure reliability. Back-up power supplies will be provided for the main control system, sensors and communications to maintain process data collection and alarming functions during power interruptions.



WATER USAGE AND SOURCE OF SUPPLY	EXISTING MAX DAY FLOW CAPACITY L/SEC	STAGE 1 PROPOSED MAX DAY FLOW CAPACITY L/SEC	STAGE 2 PROPOSED MAX DAY FLOW CAPACITY L/SEC
TOWN OF KINDERSLEY FROM SLPS / CNPS	69.6 48.4/21.2	87.0 65.8/21.2	104.2 83.0/21.2
TOWN OF ESTON, NEWCOMBE & CHESTERFIELD	15.0	15.0	15.0
TOTAL (FROM RPS)	63.4	80.8	98.0

NOTES:
1. HEAVY LINES REPRESENT PROPOSED CONSTRUCTION
2. TOWN OF KINDERSLEY PURCHASED THE CHESTERFIELD & NEWCOMBE ALLOCATION WHEN COMPLETING WATER WEST PROJECT IN 2013 FOR FUTURE USE AS NEEDED.

Figure 3.6: Proposed Upgrade to Raw Water Supply Flow Diagram

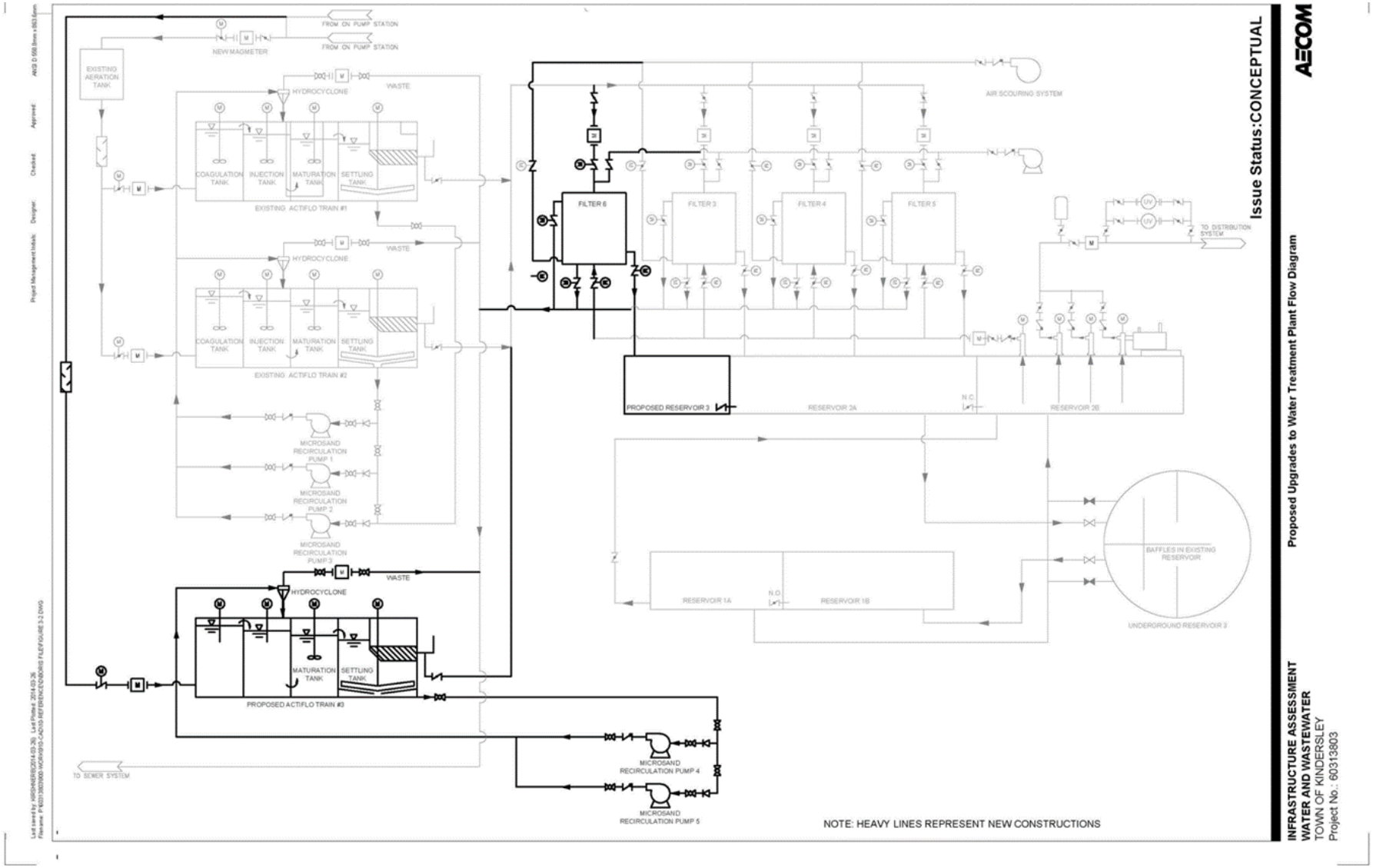


Figure 3.7: Proposed Upgrades to Water Treatment Plant Flow Diagram

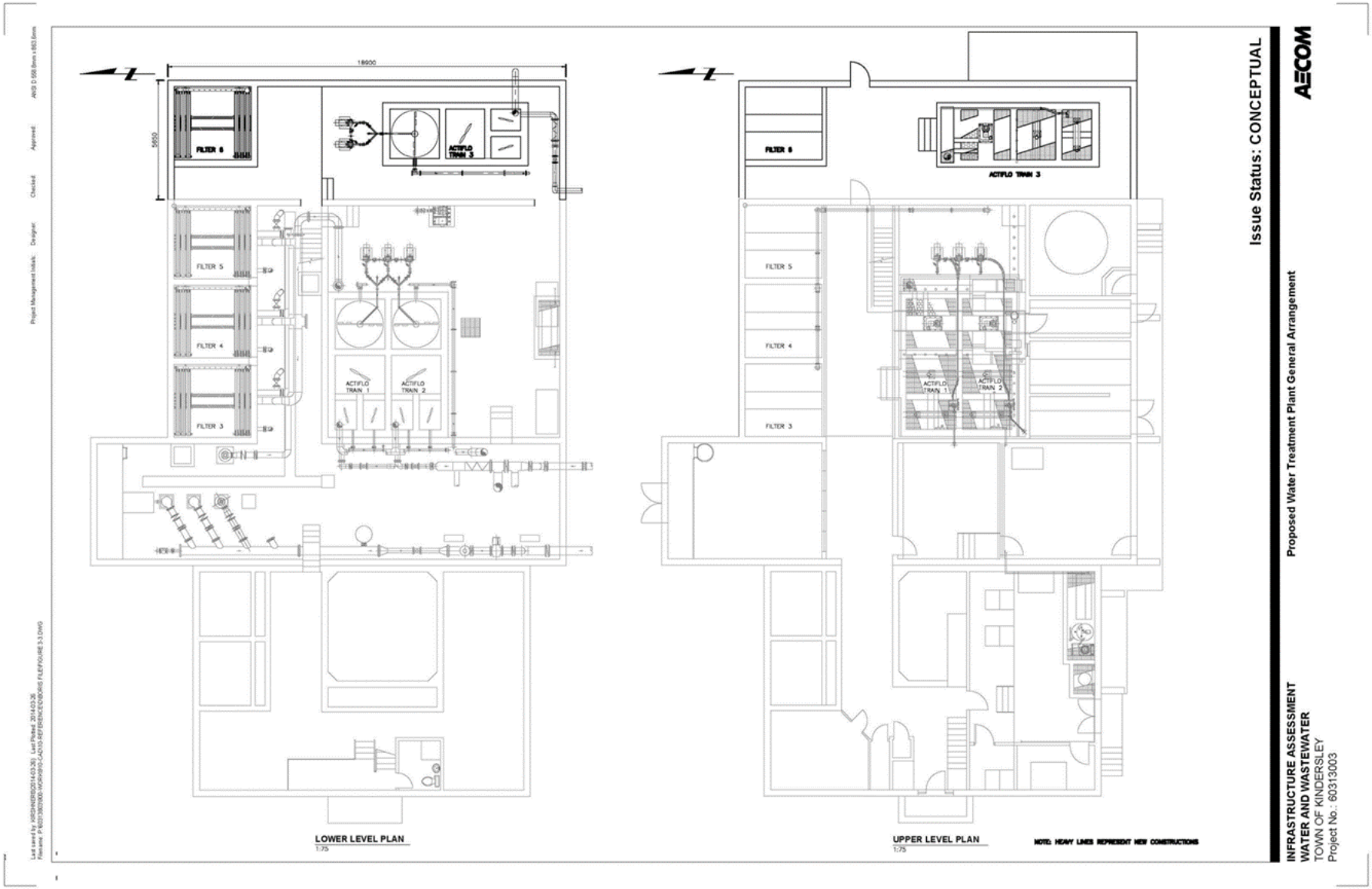


Figure 3.8: Proposed Water Treatment Plant General Arrangement

3.6 SaskWater Kindersley Capital Improvements and Repair Plan

SaskWater has provided operation and maintenance services for the Town of Kindersley since February 2018. This includes the operation of the raw water supply system, water treatment plant (WTP) and distribution pumps. As part of the service, SaskWater provides the Town an annual Capital Improvement and Repair (CI&R) plan. The report provides recommended capital improvements and repairs in order to meet Operating Permit requirements, and applicable laws and regulations. The report also allows the town to budget for upcoming upgrades and minimize emergency capital expenditures.

SaskWater also has a Certified Operation and Maintenance (COM) agreement with the Eston-Kindersley Water Administration Board (EK Board) that started in March 2021. The COM agreement includes the operation and maintenance of the River Pumping Station (RPS), the Snipe Lake Pumping station (SLPS), and non potable pipelines. SaskWater will also provide annual CI&R reports to the EK board to meet Operating Permit requirements, and applicable laws and regulations.

This section will outline the recommendations, both completed and not completed to date, by SaskWater. This will help determine any infrastructure upgrades that have been done at the WTP since 2018 and any future upgrades that are required for the water treatment plant and raw water supply system.

3.6.1 Completed Improvements/Repairs

Several improvements that were recommended by SaskWater were completed in 2020-2023. Table 3.5 summarizes the upgrades that were completed at the WTP. Improvements to note includes the addition of a spare backwash pump and motor, new bulbs and sensor for the UV system, a liquid chlorine feed system, chlorine containment system, and new turbidity meters for all three filters that are in service.

Historical upgrades identified through Eston Kindersley Water Administration Board Capital Improvement and Repair Plan (2023).

Table 3-12: Completed Upgrades at Kindersley Water Treatment Plant (From SaskWater Annual Capital Improvement and Repair Plans, 2020-2022)

Capital Improvement/Repair	How Improvement was Completed	Report Year Completed
Spare Backwash pump and motor	Saskwater supplied matching pump from one of the other systems that they operate	2020
Reference sensor for UV system	Replaced sensor	2020
Bulbs for the UV system	New UV bulbs purchased	2020
Liquid feed system for chlorine	Chlorine feed system setup to feed liquid sodium hypochlorite via a chemical feed pump	2020
Chlorine containment system	Containment system/pallet was purchased	2021
Turbidity meters for filters upgraded	Turbidity meters upgraded to Hach TU5300 for all three filters	2022
Replacement of HMI computers for the WTP	Computers ordered and will be installed by end of 2023	2023
Smaller potassium permanganate chemical pump for CN pump station	Pump has been purchased and installed	2023

Capital Improvement/Repair	How Improvement was Completed	Report Year Completed
WTP Air handling unit replacement	Unit has been replaced	2023
RPS cell booster	Upgrade complete	2023
SLPS pump packing drain	Repair Complete	2023

3.6.2 Recommended Improvements/Repairs

There are several recommended improvements for the WTP that SaskWater has recommended from 2019-2023 that have not been completed (as of October 2023). In addition, SaskWater has upgrade recommendations for the raw water system.

Table 3-13 summarizes the recommended improvements for the Kindersley WTP and Table 3-14 summarizes the recommended improvements for the EK board raw water supply system.

The 2023 WTP CI&R report recommended a couple priority upgrades to be completed in the next year that include:

- Adding anthracite media to filters #1-3
- Converting the fluoride system to a liquid feed system
- Floor grating repair
- Loading dock repair

Other improvements that are recommended for the next 2-5 years include:

- Backwash pump and motor replacement
- Chemical containment basin leak repair
- Pump motor 103 replacement
- Clearwell valve replacement
- Upgrade lights to LED

Table 3-13: Recommended Improvements for the Kindersley Water Treatment Plant (From SaskWater Annual Capital Improvement and Repair Plan, 2023)

Capital Improvement/Repair	Summary of Improvement	Recommended Completion Timeline
Anthracite filter media	Add anthracite media to bring filters 1-3 up to 1200mm freeboard. Approximately $3m^3$ is required	within the next year
Conversion of liquid fluoride feed	Supplier cannot provide solid sodium fluoride, required to convert to feed liquid fluorosilicic acid.	within the next year
Floor grating repair	Steel floor grating in basement sump area is damaged and need repairing	within the next year
Loading dock repair	Steel loading dock plate is in poor condition and needs repairs	within the next year
Chemical containment basins	Four chemical containment basins subject to leaking, repair recommended using hydraulic cement leak repair on basin joints	Next 2-5 years
Pump Motor 103 replacement	Standby distribution pump 103 motor not used, could be replaced with electric motor	Next 2-5 years
Valve 104	Valve separating clearwells 2A and 2B is in failed closed condition and requires replacement	Next 2-5 years
Backwash pump and motor	Pump and motor are older and need to replaced in the future	Next 2-5 years
Upgrade lights to LED	Replace inefficient tube light fixtures to LED; 26 light fixtures to replace	Next 2-5 years

The 2023 EK board CI&R report recommended upgrades to be completed within the first year. The RPS requires a couple priority upgrades that include upgrading the cooling system and installing new well. The cooling system requires duct work repair so the filter cassettes can be accessed and cleaned. The condition of the current production well is poor and there is significant corrosion occurring on the well casing.

The CI&R report also recommended replacing the RPS Variable Frequency Drives (VFDs) in the future. This is not a priority item and recommended to be completed in the next 2-5 years. One VFD was repaired in September 2021 and there are three remaining to be replaced. The SLPS AC unit is aged and underperforming and will need replacement in coming years.

Table 3-14: Recommended Improvements for the Eston Kindersley Water Board Raw Water Supply System (From SaskWater Annual Capital Improvement and Repair Plan, 2023)

Capital Improvement/Repair	Summary of Improvement	Recommended Completion Timeline
RPS Cooling System Upgrade	One of the air intakes require duct work repair to allow access to filter cassettes	Within the first year
RPS new well	The condition of the current production well is poor and there is significant corrosion occurring on the well casing	Within the first year
RPS and SLPS Communication Upgrades	Current communication system will shut down pump stations during a communication loss event	Upgrades in progress
RPS Variable Frequency Drive (VFD) Replacement	Three VFD's are remaining to be replaced	Next 2-5 years
SLPS AC Unit	AC Unit is aged and under performing and will need replacement in coming years	Next 2-5 years

3.7 Upgrades Summary

Table 3-15 provides a summary of all upgrades required for the raw water infrastructure and water treatment plant. Upgrades to the raw water system are to be completed in two phases, year 2021 and year 2029. The water treatment plant upgrades will be completed as one project.

Table 3-15: Summary of Water Supply and Treatment Upgrades

	Upgrade	Description	Opinion of Probable Cost	Priority
Raw Water Upgrades	Stage 1	Designed to supply 87 L/s Raw Water to Kindersley WTP	$6,950,000	8- Low
	Stage 2	Designed to supply 104 L/s Raw Water to Kindersley WTP	$6,850,000.00	8 – Low
	SaskWater Year 1	RPS Cooling System and New Production Well	 $5,000.00 TBD	1 – Immediate
	Saskwater Year 2-5	SLPS VFD Replacements x 3 AC Unit	 $30,000.00 $6,000.00	3 - Immediate
WTP – Infrastructure Upgrades	Infrastructure Upgrades	Filtration/UV upgrades[1]	$5,500,000	8- Low

Note 1: WTP infrastructure upgrades will be required when treated demand reaches 70 l/s

4. Water Distribution System

4.1 Introduction

The water distribution system provides water to the public that is safe for human consumption and has adequate pressure for use in domestic applications and provide fire flow. The existing water distribution system consists of approximately 58 km of pressure pipe ranging in diameter from 100 mm to 400 mm. Table 4-1 details the pipe material, diameter, and age range within the distribution system. All water supplied within the Town comes for the WTP distribution high lift pumps. There is a single primary supply line that leaves the WTP. This primary main provides pressure to the Town and fills the water tower. The Town's water distribution system consists of one single pressure zone.

The water distribution system pressure is primarily controlled with the water tower. Two high lift distribution pumps are located at the WTP and are used to maintain normal water level in the water tower. Pump 327 operates primarily as the duty pump and the other pump, 104 acts as the standby. The pumps are not designed or programmed to run simultaneously. Pump 327 has a rated capacity of 70 L/s at 490 kPa, with a current operating average day demand of 49.6 L/s.

The Town implements an annual cast iron replacement program, the location of the replacements are determined by the Town staff based on available budget and number of issues (breaks) with a segment of pipe.

Table 4-1: Water Distribution System Infrastructure Summary

Pipe Material	Diameter (mm)	Year of Installation		Length (m)
		Oldest	Newest	
Asbestos Concrete	150	1956	1979	11,906
	200	1968	1979	2,644
	400	1985	1985	220
Total AC				**14,770**
Cast Iron	100	1958		63
	150	1950	1962	3,796
	200	1953	1986	1,948
Total CI				**5,900**
Unlined Cast Iron	100	1950	1958	523
	150	1950	1963	1,575
	200	1953	1959	3
Total UCI				**2,101**
PVC	100	1988	1990	86
	150	1955	2021	16,919
	200	1981	2019	6,227
	250	1985	2014	1,673
	300	1986	2014	753
	400	1984	2004	2,013

Pipe Material	Diameter (mm)	Year of Installation		Length (m)
		Oldest	Newest	
Total PVC				**27,671**
Steel	200	1959		103
HDPE	150	2013	2015	1,553
	175	1991	1991	96
	200	1998	2012	232
	250	2011	2015	341
Total HDPE				**2,222**
Unknown	150			**102**
Total Water Piping		1950	2021	**52,776**
Water Piping installed 2013 or later				**6,174**

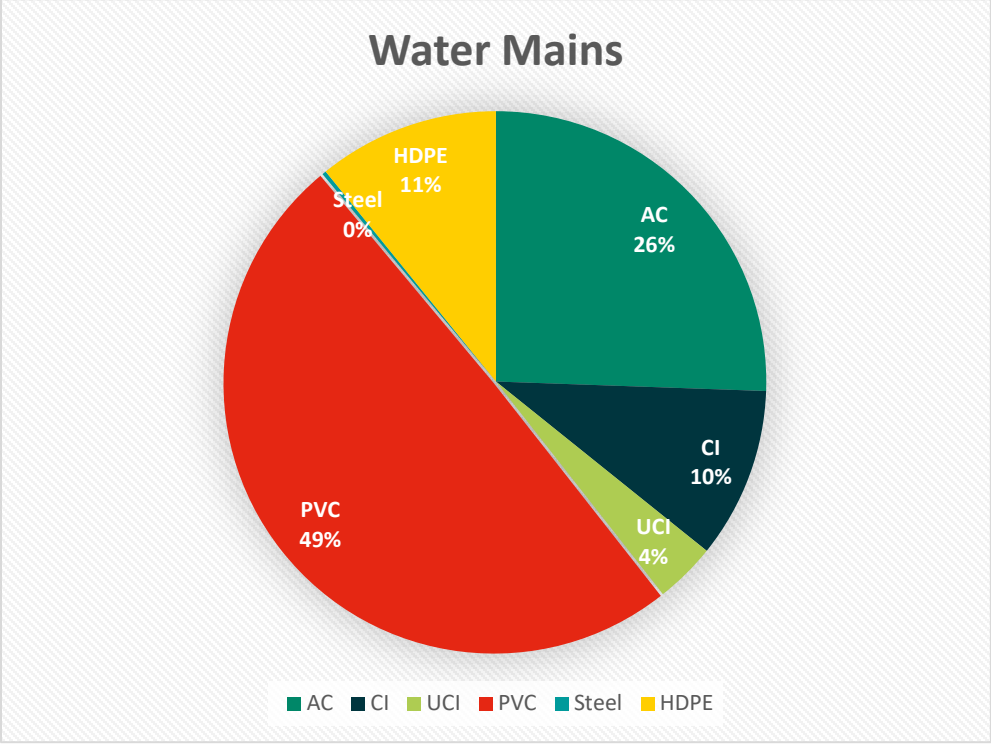


Figure 4.1: Distribution of Watermain Materials

4.2 Distribution Piping Upgrades

4.2.1 Main Street Watermain Replacement

The 2014 Infrastructure Capacity report identified upgrading piping near the water tower to have a positive effect on the distribution network. The upgrade consists of replacing 150 m of 150 mm Cast Iron water main with a recommended 250 mm water main. The upgrade will allow water will flow further into the distribution system before experiencing a significant drop in pressure therefor having a widespread positive impact throughout the distribution system.

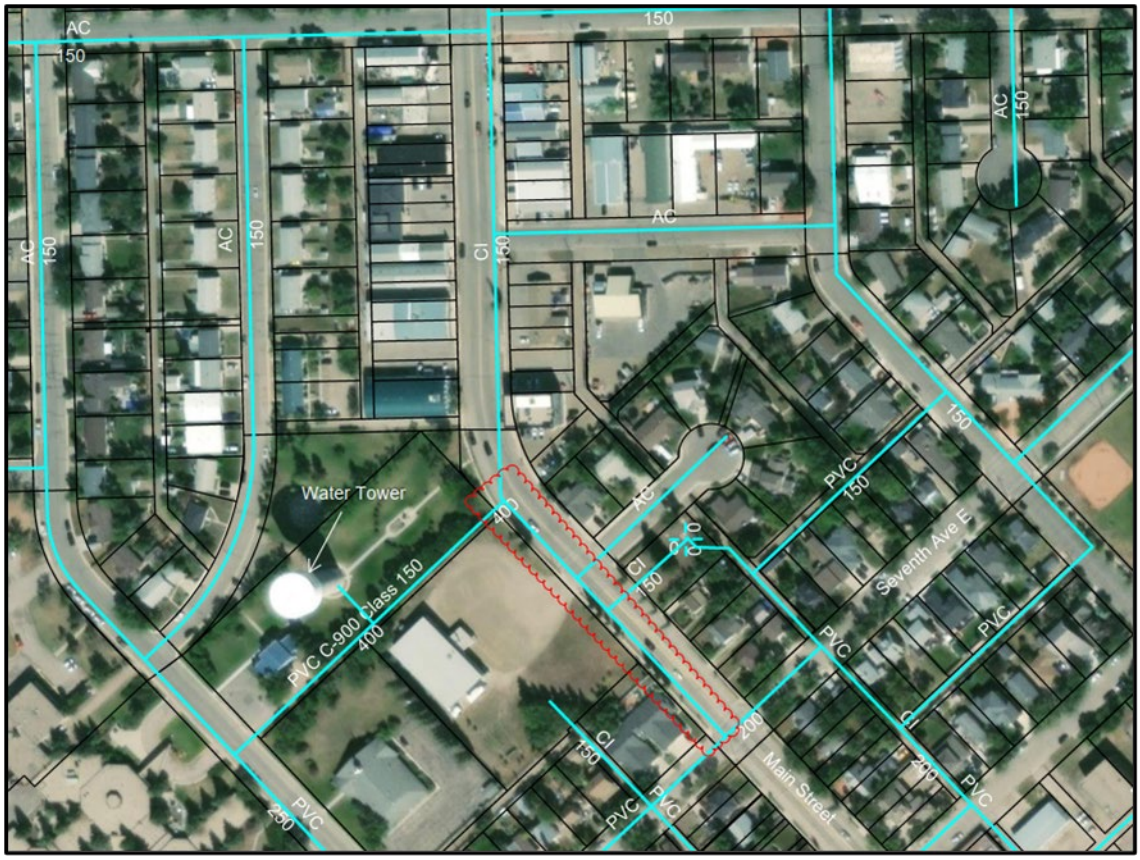


Figure 4.2: Main Street Watermain Replacement

The recommendation from the modelling completed in 2014 indicated upgrades from the water tower to Seventh Ave E would result in a positive effect on the pressure distribution system. AECOM, without modelling, is reaffirming this recommendation as an upgrade. AECOM also recommends that review of the impact of upgrading the 150 mm cast iron watermain North of the water tower to Eleventh be evaluated for upsizing as well. It is expected that upsizing the section of watermain to the north will have a positive impact on the distribution system, however, this should be verified with a computer model to verify priority of the upgrade.

4.2.2 Highway 21 Crossing

As identified in the 2014 Infrastructure Capacity Assessment distribution system modelling, flow to the West Industrial area is constricted by the pipe crossings of Highway 21 at 7th Avenue and 11th Avenue. Increasing the pipe crossings to 250 mm diameter will allow more flow into the area. Daily flow rates may typically be low due to

the smaller number of occupants in the area; however, fire flow requirements may be higher than normal if there are facilities with larger amounts of combustible materials on site. AECOM is reaffirming the recommendation for the upgrade as increasing capacity at the identified locations should result in a favourable outcome in a fireflow scenario.

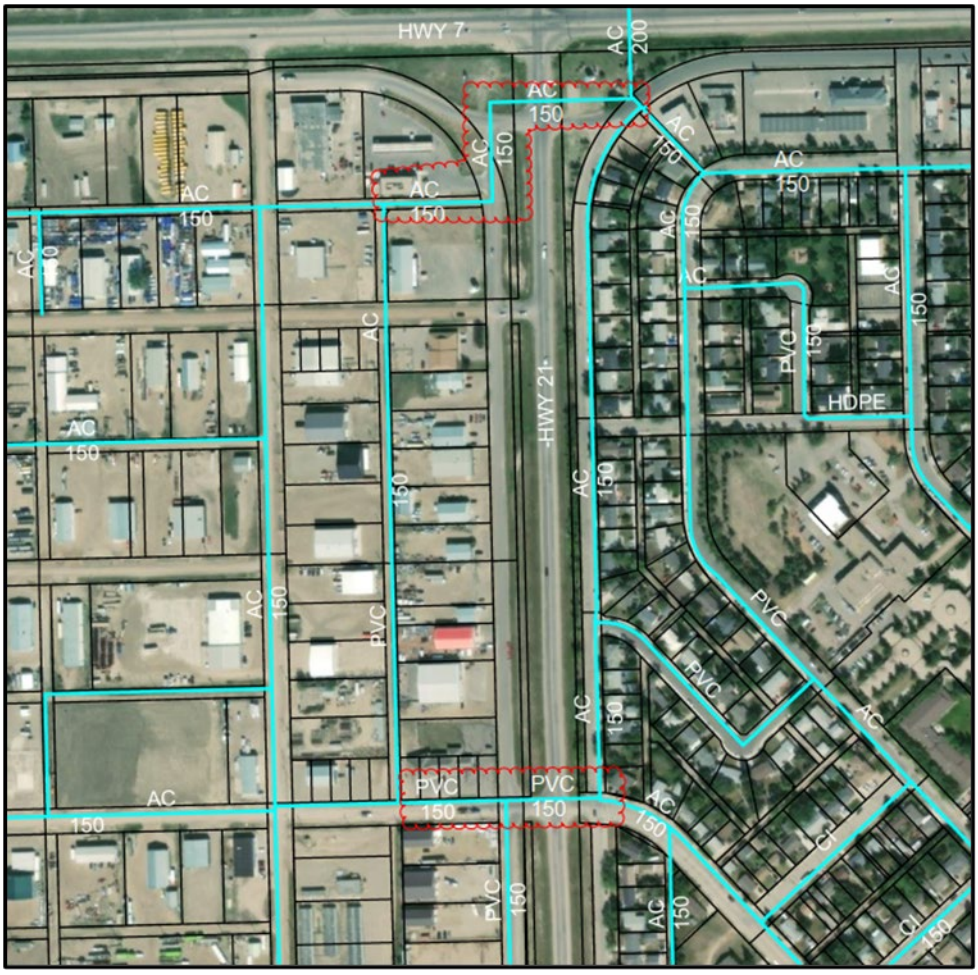


Figure 4.3: Hwy 21 Watermain Crossings

The total length of pipe recommended for replacement is 440m.

4.3 Water Tower

Treated water storage reservoirs and the water tower should be emptied for cleaning and inspection approximately every five years. The USEPA recommends a maximum inspection and cleaning interval of between two to five years for water storage facilities. In regards to ongoing maintenance activities, it is advised that the Town consider cleaning and inspecting the reservoir and water tower more frequently as the facilities age. It is not clear when all reservoirs were last cleaned, some of the clear wells at the WTP would have been emptied and cleaned in 2012 when upgrades occurring, there is no record of those reservoirs, or the water tower being drained and cleaned since.

4.4 Watermain Replacement, Assessment and Rehabilitation

The town implements an annual replacement program, the location of the replacements are determined by the Town staff based on available budget and number of issues (breaks) with a segment of pipe. The Town should continue to prioritize replacement of sections of pipe based on the following criteria:

- Watermain Break Rate
- 100 mm diameter watermain (150mm is the minimum for fire protection)
- Identified areas through hydraulic modelling which would have a positive impact on fire protection.

Watermain upgrades parameters have included incorporating looping of the watermain distribution system where improvements would be realized for two reasons, provide a more continuous flow and improved concentrations of chlorination.

Watermain upsizing is recommended in situations where distribution piping is below the minimum 150 mm Pipe diameter as 100 mm is the minimum required for fire flow.

The table below summarizes the total changes in distribution piping in the Town of Kindersley since 2013. The data below includes new pipe installed without replacement and is suspected to include additional pipeline information that may have not been identified previously resulting in partially skewed results.

AECOM recommends the Town continue to track pipeline replacements and new piping installed to aid in decision making.

Table 4-2: Water Main Material Change over 10 years

	AC	CI	UCI	HDPE	PVC	Steel
	Cumulative Pipe Length (m) Sorted by material					
2014 (Inf. Capacity Report)	15,884	7073	1704	884	24,892	872
2024	14,770	5807	2101	2,222	27,671	103
10 Year Change	-8%	-22%	123%[1]	250%	11%	-846%

Note 1: UCI pipe was not installed in the last decade, identification of unknown pipe material may have increased since 2013 resulting in the indicated 22% increase.

Based on data from the Town of Kindersley Base model since 2013, watermain upgrades can be summarized as:

- 6,174 m of watermain has been installed.
- 1,114 m of Asbestos Concrete has been replaced or removed
- 1,266 m of Cast Iron has been replaced or removed
- 669 m of Steel has been replaced or removed
- 397 m of Unlined Cast Iron has been identified
- 1,318 m of HDPE pipe has been installed
- 4,856m of PVC has been installed

Proactively managing pipelines may lead to strategic selection of locations for upgrade prior to failure. The intent of assessment prior to failure is to avoid service interruptions, depressurization, and costly repairs. As full-scale replacement has significant costs implementing a proactive approach is suggested. As an assessment program would require prioritization and field inspection, it is suggested that the Town procure a Contractor to perform Water Main Inspection and Condition Assessment.

Cast Iron: Corrosion evaluation of pipe failures. The typical recommended approach for inspection is to perform a *Corrosivity Survey*.

Opportunity spot assessments of failed pipe at the site of a watermain break may be performed to further extrapolate the condition of a section of watermain. Performance and documentation of testing on failed Cast Iron and Asbestos Concrete Watermain can lead to improved selection of pipelines for replacement.

AC Pipe: Carbonation evaluation of pipe failures. The typical recommended approach for inspection is to perform phenolphthalein stain testing of opportunity samples from repairs and service taps.

4.5 Hydraulic Modelling

A dynamic hydraulic model identifies weaknesses in a water distribution system and evaluation of the current system capacity for expansion. Effective management of a water distribution model includes continual updates as replacements are completed and provides a method for a structured assessment for community expansion. It is recommended to complete hydraulic modelling if infrastructure expansion is proposed or water pressure concerns are flagged.

AE in 2014 updated the original EPANet model into a WaterCAD model. For a full description of the work done on the Hydraulic Model in 2014, refer to the *2014 Infrastructure Capacity Analysis*.

4.6 Recommended Upgrades

Table 4-3: Recommended Distribution System Upgrades

Upgrade	Description	Reason	Cost Estimate	Priority
Main Street Watermain Replacement	Upgrade watermain to 250 mm Diameter along main street between Eleventh Avenue East and seventh Avenue East.	Increase flow out of the water Tower and remove cast iron pipe.	Capital Cost: $2,000,000.00	4 - Moderate
Cast Iron Replacement	Continue to implement Cast Iron replacement program	Prioritization to be based on highest frequency of break rates	Annual budget allocation.	3 - Immediate
100 mm Water Main Replacement	Replace 100 mm watermain with 150 mm PVC or HDPE water main. Prioritize based on age and material of pipe.	150 mm piping is the minimum diameter required for fireflow.	Annual budget allocation.	4 - Moderate
Highway 21 Crossing	Flow to the Northwest Industrial area is constricted by pipe crossings of HWY 21 at 7th Avenue and 11th Avenue.	Improve fire flow in the network.	Capital Cost: $600,000.00	4 - Moderate
Water Tower Inspection and Cleaning	Regular cleaning and inspection of water towers are recommended.	Previous date of cleaning of Water Tower is unknown.	Capital Cost: $30,000.00	2 – Immediate
Hydraulic Model Update	Build an updated hydraulic model.	An updated hydraulic model of the distribution system will support in identifying weaknesses in flow and pressure.	Engineering Cost: $30,000.00	4- Moderate
Watermain Assessment Program	Finalize the program to evaluate the condition of aging water mains. Watermain Flushing and Hydrant Testing Watermain Break Tracking and pipe break material testing	An evaluation program is proactive instead of reactive saving on disruption to services and emergency costs.	Engineering Cost: $20,000.00	3 -Immediate

5. Wastewater Collection System

5.1 Introduction

This section discusses the Town's existing wastewater collection system including the sewer mains and sewage lift stations.

The Town's wastewater collection system consists of underground gravity sewer mains, force mains, manholes, and lift stations. The collection system is divided into four distinct catchments. Within each, the wastewater flow is collected and pumped to the lagoon or flows directly into the lagoon for treatment and disposal.

The Town's AUTOCAD master base map was used to collect the existing wastewater collection system piping.

The initial collection system was constructed in 1950 and now consists of approximately 42 km of pipe, ranging in diameter from 150 mm to 900 mm. The pipe materials in the wastewater collection system include asbestos cement (AC), concrete, PVC and vitrified clay tile (VCT) pipe. Table 5-1 summarizes the pipe material, diameter, age range and linear lengths of each pipe type and diameter within the wastewater system. The Town has been replacing wastewater collection piping with PVC piping as required. Table 5-1 also shows the length of wastewater piping that has been replaced after 2013.

Table 5-1: Wastewater Collection System Infrastructure Summary

Pipe Material	Diameter (mm)	Year of Installation		Length (m)
		Oldest	Newest	
AC	200	1964	1976	311
	250	1976		12
	300	2002		4
	Total Sum of Length			**327**
Concrete	200	1950	1960	5,575
	250	1950		435
	Total sum of length			**6,010**
PVC	100	2003	2020	238
	200	1979	2020	11,557
	250	1981	2019	3,452
	300	2008	2020	782
	375	1985	2020	313
	Total sum of length			**16,343**
VCT	200	1950	2008	15,356
	250	1950	1984	2,296
	300	1950		1,150
	375	1976		332

Pipe Material	Diameter (mm)	Year of Installation		Length (m)
		Oldest	Newest	
	Total sum of length			**19,134**
	Sanitary piping installed 2013 or later			**5,874**
			TOTAL	**41,982**
Note: Golfview subdivision not included in totals				

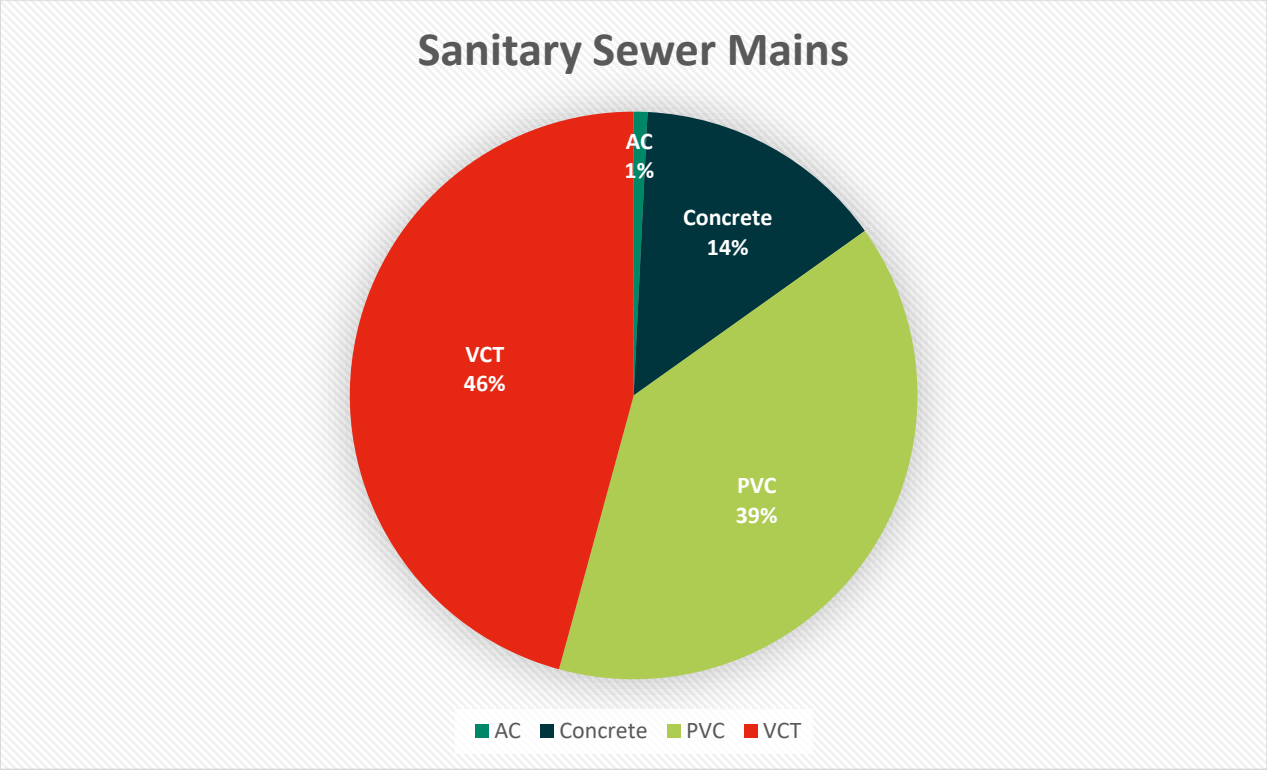


Figure 5.1: Distribution of Sanitary Sewer

5.2 Catchment Areas

For the purpose of the analysis, the Town has been split up in to four different wastewater catchment areas. These catchments are referred to by the following catchment names and descriptions:

- Rosedale Lift Station: this area includes all of Rosedale, and a portion of the Town along Ditson Drive, including the commercial area along Highway 7, east of Ditson Drive, and the acreages just north of Highway 7.
- Highway 7 & 21 Lift Station: this are includes the east portion of the industrial area, a large portion of the commercial area north of Highway 7, and the northwest corner of the Town core.
- Industrial Lift Station: this area includes the west portion of the industrial area.

- Town Core area: this is the majority of the Town within which all the wastewater flows by gravity to the lagoon.

5.3 Lift Stations

General

In total the Town has four (4) lift stations. Three of which are owned and operated by the Town (Rosedale, Highway 7 & 21, and Industrial Lift Station) and one that is privately owned and operated (Golfview). The lift stations owned and operated by the Town are assessed herein.

The lift stations are wet-well types with two submersible pumps. Hoists allow for removal of each pump from the wet well for maintenance within a room above the wet well.

As was commonplace at the time of construction, electrical and mechanical equipment required to operate the pumps and operate building services are installed in a service room directly above the wet well. Hwy 7 and 21 Lift Station and Rosedale Lift station wet well has a dedicated supply air fan to reduce the build-up of hazardous vapours and allow for inspection by an operator. The industrial lift station operates similarly but air forced into the service room is exhausted through the wetwell forcing air changes as observed on site, construction and record drawings of the facility were not available for review.

Each lift station was supplied with standby power and includes a single level transmitter to continuously monitor the level of sewage within the wet well. Upon reaching the pump start level, the transmitter automatically starts the duty pump, which operates at a constant speed. The standard operating intent is that the pumps operate as a duty / standby configuration, such that the capacity of a single pump should be equal to or greater than the peak hour inlet flow to the wet well. The pump operates until the wet well level is pumped down to the stop pump level, as measured by the level transmitter. Upon reaching this level, the transmitter automatically stops the pump. Where a single pump cannot keep up with the inlet flow and the level continues to rise, the transmitter starts the second pump as an emergency measure.

There is limited other instrumentation available to assist with operations and troubleshooting: A pump discharge pressure gauge exists at Hwy 7 and 21 Lift Station and run time hours meter for each pump is included at each location.

There is currently no means of alerting an operator to a problem using cell phones, or SCADA system.

5.3.1 Highway 7 & 21 Lift Station

The Highway 7 & 21 lift station is located at the intersection of 11th Avenue West and 8th Street West. Originally constructed in 1962, the facility underwent upgrades in 2015. The site surrounding the lift station is one of the major gateways to the Town and is treated like a public park or rest stop as travelers come into town.

The station receives sewage from a light industrial area west of Highway 21, including pumped sewage from the Industrial lift station, a commercial area north of Highway 7, and a commercial/residential area located South-East of the Highway 7 & 21 junction. Sewage from surrounding areas (commercial and industrial) is collected in a manhole located 2.6 meters from the building prior to entering the lift station wet well.

Figure 5.2: Highway 7 & 21 Lift Station

5.3.1.1 Pump Capacity and Estimated Loading

Pumps are Flygt NT 3153.180-1504 HT, impeller 456, 12 HP motor. The increased diameter forcemain installed in 2015 increased the flow rate of the pumps to an estimated 30 L/s. AECOM executed drawdown tests in December, 2023 on site to measure the performance of the pumps. Pump A on average pumped at 24.3 L/s, and pump B pumped at 29.8 L/s.

The power limit for the pumps is around 33 L/s, therefor, the impellor cannot be increased in size to increase capacity of the pump if additional capacity was required. The pumps are currently not undersized and the capacity of the pumps is expected to service the wetwells into the future based on wastewater loading. The surrounding area of the lift station has been identified to flood during spring runoff or significant rain events, this flooding at this location may have harmful effects if it enters the wastewater collection system and causes the wetwell at the lift station to overflow. It is recommended to address the drainage concerns in the area of the lift station to prevent additional stormwater from entering the system in the case of a high intensity or duration storm event.

Compiling pump hour data from November 2022 to November 2023, average day wastewater loading was estimated as well as peak hour loading at the HWY 7 & 21 Lift Station. The results are as follows:

- Average Day Loading: 5.47 L/s
- Peak day Loading: 27 L/s

5.3.1.2 Sewage Forcemain

Sewage is pumped through a 752 meter, 250 mm force main to a manhole located at 3rd Street West and 8th Avenue, then flows by gravity to the lagoon. The current forcemain was constructed in 2015 replacing the original (1962) 150 mm AC forcemain which was abandoned in place and capped. The forcemain upgrade increased the capacity of the system.

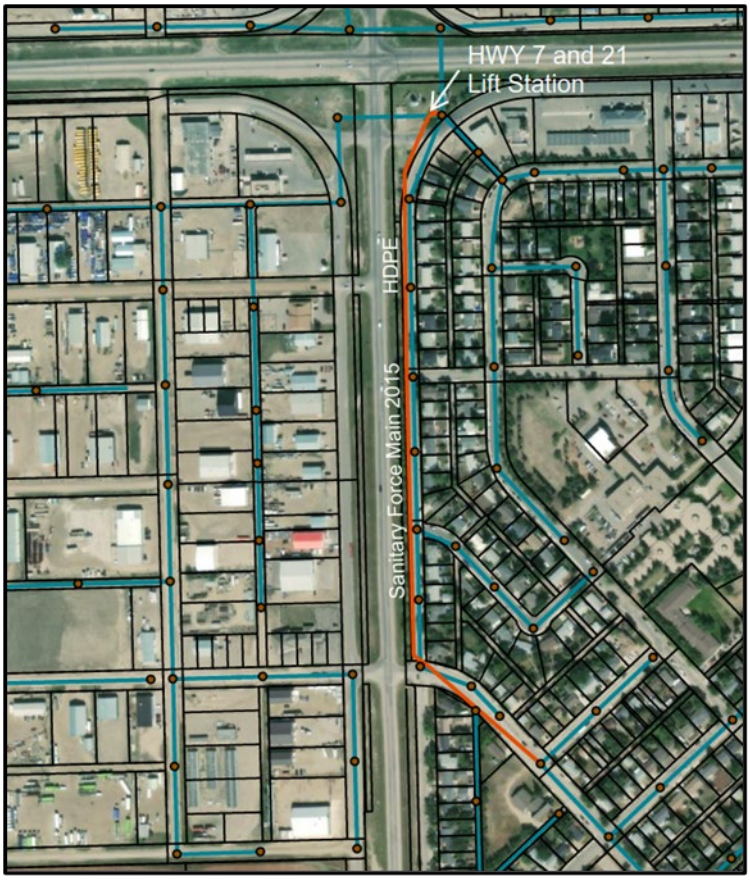


Figure 5.3: West Industrial Sewage Forcemain

5.3.1.3 Condition Review

- The piping and interior wet well components, excluding the check valves, visually appeared to be in good condition.
- The check valves visually appeared to have significant amounts of corrosion. The pressure gauge was not operating properly as an air lock was in the line. It is recommended to fix the pressure gauge and then observe the pressure reading on the gauge when both pumps aren't running. If the gauge portrays a pressure slowly dropping, it is likely that the check valves need maintenance or replacement.
- The impellor in the pumps grey iron, hard iron impellors is current standard practice in wastewater pumping applications. Grey iron impellors deteriorate faster then hard iron. Upgrading to Hard-Iron impellors is dependant on available manufacturer parts and the hydraulics of the system.

5.3.1.4 HVAC

AECOM reviewed the HVAC system with conformance to the current codes and regulations.

With the 2015 expansion of the wetwells it is suspected the exhaust rates do not accurately match the drawings in the current configuration. To verify the flow rates on design drawings are achieved it is recommended a temporary flow meter be used to test the flowrate. The wetwell HVAC as shown on the drawings operating continuously at 12 air changes per hour, is undersized. The new wet well portion, based on size requires a ventilation rate of 166 L/s, and the old wet well requires a rate of 83 L/s.

In addition, in a pumpstation where the service room is above the wetwell, there is a potential for the seal on the hatch to fail, introducing potential hazardous gases into the service area. Due to risk of failure of the hatch it is recommended to treat the service room akin to the wetwell and provide adequate ventilation in the service room. The required ventilation in the service room to achieve 12 air changes per hour (intermittent) is 87 L/s, the current HVAC provides 50 L/s.

5.3.1.5 Electrical and Backup Power

Electricity enters the building through an underground conduit on the north side of the building. Gas enters on the west side. Potable water is supplied through a 19 mm diameter underground copper pipe, located on the north side of the building. There is no telephone service at this site.

Backup power is provided by a 45 kW gas powered generator.

5.3.1.6 Previous Upgrades (2015)

Most recent upgrades occurred in 2015 to the Hwy 7 & 21 Lift station included the following:

- Hatch cut into existing slab (1.435 x 0.813)
- Existing ventilation, heater, ducting, asbestos pipe insulation removed
- 750W x 2000H opening cut into baffle wall between drywell and wetwell to create single collection wetwell
- Sump demolished
- Piping and electrical in wetwell removed
- Safety platform dismantled
- Pumps retrofitted for submersible wet well use
- Metal roof and window installed
- New safety platform
- New piping and valves
- New unit heater
- New ventilation installed in electrical room (50 L/s, continuous supply)
- Wetwell ventilation (133 – 266 L/s)

5.3.1.7 Recommendations

The facility while functioning is currently outdated in its current configuration. Upgrading the facility to meet current standards would likely involve expansion of the building and upgrading electrical equipment. The capacity of the pumps is adequate for current loading, however significant growth may trigger an upgrade.

- If wetwell capacity is exceeded during storm events, consideration should be given to upgrade the facility.
- The pressure gauge in the facility had an airlock not allowing for a proper reading to occur, it is recommended to repair the pressure gauge and consider performing maintenance on the check valves or replace the check valves.
- Improve site grading surrounding the building as drainage is poor
- Verify the flow rates of the HVAC to verify the lift station is in compliance with current codes and standards

- Consider increasing the flow rate of the ventilation in the service room to achieve 12 air changes per hour (verification of electrical capacity is required) this supports in meeting compliance in the case the hatch does not seal.)
- Convert the Gas Unit heater into explosion proof electrical unit heater.

5.3.2 Industrial Lift Station

The Industrial Lift Station was constructed in 2015 replacing the Danielson lift station. The Industrial Lift Station is located in the quarter section East of 15th St W and North of 12th Ave W. The Danielson lift station located at the NE corner of 14th Street West and 10th Avenue was decommissioned. The Wetwell was measured at 2.4m in diameter.

The Industrial Lift Station pumps wastewater through a 200 mm, 600 m HDPE DR17 forcemain and connects to the existing 200 mm 1983 PVC force main previously used as the Danielson forcemain. Wastewater is pumped a total distance of 1429 m where it is expelled into a manhole at the intersection of Eleventh Street West and Tenth Avenue West where it is conveyed by gravity to the HWY 7 & 21 Lift Station.

Figure 5.4: Industrial Lift Station

5.3.2.1 Pump Capacity and Estimated Loading

The facility operates with a two pump, alternating lead lag configuration where the pumps operate simultaneously in parallel when the high-level alarm is triggered. A backup pump is readily available providing redundancy when pump maintenance is required.

The pump model is Flygt NP 3127 HT 3 Adaptive 488, 10 HP motor. AECOM executed drawdown tests in December, 2023 on site to measure the performance of the pumps. Pump 1 operated at 14.9 L/s, and pump 2 pumped at 15.5 L/s. According to the pump hour records provided by the Town, on average for 2023, this lift station operated less than 1.5 hours per day.

AECOM compiled pump hour data from November 2022 to November 2023, average day wastewater loading was estimated as well as peak hour loading. The results are as follows:

- Average Day Loading: 0.50 L/s
- Peak day Loading: 2.6 L/s

In conclusion, the pumps are sized adequately for the observed flows and are anticipated to handle future growth within the Industrial Catchment area.

5.3.2.2 Sewage Forcemain

The Industrial Lift Station pumps wastewater 1429 m through a 200 mm, 600 m HDPE DR17 forcemain (2015) and connects to the existing 200 mm 1983 PVC force main previously used as the Danielson forcemain. Wastewater is pumped into a manhole at the intersection of Eleventh Street West and Tenth Avenue West where it is conveyed by gravity to the HWY 7 & 21 Lift Station.

Figure 5.5: Industrial Lift Station Sewage Forcemain

5.3.2.3 Condition Review

- Discussion with Town of Kindersley Operations staff identified a failure had occurred with the Control Panel, leading to the wet well backing up leaving organic/sludge residue on components within the wetwell. It is recommended the Town flush the wetwell, cleaning the excess sludge and organics off the ladder, piping, safety grating, and additional components to reduce potential corrosion and maintain the life expectancy.
- Surface rust was observed on the process piping and valves, deeper physical deterioration of piping components was not visually identifiable.

- Discussion with operators indicated maintenance has not been done on any of the components within the wetwell since the facility was constructed.
- Check valve seals deteriorate over time and require maintenance, it is recommended to replace the seals on the check valves as they have been in operation for 8 years without maintenance. No pressure gauge existed in the facility to gauge the performance of the check valves.

5.3.2.4 HVAC

Without review of the drawings for the facility, assumptions were required to be made in the assessment of the HVAC. In summary, it is suspected the HVAC is sized adequately to achieve the required number of air changes in the facility (for intermittent operation), however it should be noted the HVAC did not appear to be functioning as it was designed upon inspection of the facility in December 2023.

5.3.2.5 Electrical and Backup Power

A gas powered generator provides backup power at the facility providing redundancy in case of a power outage.

5.3.2.6 Previous Upgrades

No major upgrades have been done to the facility since construction.

5.3.2.7 Recommendations

- It is recommended to seal the gap at the bottom of the access door to maintain positive pressure in the building forcing air changes as intended in the wetwell. It is recommended to test the capacity of the existing ventilation to check that the minimum number of air changes per hour is met.
- Clean the existing wetwell to remove sludge and organic buildup from interior components due to the control malfunction which caused the system to backup. Cleaning of the wetwell will reduce increased possibility for corrosion and deterioration of the components.
- It is expected that the original section of PVC forcemain (1982) has sludge buildup that has accumulated over time. It is recommended to swab/ flush the forcemain to improve hydraulic efficiency of the pumps.
- It is advised to convert the unit heater into an explosion-proof unit

5.3.3 Rosedale Lift Station

The Rosedale sewage lift station is located on west side of Ditson Drive, at the intersection of West Road. The lift station services the Rosedale Subdivision, a small residential area north of Railway Avenue, and several acreages and a commercial development along Highway 7 east of Ditson Drive.

Figure 5.6: Rosedale Lift Station

Built in 1976, this lift station is a poured concrete wet well with two submersible pumps. The station collects sewage from a network of gravity mains, ranging in diameter from 200 mm to 375 mm, with a 375 mm diameter vitrified clay tile pipe inlet to the precast concrete circular well (2440 mm diameter).

A 1600m, 250 mm Diameter HDPE sanitary forcemain was constructed from Rosewood pumping station to the partial mix cell at the Lagoon. The Golfview sanitary forcemain was extended to tie into the sanitary forcemain where it is pumped to the lagoon with the Rosedale discharge.

As was commonplace at the time of construction, electrical and mechanical equipment required to operate the pumps and operate building services are installed in a service room directly above the wetwell.

5.3.3.1 Pump Capacity and Estimated Loading

The facility is configured to operate with a two pump, alternating lead lag configuration where the pumps operate simultaneously in parallel when the high-level alarm is triggered. A backup pump is readily available providing redundancy when pump maintenance is required.

The pump model in the Rosedale lift station is N3127.181 HT 488 .

Due to inaccurate level readings from the Siemens XPS-10 ultrasonic transducer the pump sequencing was not operating as intended.

- It was observed with every pump cycle the high alarm was triggered initiating both pumps. This is causing both pumps to operate simultaneously resulting in an increase in power consumption and leading to a decrease in the life of the pumps and starter equipment.

Drawdown Testing Observations

A draw down test was performed with the wet well hatch open. Readings from the Multiranger level reading increased and decreased rapidly while the wetwell steadily was filled. It is estimated that P1 is operating at 27.7 L/s and P2 is operating at 35 L/s. To generate these flow estimates the following was assumed:

- It is estimated the level sensor was reading values with up to 600 mm of error at the site visit in December 2023.

Compiling pump hour data from November 2022 to November 2023, average day wastewater loading was estimated as well as peak hour loading. The results are as follows:

- Average Day Loading: 3.2 L/s
- Peak day Loading: 17.8 L/s

In conclusion, the loading estimates provide evidence to support the fact that the pumps themselves are not undersized. The age and condition of the facility is expected to be a factor triggering upgrades before the pump capacity will be a factor in an upgrade.

It is recommended to immediately address the issues with the level transmitter and perform drawdown tests on the pumps so a more accurate estimate of pump performance and sewage loading can be generated.

5.3.3.2 Sewage Forcemain

A 1600m, 250 mm Diameter HDPE sanitary forcemain was constructed from Rosewood pumping station to the partial mix cell at the Lagoon. The Golfview sanitary forcemain was extended to tie into the sanitary forcemain where it is pumped to the lagoon with the Rosedale discharge.

Figure 5.7: Rosedale Sewage Forcemain

5.3.3.3 Condition Review

- Discussion with Town of Kindersley Operations staff identified the backup level floats were removed from the operation.
- Discussion with Town of Kindersley Operations staff identified the Siemens XPS Ultrasonic Transducer has historically caused issues and the sensor requires frequent cleaning of moisture and grease buildup.
- Surface rust was observed on the process piping and valves, deeper physical deterioration of piping components was not visually identifiable.
- A problem with the transfer switch was identified and repaired recently.
- Check valve seals deteriorate over time and require maintenance, it is recommended to replace the seals on the check valves as they have been in operation for 8 years without maintenance. No pressure gauge existed in the facility to evaluate the performance of the check valves.

5.3.3.4 HVAC

The wetwell ventilation, operating continuously at 12 air changes per hour, is undersized at 118 L/s. The wet well, requires a ventilation rate of 125 L/s. Currently, the heating capacity of SE-2 is 6 kW, would need to be upgraded to achieve $\triangle T$ = 45C at the desired flow rate of 125 L/s.

The design of the ventilation of the service room is achieving 12 air changes per hour. However, it should be noted significant odour was observed in the service room upon inspection of the facility in December 2023.

5.3.3.5 Electrical and Backup Power

Electricity is fed through an underground conduit from the post located approximately 22 meters south of the building. The conduit enters the building underneath the electric meter. There is no potable water, gas or telephone service at this site. There is an underground telephone cable south of the building.

The Town indicated that the existing 60 kW Generator at the Rosedale pump station has reached its life expectancy and has acquired a quote to replace the generator with a new 60 kW Natural Gas Powered Generator.

5.3.3.6 Previous Upgrades (2010)

The upgrades listed below were completed in 2010:

- Building expansion for new electrical equipment;
- Two new pumps, Flygt NP3127.181 HT, rated at 30.5 L/s at 15.8 m head;
- Piezometric water level sensor and float switches to replace existing;
- Isolation and Check valves complete with stainless steel process piping to replace existing;
- Aluminum access hatch door, ladder, grating platform to replace all existing metal works;
- Complete HVAC system, heat exchanger, Wet well fresh air inlet/exhaust fans and ducting;
- Stand-by power generator with a sound-attenuation enclosure, installed outside of the building;
- Electrical control panel, mcc, service entrance, and automatic transfer switch.

5.3.3.7 Recommendation

AECOM recommends the Town proceed with a preliminary design report for upgrades to the Rosedale Sewage Lift Station.

- It has been identified the original HVAC design does not meet the current flow rate required to achieve the number of air changes as per NFPA and WSA standards and the heating capacity is undersized.
- The current configuration of the facility does not provide for separation if the seal on the hatch leaks, classifying the service room which houses all mechanical and electrical equipment. Due to the age and identifiers herein it is recommended to pursue a pre-design report for upgrades for the facility.
- It is recommended to service the Ultrasonic Level Transmitter that is malfunctioning.
- It is recommended to install the backup floats in addition to the electronic level transmitter.

5.4 Wastewater Hydraulic Modelling

A dynamic hydraulic model can identify weaknesses in the conveyance system, aiding in providing infrastructure upgrade recommendations and can provide evaluation of existing capacity for expansion. Effective management of a wastewater hydraulic model will evaluate and predict where future upgrades may be required. In the *2014 Infrastructure Capacity Assessment* a Mike Urban Model was created by AE to identify weaknesses. An update to the model has not been done since the model was created 2014.

Hydraulic models use existing elevation and geometric data where it is then compiled to use for modelling. This data in the form of GIS files is the structure of a model. The GIS data can be updated as the community expands, and upgrades to infrastructure is made. Having a working model allows for more effective infrastructure management in a community.

AECOM recommends the Town obtain a working sanitary model in XPSWMM or INFOWORKS.

5.5 Sanitary Sewer Assessment

The Town has older sanitary gravity mains in the wastewater collection system, with some from the original 1950s gravity main installation. These mains are expected to deteriorate and eventually fail over time. To determine the condition of these pipes, a CCTV inspection program is recommended to implemented by the Town. AECOM recommends excuting the program in a phased approach, for example, inspecting 3-4 blocks at a time, however, it is recommended to execute a plan to optimize contractor pricing. The CCTV inspection plan should correspond to gravity mains that are under roads planned to be rehabilitated in the future.

5.6 Potential Upgrades for Consideration

Table 5-2: Upgrades for Consideration

Upgrade	Description	Reason	Cost Estimate	Priority
Sanitary pipes 220, 223, and 224	The gravity mains that convey the industrial area wastewater to the Highway 7 & 21 Lift Station.	The 2014 model showed the pipes had sufficient capacity for the existing system. Buildout of the west industrial area is expected to push the boundary of pipe capacity.	$300,000.00	4-Moderate

Upgrade	Description	Reason	Cost Estimate	Priority
Future Industrial -South of existing Industrial area	Infrastructure planning is required for the South Industrial Area. The 2014 infrastructure capacity assessment recommended a pump station at the South of the Industrial area, further review of the most effective method of wastewater management is recommended.	The Industrial Lift Station has adequate capacity for future buildout in the west industrial area to handle flow from the South. The upgrades to Highway 7 and 21 pump station sewage forcemain has increased the potential for future capacity upgrades at this location to handle the flow conveyed from the industrial lift station.	Further review of the wastewater loading is recommended for infrastructure planning.	8-Low

5.6.1 Future Industrial - South of existing Industrial area *(AE, 2014)*

- Using the Associated Engineering design standards, the minimum average wastewater generation for an industrial area is 17,500 litres per gross hectare per day (L/ha/d). The type of land use within the current industrial area consists of large lots, laydown areas, and buildings that do not generate a large amount of wastewater. If the town is planning to allow heavier industry to develop, a larger amount of wastewater generation would need to be considered in the future design.

5.6.2 Future Industrial and Highway Commercial – North of Highway 7 *(AE, 2014)*

- The OCP has identified two 45 hectare areas for future industrial development. Currently the information for the gravity main north of Highway 7 is not known. Once the existing lots are developed, and future development occurs to the north, depending on the actual grade of the pipe, this main may need to be upgraded. Assuming that the existing mains are graded at 0.4%, the pipes have sufficient capacity to service the industrial area to the north, unless heavy industrial will be located there, then further design would need to be done.

5.7 Recommended Upgrades

Table 5-3: Wastewater System Upgrades

Upgrade	Description	Reason	Cost Estimate	Priority
Rosedale Lift Station Upgrade	Repair level transmitter and install backup floats	Level transmitter not reading accurately.	$10,000.00	1 - Immediate
	Replace Generator	Generator has reached its life expectancy	$75,000.00	4 - Moderate
	Preliminary Design of Rosedale Lift Station Upgrades	A review of upgrade options and recommendation to get the facility up to current standards. Cost estimate includes geotechnical (If required).	$65,500.00	1-Immediate
	Significant lift station upgrades	An engineered upgrade is expected to lead to the recommendation of significant upgrades, options will be reviewed	$2,250,000.00	4-Moderate
HWY 7 & 21 Lift Station Upgrade	Repair Pressure Gauge	Pressure gauge not functioning, gauge to be used for evaluation of pump performance and ball check performance	$2,000.00	1 - Immediate
	Service/Replace Ball Check Valves after checking on seal	Seals need to be serviced	$2,000.00	3 - Immediate
	Install Backup Floats	Backup floats are for pump protection	$4,000.00	3 - Immediate
	Temporary HVAC flow monitoring.	It is expected the flow rates in the wetwell is not as indicated on the design. Temporary flow monitoring is recomended to verify the facility HVAC is in compliance.	$10,000.00	4 - Moderate
	Increase flow rate of Service Room ventilation	Increasing the flow rate to achieve 12 air changes per hour in the service room provides adequate ventilation in the case the seal of the hatch fails	1.Could be low cost upsize fan or blower ($5,000.00) 2. May require more significant upgrades further review is required	4- Moderate
Industrial Lift Station Operational Repairs	Service Ventilation System	The HVAC system is not functioning as intended. Physical indicators were lack of airflow from Wetwell exhaust vent and airflow from crack below access door.	$5,000.00	1 - Immediate
	Clean Wet well	Clean the wetwell to preserve the service life of the components within the wetwell.	$5,000.00	1 - Immediate

Upgrade	Description	Reason	Cost Estimate	Priority
	Service/ Replace Ball Check Valves	Seals need to be serviced	$2,000.00	3 - Immediate
	Flush/Swab the existing forcemain	The original (1982) PVC forcemain likely has sludge buildup. Flushing/Swabbing to remove any sludge buildup will improve hydraulic performance of the system.	$2,000.00	3 - Immediate
Wastewater Hydraulic Modelling	Update the Town Wastewater Hydraulic Model	A working model aid in identifying areas for upgrade	$30,000.00	4 - Moderate
CCTV Inspection Program	Inspect areas of aging sewer main via camera annually.	Inspection will support in identification of areas for repair	$50,000.00	4 – Moderate

6. Wastewater Treatment

6.1 Introduction

This section will discuss the Town's existing wastewater treatment system and analyze the system's treatment performance. The current regulatory requirements, including the permit to operate, will be summarized.

The Town's wastewater treatment lagoon was recently upgraded with construction completed in October 2020. The lagoon expansion and associated upgrades were designed to service a population of 10,000 people with a total demand of 3.08 ML/day. The completed upgrade included the construction of two new partial mix aeration cells. Details of the upgrade will be described below and can be found in the *2021 Town of Kindersley Lagoon and WW Completion report* (AECOM, 2021).

6.2 Regulatory Requirements

The Water Security Agency (WSA) is responsible for waterworks operations in Saskatchewan and regulates adherence to effluent quality criteria set out in the *Waterworks and Sewage Works Regulations* (Government of Saskatchewan, 2015). Wastewater treatment in Saskatchewan is regulated at the provincial level through the EMPA (Environmental Management and Protection Act). Through the act, a Permit to Operate a Sewage Works are issued to any permittee that operates a wastewater treatment and/or wastewater collection facility. The permit ensures that the permittee discharges wastewater that is safe for the receiving waterbody. Any construction or alteration to wastewater facilities requires obtaining a new or altering a Permit to Operate.

Saskatchewan wastewater quality standards are periodically updated to address environmental and health risks caused by constituents in wastewater effluent. As treatment technologies are advanced and new environmental issues are identified, it is anticipated that the maximum effluent limits will become more stringent with time.

6.2.1 Downstream User and Impact Study

The 2014 *Infrastructure Capacity Assessment* included a recommendation for a future Downstream Use and Impact Study (DUIS) to be submitted to the Water Security Agency (WSA) prior to the wastewater treatment upgrade. A DUIS was prepared and completed by AECOM in August 2015 on behalf of the Town and submitted to WSA for review. The DUIS established effluent limits for the Kindersley wastewater system as shown in Table 6-1 below. The DUIS also determined that the evaporative cell, downstream drainage run and Teo Lake are all saline and thus not fish bearing environments or waters. This eliminated the ammonia and phosphorus removal from the effluent stream as a requirement. The DUIS limits were accepted by WSA, thus the wastewater system was designed to meet the recommended effluent parameters.

Table 6-1: Recommended Wastewater Effluent Criteria (From DUIS Study)

Parameter	Proposed Effluent Criteria	Basis for Compliance
Biochemical Oxygen Demand (BOD)	≤ 25 mg/L	Maximum
Total Suspended Solids (TSS)	≤ 25 mg/L	Maximum

6.2.2 Permit to Operate

The waterworks system for Kindersley includes a Class 1 wastewater treatment facility and a Class 2 wastewater collection facility for the purpose of the permit. A new permit to operate was issued after the lagoon upgrade and the DUIS study was used as a basis for the wastewater effluent limits. The current permit expires in January 2027 and the permit number is 00050460-05-00.

The permit to operate specifies parameters that are required to be measured, the wastewater sampling locations and the minimum sampling frequencies. The permit specifies the wastewater quality limits for the final treated wastewater effluent that include 5-day carbonaceous biochemical oxygen demand(cBOD), total suspended solids (TSS) and biological oxygen demand (BOD). Chloride, total coliform bacteria, and *Escherichia Coli(E-coli)* are also required to be measured from the final treated wastewater effluent but do not have limits specified in the permit. The wastewater discharge from Teo Lake has testing requirements cBOD, chloride, TSS, total coliform bacteria and *E-coli* but have no limits specified in the permit. Similarly, three monitoring wells require testing for conductivity, chloride, nitrate, total coliforms and *E-coli* but have no specified limits.

Table 6-2 summarized the testing requirements and figure x shows the permit limits for the final treated wastewater effluent. The full permit to operate is shown in Appendix C.

Table 6-2: Wastewater Testing Requirements
(Adapted from Permit to Operate A Sewage Works (WSA, 2022))

Location	Frequency	Parameters	Limit in Permit?
Wastewater discharge to Teo Lake	Semi annually- midway through a discharge period (Once April to September, once October to March)	5-day cBOD/BOD Chloride TSS Total Coliform Bacteria *E-coli*	No
Treated wastewater effluent discharge to environment	Once midway though each discharge period	5-day cBOD/BOD Chloride TSS Total Coliform Bacteria *E-coli*	Yes for BOD, cBOD, TSS
Monitoring wells	Once per year (June to August)	Conductivity Chloride Nitrate-N Total Coliform Bacteria *E-coli*	No

Location	Parameter	Limit
Final Treated Wastewater Effluent SK05GB0110 – Teo Lake Discharge	5-day Carbonaceous Biochemical Oxygen Demand	Shall not exceed an annual arithmetic mean of 25 milligrams per litre.
	Total Suspended Solids	Shall not exceed an annual arithmetic mean of 30 milligrams per litre.
	Biological Oxygen Demand	Shall not exceed an annual arithmetic mean of 30 milligrams per litre.

Figure 6.1: Final Treated Wastewater Effluent Discharge Limits
(From Permit To Operate A Sewage Works (WSA, 2022))

6.3 Existing Treatment

The wastewater treatment system includes a series of aerated facultative and partial mix lagoons and an evaporative cell. Prior to the recent lagoon upgrade, raw wastewater entered a large single aerated facultative cell and the treated effluent was pumped into a man-made evaporative cell at Teo Lakes approximately 10 km east of the Town. The effluent was then released into Teo Lakes from the evaporative cell.

However, the previous facultative aerated lagoon treatment system did not meet effluent limits making a treatment upgrade necessary. Upgrades were completed in 2020 and included the construction of two new partial mix aerated cells installed at the front end of the treatment process, i.e., before the existing facultative cell. The treated effluent is than pumped into the evaporative cell and eventually into Teo Lakes as done before the upgrade.

6.3.1 Wastewater Collection

All the Town's effluent (excluding the process wastewater at the water treatment plant) is collected through a gravity collection system and a series of lift stations as noted in Section 5. Industrial and Highway 7 & 21 lift stations discharge into the gravity collection system. Prior to the wastewater upgrades, the gravity trunk main discharged wastewater into the northwest portion of the wastewater lagoon and the Rosedale lift station had a forcemain which discharged directly into the northeast portion of the wastewater lagoon. As part of the lagoon upgrades, both the Rosedale force main and the gravity trunk main were replaced and re-routed to have the wastewater enter the first new aerated cell.

6.3.2 Wastewater Lagoons

Kindersley's wastewater treatment infrastructure was initially constructed in 1955 as a two-cell facultative lagoon system. In 1983, the then three cell lagoon was converted to a single cell system by breaching the internal berms and hydraulically connecting the three cells. In 2010 the Town contracted Nelson Environmental Inc. (Nelson) to implement an aeration system in the wastewater lagoon to mitigate odour that was being generated from the site and drifting into Town.

As described above, two new partial mix cells were added to the treatment process as part of the 2020 lagoon upgrade. The wastewater flows through the two partially mixed cells before entering the existing single facultative cell. Transfer piping manholes are used to move wastewater between the cells. Figure 6-2 shows an aerial view of the lagoon cells.

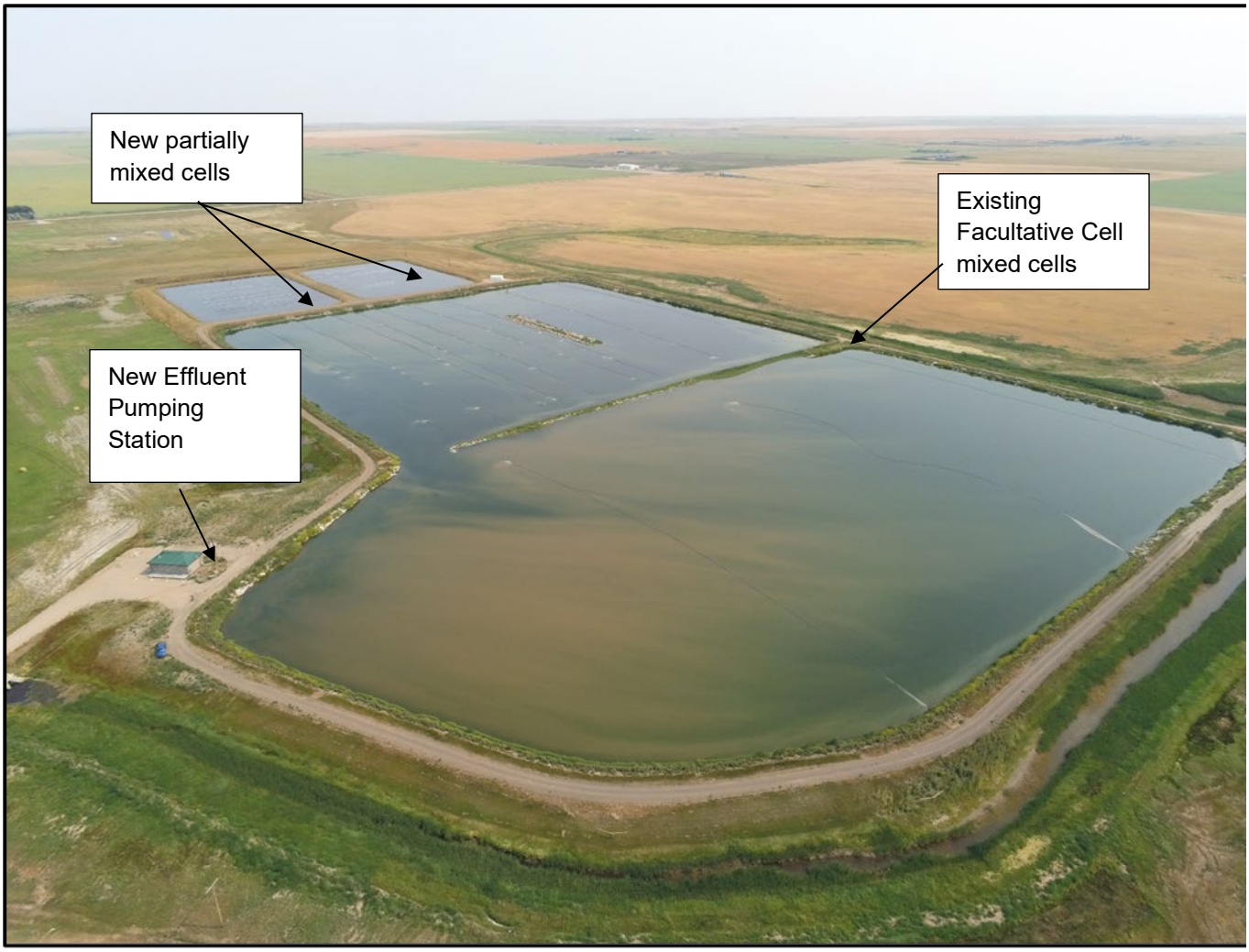


Figure 6.2: Aerial view of Town of Kindersley Lagoon Cells

Table 6-2 shows the lagoon cell sizes and retention times including the newly installed cells. Note that the two smaller existing cells are combined as one cell in this table.

Table 6-3: Upgraded Lagoon Cell Volumes

Cell	Reactor type	Water Depth(m)	Water Volume(m^3)	Retention time(days)
1	Partial mix	4.5	50,963	16.5
2	Partial mix	4.5	50,963	16.5
3	Existing Facultative	1.5	100,979	32.8
4	Existing Facultative	1.5	98,609	32.0
		TOTAL	**301,515**	**97.9**

6.3.3 Blower System

A blower building was constructed adjacent to the effluent pumphouse as part of the 2010 project with Nelson and consisted of two-60hp positive displacement blowers which were both in operation during normal conditions. The existing blower building is still being used; however, as part of the upgrade, a second building was installed to house blowers for the new aeration system. The second building contains three 60hp positive displacement blowers operating as two in service and one on standby.

6.3.4 Evaporative Cell

An evaporative cell was constructed in 1979 under a Prairie Farm Rehabilitation Program (PFRA). It is located 10km west of town adjacent to Teo Lakes. It is approximately 834 ha in area and separated from Teo lakes by an embankment, a drainage run and Highway 7. In 1979 an earthen berm was constructed to control the evaporative cell's size and water levels. An overflow structure at the evaporative cell redirects overflow of treated effluent into Teo Lakes.

6.3.5 Effluent Pumping Station

An effluent pumping station was originally constructed in 1968, located at the southwest corner of the lagoon cell near the aeration blower building. Upgrades to the original pumping station were completed in 1979 and 1987. Two wastewater forcemains are connected to the effluent pumping station and extends to the evaporative cell. In 1968 a 150 mm diameter asbestos cement (AC) pipeline was constructed and in 1984 a 250mm diameter PVC pipe was constructed parallel to the existing pipeline.

The effluent pumping station was replaced as part of the lagoon upgrade as the existing station was not suitable going forward and is located adjacent to the existing pumphouse. The pumping station consists of a wetwell/drywell configuration. The wetwell is supplied wastewater through a transfer pipe installed into facultative cell No. 4. The wastewater pumps are installed in the drywell section of the station supplied with wastewater from suction pipes installed in the wetwell. There are two wastewater pumps installed in a duty/standby configuration, both powered with a variable frequency drive (VFD). Figure 6-2 shows the location of the new effluent pumping station relative to the lagoon cells.

The effluent pumping station does not have backup power.

6.3.6 Lagoon De-Sludging

The existing lagoon cells were de-sludged as part of the upgrade. A sludge survey of the existing cells was completed determining an approximate 64,000 m^3 of sludge required to be removed. The Town proceeded with dredging, drying via centrifuge and stockpiling of sludge removed.

6.3.7 Lagoon Performance

The lagoon performance was assessed using parameters including carbonous biological oxygen demand (cBOD), dissolved chloride, total coliforms, *Escherichia Coli (E-coli)*, and total suspended solids (TSS). The parameters were compared before and after the lagoon upgrade was completed and to the permit to operate limits. Table 6-4 summarizes the minimum, maximum and average effluent data prior to the October 2020 upgrade; Table 6-5 summarizes the parameters after the upgrade.

The lagoon sample results were obtained from the Government of Saskatchewan Waste Water Sample Test website for Kindersley (Waste Water Sample Tests (saskatchewan.ca). There were 64 monthly tests from October

2012 to August 2021 and yearly tests from August and October 2023. All samples were collected from the primary 1st cell effluent.

Table 6-4: Kindersley Lagoon Effluent Data- before October 2020

Description	Chloride Dissolved (mg/L)	TSS (mg/L)	Total Coliform orgs/100ml	*E.Coli* orgs/100 ml	Carbonaceous Biochemical Oxygen Demand (mg/L)
Minimum	86	7	2419	146	7.4
Maximum	491	764	980400	648800	150
Average	246	96	211941	99918	41.5
WSER Limit	-	30	-	-	25

Table 6-5: Kindersley Lagoon Effluent Data- October 2020 and later

Description	Chloride Dissolved (mg/L)	TSS (mg/L)	Total Coliform orgs/100ml	*E.Coli* orgs/100 ml	Carbonaceous Biochemical Oxygen Demand (mg/L)
Minimum	118	9	10	10	12
Maximum	329	128	829700	3255	45
Average	223	49	109085	583	25.1
Permit	-	25	-	-	25

The lagoon effluent data showed that TSS, coliforms, *E-coli* and cBOD all decreased after the lagoon upgrade. The dissolved chloride stayed relatively the same. The subsections below will discuss these parameters in detail including graphs showing the parameter values over time.

6.3.7.1 Total Suspended Solids

Figure 6-3 shows the monthly TSS concentration (when available) for the years 2015, 2017, 2019, 2021 and 2023. The TSS limit indicated in the wastewater permit to operate is also shown on the graph to show if the TSS was meeting the regulatory requirements.

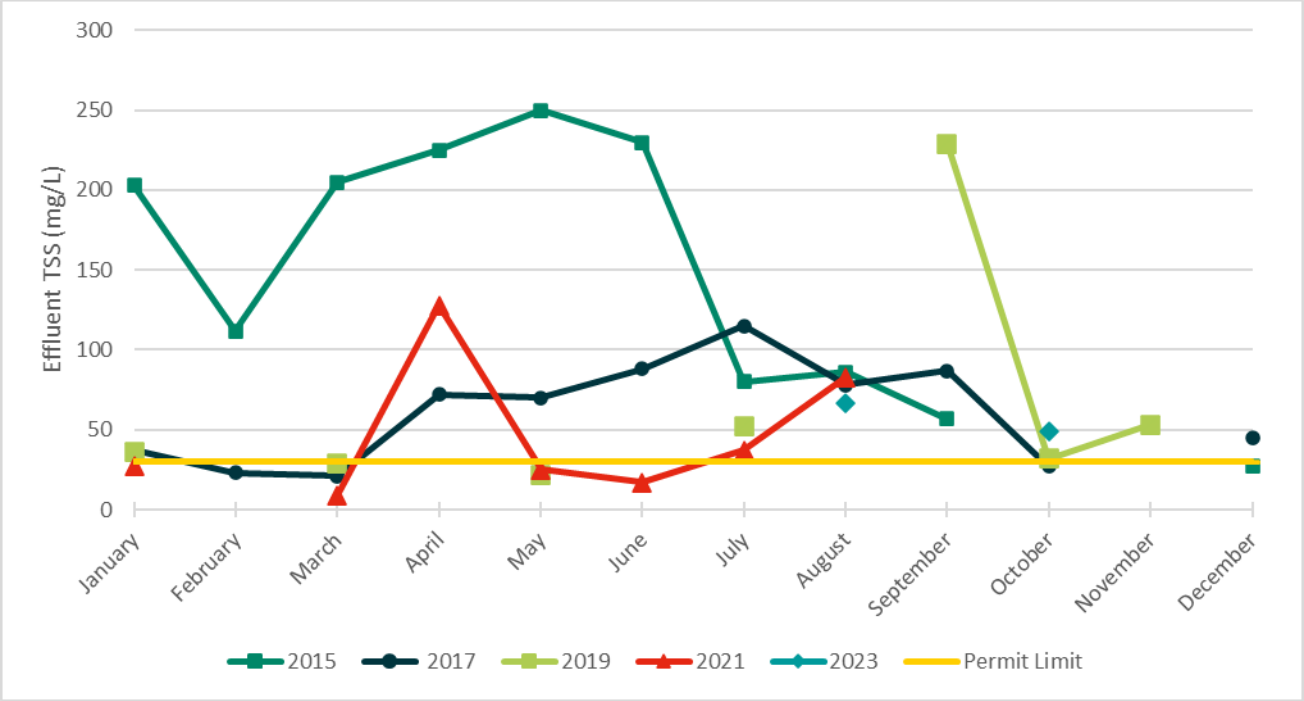


Figure 6.3: Monthly Effluent TSS (2015, 2017, 2019, 2021 and 2023)

The effluent TSS was the highest in 2015 and lowest in 2021 after the lagoon upgrade. The TSS was generally highest in the summer with June and August having the highest TSS concentrations.

The TSS before the lagoon upgrade ranged from 7-764 mg/L with an average of 96 mg/L. The TSS after the upgrade ranged from 9-128 mg/L with an average of 49 mg/L. The average effluent TSS decreased 49% after the upgrade; however, the average TSS is still above the 30 mg/L limit specified in the permit to operate.

6.3.7.2 Microbiology

Figure 6-4 and Figure 6.5 shows the monthly effluent total coliforms and *E-coli* concentration respectively (when available) for the years 2015, 2017, 2019, 2021 and 2023. Note that the counts were log transformed for ease of comparison.

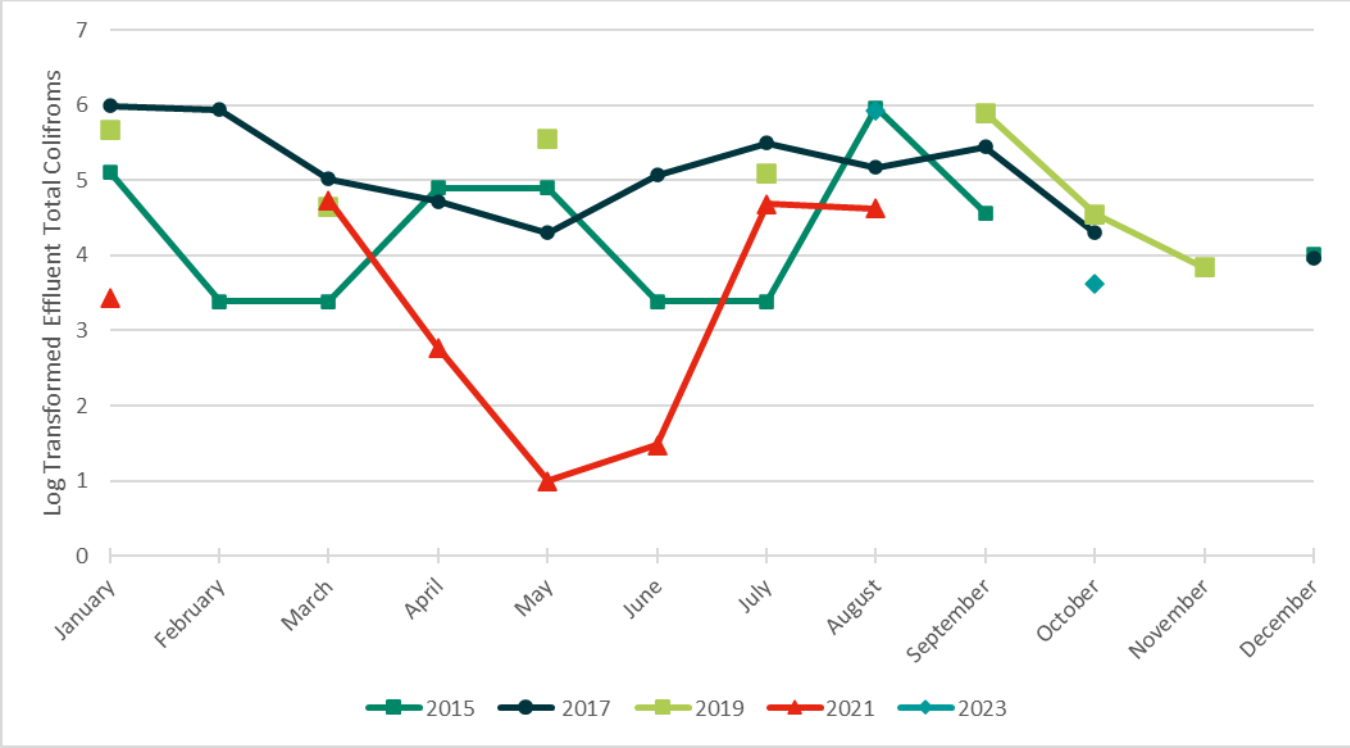


Figure 6.4: Log Transformed Effluent Monthly Coliform Count (2015, 2017, 2019, 2021 and 2023)

The total coliforms before the lagoon upgrade ranged from 2,419 to 980,400 counts/100 mL with an average of 211,941 counts/100 mL; the total coliforms after the upgrade ranged from 10-829,700 counts/100mL with an average of 109,085 counts/100 mL. The average total coliforms decreased 48.5% after the upgrade.

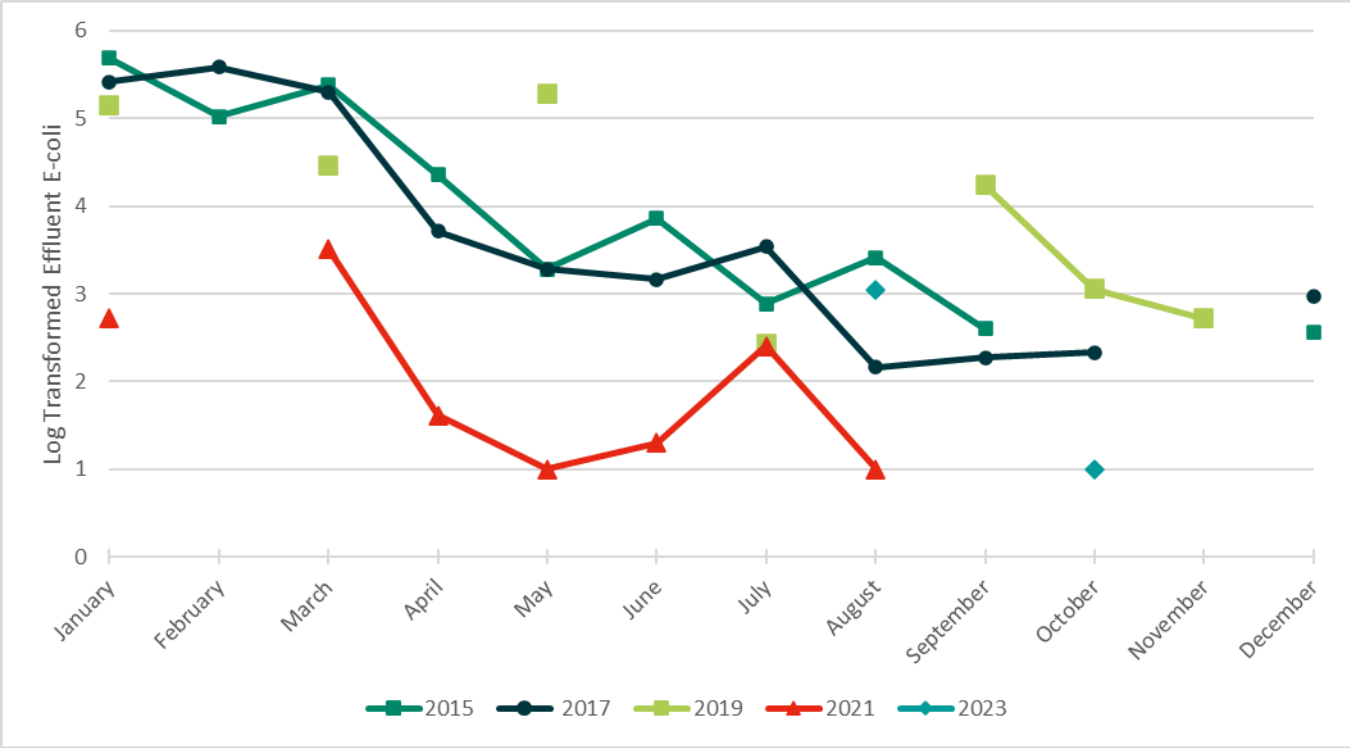


Figure 6.5: Log Transformed Effluent Monthly E-coli Count (2015, 2017, 2019, 2021 and 2023)

The *E-coli* count before the lagoon upgrade ranged from 146 to 648,800 counts/100 mL with an average of 99,917 counts/100 mL; the *E-coli* count after the upgrade ranged from 10-3,255 counts/mL with an average of 583 counts/100 mL. The average *E-coli* count decreased a significant 99.4% after the upgrade.

6.3.7.3 Carbonous Biological Oxygen Demand

Figure 6-6 shows the monthly effluent cBOD concentration (when available) for the years 2015, 2017, 2019, 2021 and 2023.

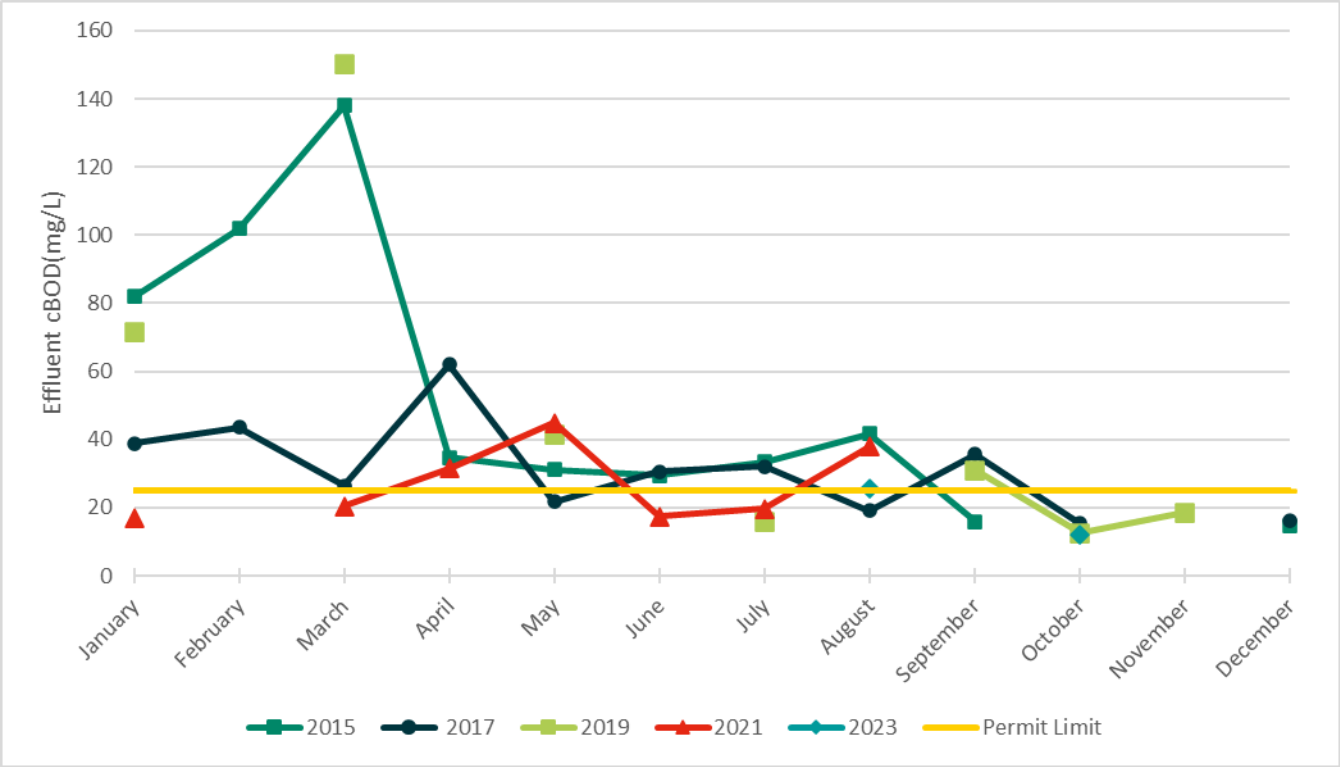


Figure 6.6: Monthly Effluent cBOD (2015, 2017, 2019, 2021 and 2023)

The effluent cBOD was the highest in January to March 2015 and January to March 2019. The cBOD lowered closer to the limit in April in both 2015 and 2019. The cBOD before the lagoon upgrade ranged from 7-150 mg/L with an average of 41.5 mg/L. The cBOD after the upgrade ranged from 12-45 mg/L with an average of 25 mg/L. The average effluent cBOD decreased 39% after the upgrade and the average cBOD is at the 25 mg/L limit specified in the permit to operate.

6.3.7.4 Chloride

Figure 6-7 shows the monthly effluent cBOD concentration (when available) for the years 2015, 2017, 2019, 2021 and 2023.

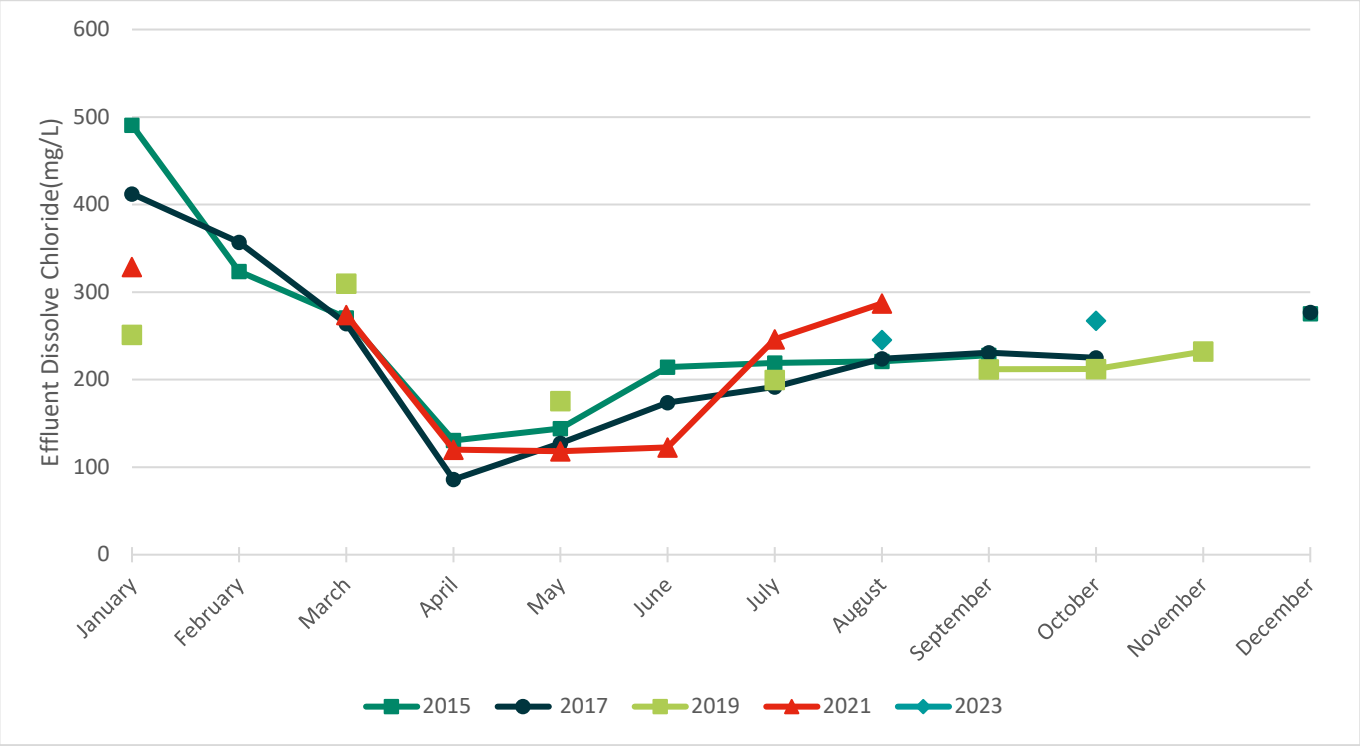


Figure 6.7: Monthly Effluent Dissolved Chloride (2015, 2017, 2019, 2021 and 2023)

The effluent dissolved chloride generally stayed the same each year and followed the same seasonal patterns. The dissolved chloride before the lagoon upgrade ranged from 86-491 mg/L with an average of 246 mg/L. The dissolved chloride after the upgrade ranged from 118-329 mg/L with an average of 223 mg/L. The average effluent dissolved chloride decreased a slight 9% after the upgrade.

6.3.8 Future Wastewater Loading and Lagoon Capacity

The estimated future wastewater loading has been updated based on a population projection of 0.5%, the loading estimates are found in Table 2-10. The current lagoon, with a capacity sized to meet 3080 m^3/day is expected to service the community beyond the future 25 year outlook.

6.4 Upgrades and Maintenance

6.4.1 Blower Upgrade

It is recommended to upgrade the blower system in the old lagoon cell to provide improved aeration and treatment. The upgrade will require an upgraded control panel.

6.4.2 Lagoon Maintenance

A sludge survey of the newly constructed cells is recommended to be performed in a 10 – 15 year interval to determine the requirements for desludging. Additional efforts can be explored such as microbiological digestion of sludge which can reduce the volume of sludge produced.

Introduction of a microbiological sludge removal system is anticipated to cost $250,000.00.

Table 6-6: Recommended Wastewater Lagoon Upgrades and Maintenance

Upgrade	Description	Reason	Cost Estimate	Priority
Old Cell Blower Upgrade	Upgrade aeration in old cell, upgrade control panel	Improve lagoon aeration improving effectiveness of treatment	$300,000.00	1 - Immediate
Lagoon Desludging Survey	Complete sludge survey for evaluation of desluding	Sludge survey within 10-15 year period to determine requirements for desludging.	$10,000.00	6 - Moderate
Microbiological sludge Removal	Microbiological treatment	The additional treatment is intended to reduce sludge buildup over time, further review of this technology for the application in the Kinderlsey Lagoon is recommended	$250,000.00 capital cost with an annual maintenance cost	9 - Low

7. Storm Water System

The primary purpose of the Town of Kindersley storm water system to provide flood protection. The existing system uses a combination of overland and underground infrastructure. The storm water system is defined by the major and minor systems and catchments:

Minor System: Consists of piping, manholes, catch basins and outfall structure that are able to convey runoff from more frequent lower intensity storm events.

Major System: Consist of overland street drainage, detention facilities, park land and other lands that is required to convey runoff from less frequent higher intensity storms.

Catchment Area: The storm water system can further be separated by catchment area. Each independent catchment area is defined by the extend of area which would drain to a singular point.

To identify weaknesses and capacity of a storm water system of a municipality an evaluation system is required. Ideally, catchment areas within the town should be evaluated such that the system is capable of handling a certain level of storm event.

Provincial regulation of a storm water management system does not exist to the same extent that is governed by the water security agency for water and sewer systems. It is predominantly up to a Municipality to adopt storm water management objectives and implement accordingly for the protection of their infrastructure.

The assessment completed herein includes areas of flood concern which have been identified by the Town and residents.

- Further assessment of the storm water system after an issue has been identified by the Town includes using the Rational Method to determine pipe capacity when applicable. This method evaluates the minor system but it is recommended it be confirmed with computer modelling. The major system requires computer aided modelling for evaluation.

AECOM recommends the Town upkeep the infrastructure to provide adequate drainage to meet specific criteria for assessment:

- Minor system achieving 1 in 5 year design storm
- Major system achieving 1 in 100 year design storm

7.1 Existing System

Table 7-1: Pipe Materials

Pipe Material	Diameter (mm)	Year of Installation		Length (m)
		Oldest	Newest	
Concrete	300	1964	1966	403
	375	1964	1966	2,296
	450	1964	1966	1017
	525	1964	1966	886
	600	1964	1982	890
	650	1966		308
	750	1964	1966	592
	Total sum of length			**6,392**
VCT	250	1964	1966	161
	300	1955	1966	2,618
	375	1986		155
	400	1970	1985	345
	425			56
	Total sum of length			**3,336**
PVC	200	2008		193
	250	1980	2019	612
	300	1982	2014	1076
	375	1983	2019	445
	450	1980	2014	1012
	525	1985		207
	600	2014		411
	900	2012		127
	Total sum of length			**3891**
Sanitite HP	900	2012		**526**
CSP	375	1985		353
	900	1985		111
	1200	1964		199
	Total sum of length			**662**
Unknown				1,795
			TOTAL	**16,603**

Note: Golfview subdivision not included in totals

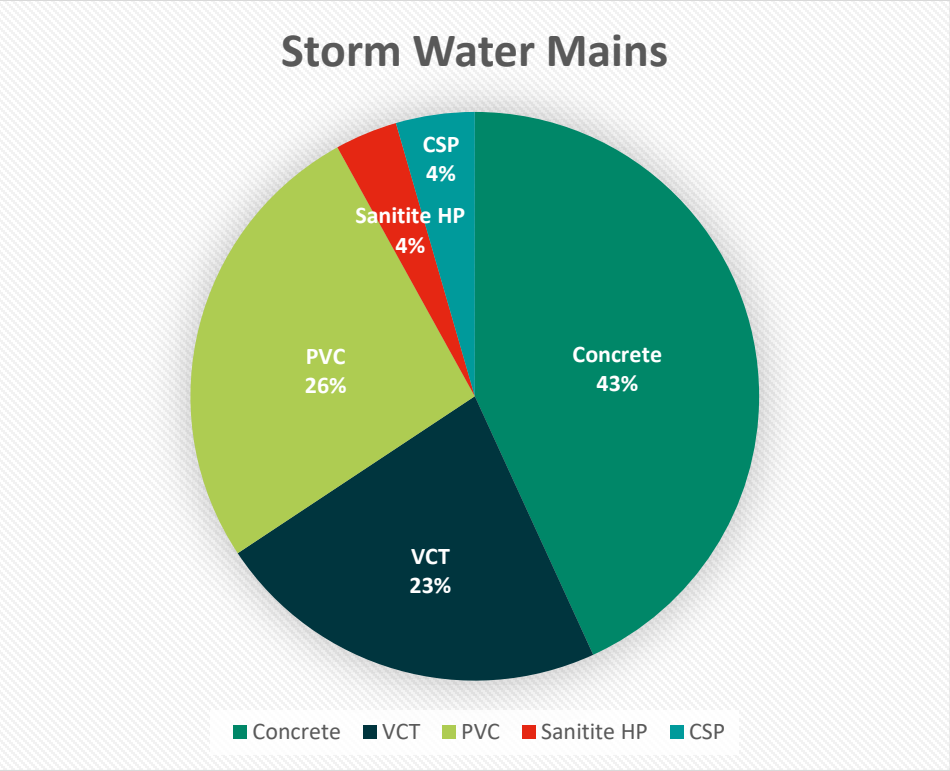


Figure 7.1: Distribution of Storm Water Pipe

7.2 Assessment

The 2014 Infrastructure Capacity Analysis included an assessment of the stormwater pipe network, the minor system. The analysis of the pipe network, generally determined most of the storm water system to be under capacity. It is important to note, evaluating the minor system and not the major system typically generates conservative results. For more information on the Storm Water System analysis completed, the 2014 infrastructure capacity report should be referred to directly. An analysis of the overall system has not been included herein as to build on the 2014 infrastructure assessment significant time is required.

Constructing an up to date model capable of analysing the major and minor storm water system is recommended. To accurately develop a model, missing information including the following is required to be collected.

- Rim and Invert Elevations
- Pipe Materials and Diameters
- Culvert Materials and Diameters

Mapping of infrastructure data has been proven to be effectively stored in a GIS database. GIS data can easily be converted for use in AutoCAD/Civil 3D and modelling software.

7.3 Storm Water System Problem Areas

The Town of Kindersley has worked with AECOM Identifying areas in the community where the existing stormwater infrastructure has been underperforming.

The following areas have been identified to have stormwater drainage issues:

- West Industrial Roads and Drainage Ditches
- 13th Ave East
- 2nd Avenue East and Overlord Crescent.
- East Grid
- Ditson Drive Culvert
- HWY 7 and Hwy 21 Intersection
- Sidewalk Adjacent to Kindersley Inn

7.3.1 West Industrial Drainage

The West Industrial area has historically had problems with overland drainage due to limited slope and overgrown undesired weeds. Drainage and roadway improvements were completed in 2021 regrading ditches, building up roads, adding culverts and defining approaches.

Ongoing maintenance on the ditches is recommended ensuring desired vegetation is established and controlled to allow for proper flow through ditch system. Re-seeding ditches and controlling the height of vegetation is also recommended.

Figure 7.2 West Industrial Area

7.3.2 Drainage issues along 13th Avenue East

There is an identified need to upgrade the drainage on 13th Avenue East. Due to limited elevation change, drainage ditches have been ineffective. The Town has been actively seeking solutions to improving the drainage in the area and is prioritizing the completion of a long-term solution. The Town is currently part way through the construction of a retention pond, however, further review is recommended to develop a final solution.

Figure 7.3: Thirteenth Avenue East Drainage

7.3.3 Drainage Issues at 2nd Ave East and Overlord Cres.

Drainage issues have been identified at the intersection of 2nd Street E and Overlord Cresent. A figure showing the identified drainage issues is included below. The runoff from the parking lot to the North and runoff from 2nd Ave East enter the piped network running through developed lots. Using the *Rational Method* the piped system has been determined to be undersized.

Figure 7.4: 2nd Avenue East and Overlord Cres. Drainage Issues

AECOM is currently working with the Town of Kindersley on the design and construction of a stormwater pumping station to redirect the runoff collected in the upstream system away from the underground piping system.

7.3.4 East Grid Culvert Upgrade

The Town of Kindersley has identified a location along the east grid which during a high runoff season is flooded out and the grid becomes unusable. Two culverts exist to convey water across the road, however, are undersized. Location 2 identifies where flooding occurs and the approximate location of the existing culverts. Location 1, has been identified as a location with a poor line of site causing a hazard for the West Road and East Grid intersection.

Figure 7.5: East Grid Road Flooding

AECOM has completed an assessment using computer aided modelling of the overland drainage and has recommended upgrading to two 900 mm culverts for installation at location 2 shown above. With the culvert upgrade, the road at location 2 is required to be built up and a solution using fill from area 1 is being explored which will both support the buildup of the East Grid for culvert installation and will improve line of site safety issues at the West Road and East Grid intersection.

7.3.5 Ditson Drive Culvert Repair

The Town of Kindersley has identified a culvert along Ditson Drive to have partially collapsed. AECOM recommends monitoring of the culvert to determine the rate of deformation to prioritize rehabilitation.

Figure 7.6: Ditson Drive Culvert Failure

AECOM is working through providing a recommendation to the Town of Kindersley for rehabilitation options of the culvert.

7.3.6 Hwy 7 and Hwy 21 Drainage

The Town of Kindersley has identified drainage issues at HWY 7 and 21 culverts. The ditch in the area has been excavated to improve the drainage, however, proper sloping of the ditches was not completed resulting in a safety hazard. It is recommended to improve sloping of the adjacent ditch and that a more thorough assessment be completed to determine an effective solution.

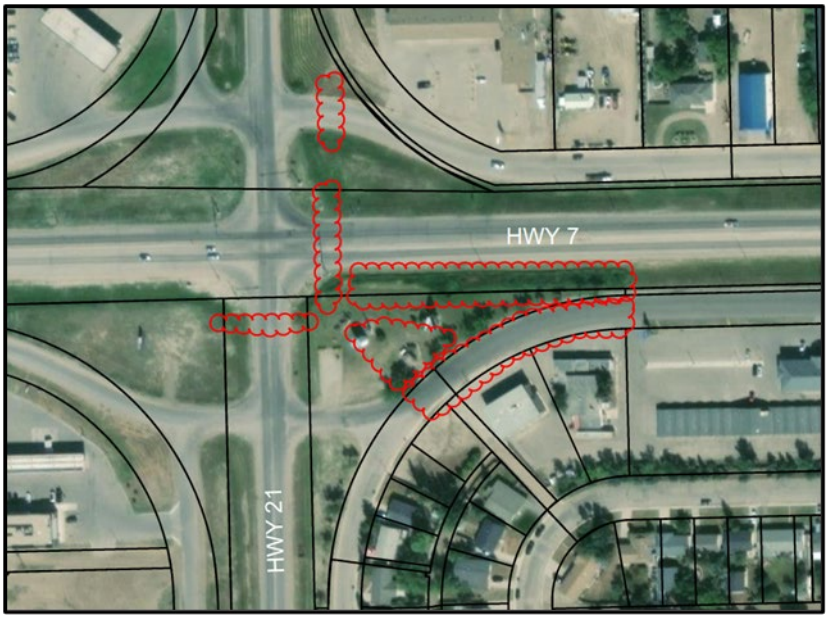


Figure 7.7: HWY 7 and 21 Drainage Issues

7.3.7 Sidewalk Adjacent to Kindersley Inn – Drainage

The Town of Kindersley has identified overland drainage problems adjacent to the sidewalk North of the Kindersley Inn. Maintenance and establishment of selected vegetation

Figure 7.8: Sidewalk Adjacent to Kindersley Inn Drainage Problems

7.4 Recommendation

A storm water modelling software with capacity to model both storm water piping (Minor System) and overland drainage (Major System) was recommended by AE in 2014. AECOM recommends the Town proceed with the development of a model to aid in infrastructure upgrade design.

Table 7-2: Storm Water System Upgrades

Upgrade	Description	Reason	Cost Estimate	Priority
West Industrial Drainage	Ongoing ditch maintenance	Maintain ditches and prevent erosion	Varies	3-Immediate
Drainage Issues along 13th Avenue East	Upgrades to drainage ditch and culvert repairs	Improve drainage	$250,000.00	4-Moderate
Drainage Issues at 2nd Avenue East and Overlord	Storm water pumping station and forcemain	Alleviate storm water surging through Overlord system	$200,000.00	1-Immediate
East Grid Culvert Upgrade	Increase culver diameter and roadway improvements improving intersection safety	Reduce water overtopping of roadway during storm events, improve safety of intersection improving line of site	$250,000.00	2-Immediate
Ditson Drive Culvert Repair	Repair of failing culvert	Culvert is failing structurally	$200,000.00	2-Immediate
Hwy 7 and Hwy 21 Drainage	Upgrade culverts, assess drainage	Reduce ponding during storm events	$200,00.00	4-Moderate
Sidewalk Adjacent to Kindersley Inn – Drainage Problems	Drainage ditch improvements	Improve drainage	$50,000.00	4-Moderate
Storm Water Model Development	Evaluation of overall existing major and minor storm water system components.	Leads to Improvement of overall stormwater management system	$50,00.00	8-Low

8. Roadway Conditions

8.1 Introduction

This section will discuss the roadway pavement conditions in the Town as well as identify the undergound infrastructure within roadways classified as poor. The age, condition, and service of the roadways, along with the type and age of associated undergrounds for each road section is to be used for infrastructure upgrade prioritization.

8.2 Roadway Pavement Conditions

The roadways' pavement conditions were obtained from the Town's 2020 Asphalt Assessments. The assessments included surveys of sections of pavement throughout the Town. Based on the survey results, a Pavement Condition Index (PCI) was calculated for each block or section of road. A PCI rating schedule was created to categorize the pavement conditions as shown in Table 8-1. The PCI rating scale and suggested colors in ASTM *Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys* (2023) were used as a baseline to develop the rating schedule used for this report. The condition index found in Table 8-1 used for this report combined rating categories from the standard for simplification.

Table 8-1 Pavement Condition Index

PCI Index Range	Condition Category	Hatching Colour
70-100	Good	Green
40-69	Fair	Yellow
10-39	Poor	Orange
0-9	Failed	Red

Most PCIs were in the "Good" or "Fair" category, however there were sections in the "Poor" category.

8.3 Roadway Pavement Age

The year when the last roadwork for each road section was completed was obtained from the Town's AUTOCAD basemap and record drawings provided by the Town. The year of last roadwork gives an indication of the asphalt/pavement age. The pavement age is used to determine older roads that may require pavement replacement and/or maintenance in the future and is included in Appendix E

Table 8-2 Decade of Last Roadwork Colour Index

Decade of last roadwork	Corresponding Colour
2020-Present	Green
2010-2019	Blue
2000-2009	Purple
1990-1999	Yellow
Older than 1990	Pink

8.4 Road Structure Assessments

It is recommended the Town of Kindersley, prior to overlay or paving of any streets throughout the Town, complete core sampling of the road structures for assessment of the granular base below the road. Ensuring road structures are adequately assessed will ensure capital improvements are more effective on roads.

8.5 Poor Road Conditions and Underground Infrastructure

Roads with poor road conditions identified above were cross referenced with underground infrastructure needing to be rehabilitated. Pricing for road rehabilitation and replacement of underground infrastructure is estimated below. The decision tor replace sewer mains and storm sewer mains is to be verified with CCTV inspection prior to completing replacement as the sewer and storm sewer may be determined to be in adequate condition therefor only replacement of the watermains and road structure would be recommended.

Table 8-3: Road Rehabilitation and Associated Underground Infrastructure Replacement Recommendations

Street		Underground Piping			Cost Estimate	Priority
	Condition	**Water**	**Sanitary**	**Storm**		
8th St West (Carmichael Ave to 11th Ave W)	Poor	AC (1965)	VCT (1964)	None	Full Road Rehab-$350,000 Watermain Repl.-$400,000 Sewer Main Repl.-$380,000 **Total - $1,100,000.00**	3-Immediate
2nd St W (Carmichael Ave to 1st St W)	Poor	AC (1965)	VCT (1964)	Concrete (1966)	Full Road Rehab-$580,000 Watermain Repl.-$675,000 Sewer Main Repl.-$575,000 Storm Water Repl.-$200,000 **Total - $2,000,000.00**	1-Immediate
2nd St W (King Drive to 8th Ave W)	Poor	AC (1964)	None	None	Full Road Rehab-$150,000 Watermain Repl.-$150,000 **Subtotal - $300,000.00**	1-Immediate
2nd St W (8th Ave W to 7th Ave W)	Fair	CI (1960)	None	VCT (1966)	Full Road Rehab-$150,000 Watermain Repl.-$100,000 Storm Water Repl.-$75,000 **Subtotal - $325,000.00**	
2nd St W (7th Ave W to 6th Ave W)	Poor	AC (1960)	None	VCT (1965)	Full Road Rehab-$150,000 Watermain Repl.-$75,000 Storm Water Repl.-$75,000 **Subtotal - $300,000.00** **Total - $925,000.00**	
2nd Ave W (5th St W to 4th St W)	Poor	CI (1960)	None	VCT (1966)	Full Road Rehab-$200,000 Watermain Repl.-$120,000 Storm Water Repl.-$60,000 **Total - $380,000.00**	1-Immediate

Additional recommendations for prioritization

- 8th St West (Carmichael Ave to 11th Ave W) – It is recommended to complete an assessment of the drainage issues in the area as identified in section 7.3.6 herein prior to completing a road rehabilitation project at this location. Without address the ponding water problems a road rehabilitation project may be less effective.

9. Conclusion & Recommendations

The Infrastructure Upgrades Prioritization Schedule and Capital Cost Estimate is provided in Appendix F.

The recommendation schedule was developed based on opinions of AECOM with consultation with the Town. The opinions are intended to provide a framework to evaluate the need of the upgrade based on impact of the upgrade. The prioritization schedule is summarized below for reference to the Infrastructure Upgrades Prioritization Schedule and Capital Cost Estimate in Appendix F:

- Immediate: It is recommended to proceed with implementation of the upgrades identified as immediate are to be implemented as soon as possible and are of highest priority.
- Moderate: Upgrades classified as moderate priority are recommended to be completed within a 15 year outlook.
- Low: Upgrades recommended classified as low priority, to be completed beyond the 15 year outlook

10. References

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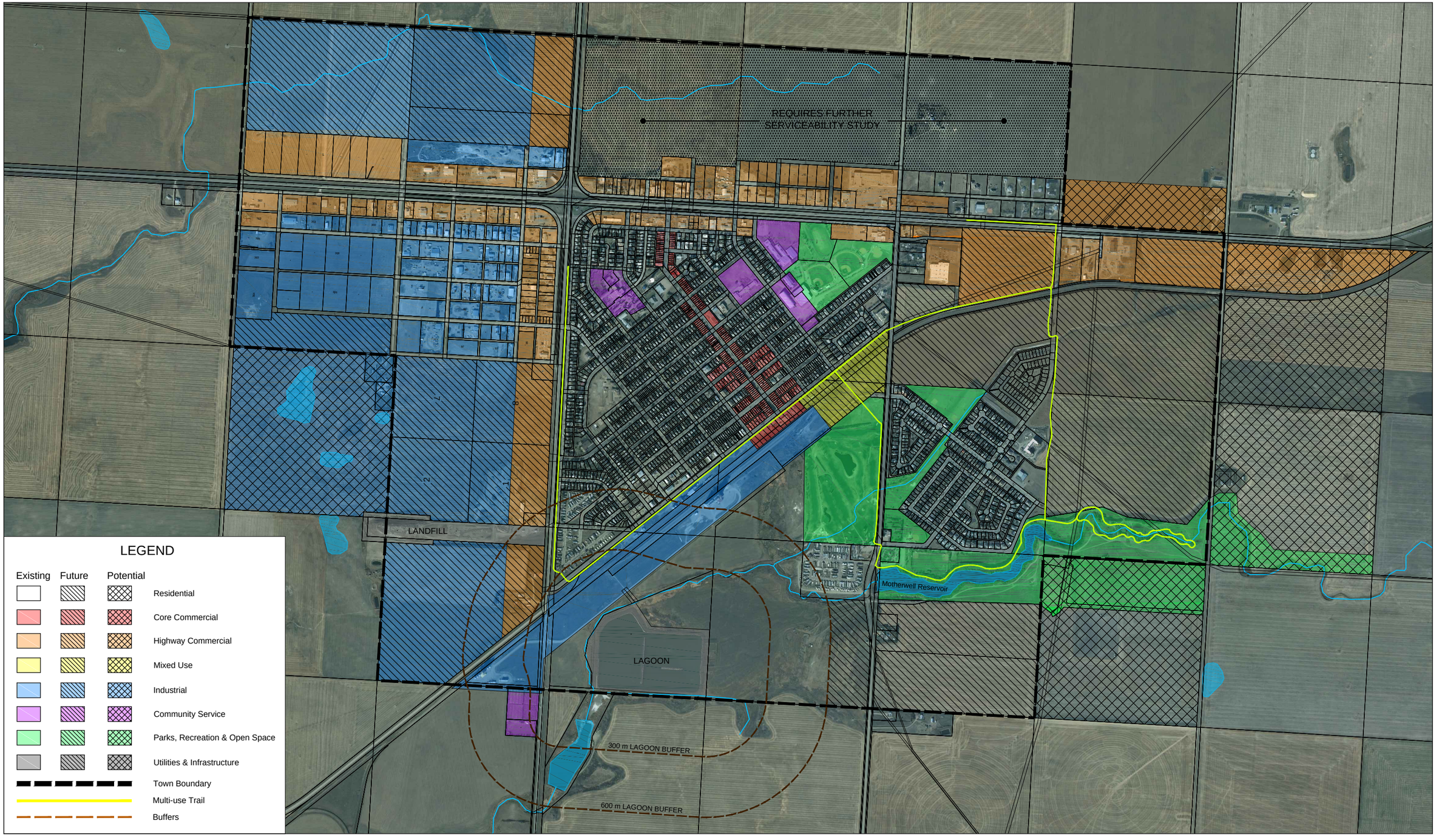
Appendix A

Town of Kindersley Official Community Plan



Town of Kindersley Official Community Plan

Map 1 - Future Land Use Concept

0 100 250 500 1000 m

CROSBY HANNA & ASSOCIATES
LANDSCAPE ARCHITECTURE & COMMUNITY PLANNING

2013-10-04

North

Appendix B

Permit to Operate a Waterworks

Water Security Agency

Environmental and Municipal Management Services

Permit to Operate a Waterworks

Altered pursuant to section 28(1)(h) of *The Environmental Management and Protection Act, 2010*

Permit No.: 00002274-08-00
File: 21020-50/WW/OP/Kindersley

ISSUED TO **the Town of Kindersley (the Permittee)**, the person responsible for a waterworks that is used to provide water intended for human consumption to the Town of Kindersley. The Permittee shall ensure that the water supplied by this waterworks is safe for human consumption. This waterworks consists of a Class Three (3) water treatment facility and a Class two (2) water distribution facility, located in The Town of Kindersley and at the water treatment works located at Utility Parcel U1 Plan 82500835, in the Province of Saskatchewan.

PURSUANT to section 28(1)(h) of *The Environmental Management and Protection Act, 2010*, the Permit to Operate a Waterworks No. 00002274-07-01 issued to the permittee on April 1st, 2021, whose waterworks is located in the Town of Kindersley and at the water treatment works located at Utility Parcel U1 Plan 82500835, in the Province of Saskatchewan, is hereby altered and amended, subject to the terms and conditions attached to this permit.

This permit takes effect on the **31st day of December, 2021**.

This permit expires on the **1st day of January, 2024**, unless cancelled or suspended before that date.

Issued

_____*
Environment Officer
Water Security Agency

*☑ This digital signature affixed to the permit is legally binding and is considered a sufficient electronic signature as required under *The Electronic Information and Documents Act*, 2000. The original copy is retained by the Water Security Agency and shall be considered the official record.

Terms and Conditions

Section One: Definitions

1.1 All words and phrases have the same definitions as set out in *The Environmental Management and Protection Act, 2010*, or *The Waterworks and Sewage Works Regulations*, as the case may be.

1.2 In this permit:

(a) "*Act*" means *The Environmental Management and Protection Act, 2010;*
(b) "*Regulations*" means *The Waterworks and Sewage Works Regulations;*
(c) "Environmental and Municipal Management Services" means the Environmental and Municipal Management Services Branch of the Water Security Agency of Saskatchewan;
(d) "Environment officer" has the same meaning as defined in the *Act*;
(e) "Accredited" means a laboratory accredited pursuant to the requirements of the Canadian Association for Laboratory Accreditation in accordance with the parameters for which the laboratory has been accredited;
(f) "Positive bacteriological result" means a test result showing the presence of total coliforms, fecal coliforms, *Escherichia coli* or 200 or more organisms per 100 milliliters as an overgrowth of background bacteria;
(g) "Remote monitoring" is the ability to continuously receive real time data, operational conditions, and alarms indicating adverse operational conditions from a remote location via various methods of electronic data transfer;
(h) "Remote process control" is the ability to employ remote monitoring in addition to having the ability to make operational or process adjustments from a remote location;
(i) "Water Rights License" is a water rights license issued pursuant to section 50 of *The Water Security Agency Act*; and
(j) "Approval to Operate Works" is an approval to operate a raw water surface water/groundwater supply works that is issued pursuant to section 59 of *The Water Security Agency Act*.

Section Two: Operation

2.1 The permittee shall comply with the *Act* and the *Regulations*, and the terms and conditions of this permit.

2.2 In the event of an inconsistency between the *Act* and this permit, or the *Regulations* and this permit, the more stringent requirement shall apply.

2.3 The permittee shall have a valid Water Rights License and a valid Approval to Operate Works issued pursuant to *The Water Security Agency Act*.

2.4 The permittee shall not extend or alter the waterworks without approval of Environmental and Municipal Management Services.

2.5 The permittee shall have a written quality assurance and quality control policy in place that is satisfactory to the minister. The permittee shall update its quality assurance and quality control policy from time to time to incorporate changes to the waterworks equipment, operational procedures, chemical use, or any other matter or thing that could affect the quality of the water produced by the waterworks. The permittee shall:

(a) provide a copy of the policy to any employee, agent or contractor performing work or service in relation to the waterworks; and
(b) inform the persons mentioned in 2.5(a) of the contents of the quality assurance and quality control policy.

2.6 Where all or part of a distribution system is new, extended, altered or repaired, the permittee shall after completion of the new waterworks or the alteration, extension or repair:

(a) disinfect the portion of the distribution system that is new, extended, altered or repaired, in accordance with American Water Works Association Standard C651 *Disinfecting Water Mains*, or a standard that would offer an equivalent or greater level of protection of human health, before the commencement of its use; and
(b) take water samples from the distribution system that is new or has been extended, altered or repaired, and have the samples analyzed for bacteria.

2.7 The permittee shall ensure that the operation, repair and maintenance of the waterworks is under the direction of an operator who holds at least the corresponding certificate for the classification of the waterworks as set out in the Saskatchewan Water and Wastewater Works Operator Certification Standards, December 2016.

Section Three: Sampling, Monitoring and Water Quality

3.1 The permittee shall cause water samples to be taken from the waterworks to test for bacteria, turbidity, chlorine and for the other parameters listed in Appendix A, at the locations, times and frequency set out in Appendix A.

3.2 The permittee shall ensure that the water provided to consumers does not exceed the limits set out in Appendix B for bacteria, turbidity, and the chemical parameters listed in that appendix. The permittee shall cause the chlorine residuals to be maintained as set out in Appendix B.

3.3 Subject to 3.4, the permittee shall have water samples analyzed by an accredited laboratory, in accordance with the *Regulations*.

3.4 The permittee may perform water sampling and on-site analysis for the parameters indicated for "on-site testing" in Appendix A or by continuous water quality monitoring equipment, when authorized to do so.

3.5 The permittee shall take water samples in accordance with the instructions provided by the institution or laboratory that provides the sampling bottles or containers.

3.6 The permittee shall ensure that all water quality monitoring and testing equipment is maintained and calibrated on a frequency as recommended by the manufacturer; verification of the accuracy of online continuous monitoring equipment shall occur weekly.

3.7 The permittee shall perform and record the turbidity analysis and chlorine analysis manually and by means of on-site test equipment every 4 hours in the event of an unplanned continuous online turbidimeter failure or outage.

3.8 The permittee shall immediately notify the minister if a continuous chlorine analyzer or continuous online turbidimeter failure or outage is expected to last longer than 24 hours and results in manual readings as per 3.7.

Section Four: Recordkeeping

4.1 The permittee shall maintain records containing the following information:
- (a) total water pumped into the distribution system on a daily basis or the total raw water used;
- (b) the types, dosages and total amounts of chemicals or ultraviolet light applied to the water for treatment;
- (c) the locations from which samples for any tests conducted by the permittee of the waterworks were taken, in accordance with this permit, and the name of the person who conducted the sampling or testing and the results of those tests;
- (d) any departures from normal operating procedures that may have occurred and the time and date that they occurred;
- (e) any instructions that were given during operation of the waterworks to depart from normal operating practices and the name of the person who gave the instructions;
- (f) any upset condition or bypass condition, the time and date of the upset condition or bypass condition and measures taken to notify others and resolve the upset condition or bypass condition;
- (g) any condition of low disinfectant levels, the time, date and location of occurrence and measures taken to restore disinfectant levels to required values;
- (h) the dates and results of calibrating any metering equipment and testing instruments; and
- (i) the dates and types of maintenance performed on equipment and any actions taken to ensure the normal operation of the waterworks.

4.2 The permittee shall cause the operational records or logs mentioned in 4.1 to be recorded and maintained in the following manner:
- (a) operational records or logs must be made in chronological order, with the dates, times and testing locations clearly indicated;
- (b) entries in an operational record or log must only be made by the permittee, which includes by definition any principal or agent of a permittee;
- (c) any person making an entry in an operational record or log must do so in a manner that allows the person to be unambiguously identified as the maker of the entry;
- (d) operational records or logs must be maintained on a daily basis and retained for at least five years;
- (e) any anomalies or instances of missing entries in an operational record or log must be accompanied by explanatory notes;
- (f) operational records or logs must only contain data or information that is actually observed or produced;
- (g) operational records or logs must not contain default values generated manually or by automated means; and
- (h) operational records or logs maintained pursuant to clause (e) must be made available promptly on request of the minister.

4.3 The permittee shall review the records and logs mentioned in 4.1 on a monthly basis to ensure that the operating parameters are being achieved and that the limits set out in Appendix B are not exceeded.

4.4 The permittee shall report the findings to the minister as soon as is reasonably practicable after each review required by 4.3 should the review of the records and logs indicate that the quality of water from the waterworks has been adversely affected, that any upset condition, bypass condition or event at the waterworks has not been reported, or that on-site water quality testing records are missing.

Section Five: Reporting and Consumer Reporting

5.1 The permittee shall submit the results of water sampling analysis performed in accordance with this permit to the minister:
- (a) in the case of a positive bacteriological result, within 24 hours following completion of the sampling analysis; and
- (b) in the case of all other parameters, within 7 days following completion of the sampling analysis.

5.2 The permittee shall direct the laboratory performing its water sampling analyses to submit the results within the timeframes mentioned in 5.1 directly to Environmental and Municipal Management Services, in a format in accordance with EPB 383 Water Security Agency and Ministry of Environment - Environmental Management System (SEEMS) Lab-Operator (LAB-OPR) Data File Format, in addition to submitting the written results to the permittee.

5.3 The permittee shall immediately report to the minister any known or anticipated upset condition, bypass condition or events at or affecting a waterworks that could adversely affect the quality of water produced by the waterworks.

5.4 The permittee shall immediately report to the minister any instance where:
- (a) disinfection equipment fails;
- (b) the level of disinfection identified in Appendix B is not achieved or is not anticipated to be achieved;
- (c) any other parameter level identified in Appendix B is not achieved or is not anticipated to be achieved;
- (d) there is a retirement, suspension, resignation, scheduled absence or termination of employment of any certified waterworks distribution or waterworks treatment operator, or any anticipated retirement, suspension, resignation or termination that results in the waterworks not being under the direction of a certified operator that holds at least the corresponding certificate for the classification of those works; or
- (e) a system depressurization has occurred.

5.5 The permittee shall instruct its employees, agents and contractors performing work or service in relation to the waterworks, of their obligation under section 34(1) of the *Regulations* and to report to the minister any instance as described in 5.4 and any known or anticipated upset condition, bypass condition or events at or affecting a waterworks that could adversely affect the quality of water produced by the waterworks.

5.6 The permittee shall as soon as reasonably practical report any of the events mentioned in 5.3 or 5.4 to the minister.

5.7 The permittee shall, once per calendar year, provide the consumers supplied by the waterworks with a notification of:
- (a) the quality of water produced or supplied by the waterworks in comparison with the levels set out in this permit; and
- (b) the permittee's compliance with sample submission requirements described in this permit.

5.8 Within 30 days after providing consumer notification required by 5.7, the permittee shall provide a written copy of the notification to the minister.

5.9 The permittee shall maintain records for all parameters that are specified to be tested "on-site" as indicated in Appendix A and make them available to the minister upon request. For all other parameters, the permittee shall ensure that reporting is conducted in accordance with section 37 of the *Regulations.*

Section Six: Inspection

6.1 An environment officer may enter the waterworks at any time to conduct an inspection to ensure that the permittee is complying with this permit, the *Act* or the *Regulations.*

6.2 Upon the request of an environment officer, the permittee shall immediately provide any books, records, logs, graphs, papers, documents, or data, including any computer, digital or electronic records, logs, graphs, files or data maintained with respect to the waterworks.

Section Seven: General

7.1 A copy of this permit shall be posted in a conspicuous place at the waterworks.

7.2 The permittee shall provide each operator of the waterworks with a copy of this permit and the *Regulations*.

7.3 The minister may cancel, alter or suspend this permit for the reasons and in the manner set out in the *Act*.

7.4 The permittee shall apply for renewal/alteration of this permit at least 60 days prior to its expiry.

7.5 In the event of any inconsistency between a previously issued Permit to Operate a Waterworks, and the terms and conditions of this Permit to Operate a Waterworks, the terms and conditions of this permit prevail.

7.6 This permit does not replace or supersede any approvals, licenses or authorizations that may be required due to municipal, provincial or federal legislation. The permittee shall maintain in force any and all such approvals, licenses or authorizations that may be required.

7.7 Where any notice or reporting is required to be given by the permittee, it shall be provided to:

Water Security Agency.
Scott Klippenstein Environmental Project Officer
306-350 Cheadle Street West
SWIFT CURRENT, SK S9H 3G5
Telephone (306) 741-7718
Fax: (306) 778-8271
Email: WSAEPOKindersley@wsask.ca

After hours, weekends and holidays, the Water Security Agency can be contacted by calling the Upset Report Line at 1.844.536.9494**.**

Appendix A

Permit to Operate a Waterworks
Monitoring Schedule
Permit No.: 00002274-08-00

Parameter(s)	Station Number	Testing Required	Limit[1] Applied	Treated Water Sampling Locations and Minimum Sampling Frequency[1]
		Yes	Yes	
1. Bacteriological Total coliform *Escherichia coli*	SK05GB0004	X	X	Two (2) samples every week from representative locations in the distribution system. Repeat and special samples resulting from follow-up to a contaminated sample, and other samples are not considered as regular sample submissions.
2. Chlorine Residual (on-site testing)	N/A	X	X	Once (1) per day for free residual in the water entering the distribution system; AND at the same frequency and locations as for bacteriological sampling, for free and total residuals.
3. Turbidity (on-site testing)	N/A	X	X	Continuously from the treated water from the filter effluent from each filter; AND At least once (1) per day for water entering the distribution system. AND at the same frequency and locations as for bacteriological sampling. AND At least once (1) per week from the raw water entering the water treatment facility.
4. Fluoride (on-site testing)	N/A	X	X	Once (1) per day in the water entering the distribution system.
5. Fluoride (off-site testing)	SK05GB0004	X	X	Once (1) every week from representative locations in the distribution system.
6. Chemical - General Alkalinity Bicarbonate Calcium Carbonate Chloride Conductivity Fluoride Hardness Magnesium Potassium Nitrate pH Sodium Sulphate Total dissolved solids	SK05GB0004	X	Limits apply to Nitrate and Fluoride	Once (1) every year, from the treated water at the water treatment plant.
7. Chemical – Health Aluminium Antimony Arsenic Barium Boron Cadmium Chromium Copper Iron Lead Manganese Selenium Silver Uranium Zinc	SK05GB0004	X	Limits apply to Arsenic, Barium, Boron, Cadmium, Chromium, Lead, Selenium and Uranium	Once (1) every year, from the treated water at the water treatment plant.

8. Trihalomethanes (THMs) and Haloacetic Acids (HAA_5)	SK05GB0004	X	X	Once (1) every three (3) months from the water in the distribution system in **2024**. One sample must be taken in each of the following periods: January to March, April to June, July to September, and October to December. Samples are to be collected from a single representative location at an extremity of the distribution system. The same sampling location is to be used each time the sample is collected.
9. Microcystin-LR and/or Total Microcystins	SK05GB0004	X	X	At the water treatment plant following detection of significant algal blooms affecting a water intake AND Once (1) in August of each year.
10. Ultraviolet Disinfection (on-site testing)	N/A	X	X	Once (1) per day for ultraviolet dosage, ultraviolet transmittance, and flow rate in the water entering the ultraviolet disinfection system(s).
11. Manganese (on-site testing)	N/A	X		Twice (2) per month in the water entering the distribution system.

[1] Limits for identified parameters are provided in Appendix B.

Appendix B

Permit to Operate a Waterworks
Permit Limits
Permit No.: 00002274-08-00

The following water quality limits apply where identified in Appendix A.

Bacteriological:

(a) total coliform levels of zero organisms detectable per 100 millilitres;
(b) *Escherichia coli* levels of zero organisms detectable per 100 millilitres; and
(c) background bacteria levels of less than 200 organisms per 100 millilitres or no overgrowth.

Chlorine Residual

(a) a free chlorine residual of not less than 0.3 milligrams per litre in the water entering a distribution system as outlined in the Waterworks System Assessment to ensure an adequate 0.5 log *Giardia* inactivation[8]; and
(b) a total chlorine residual of not less than 0.5 milligrams per litre or a free chlorine residual of not less than 0.1 milligrams per litre in the water throughout the distribution system.

Ultraviolet Disinfection

As per the Ultraviolet Validation Test Certificate a minimum validated ultraviolet dosage no less than 12 $mW \cdot s/cm^2$ (mJ/cm^2) at a maximum flow rate through the reactor of 69.4 L/sec (6.0 MLD) and a minimum ultraviolet transmittance of 90% in the treated water shall be maintained in order to achieve 3.0 log inactivation credit for *Cryptosporidium*.

Disinfection

(a) The water treatment facility must achieve a minimum of 4.0 log removal/inactivation of viruses which can be achieved through a combination of physical removal and/or disinfection.
(b) The water treatment facility must achieve a minimum of 2.0 log inactivation of viruses through disinfection.
(c) The water treatment facility must achieve a minimum of 3.0 log inactivation/removal of *Giardia lamblia* cysts and *Cryptosporidium parvum* oocysts through conventional chemically assisted surface water treatment and disinfection.
(d) The water treatment facility must achieve a minimum of 0.5 log *Giardia* inactivation through disinfection.
(e) The water treatment facility must maintain a free chlorine residual of not less than 0.1 milligrams per litre in the water entering the distribution system.

Turbidity:

Waterworks, regardless of the source, must maintain turbidity levels for water entering the distribution systems at levels that will always result in acceptable microbiological quality and that will not compromise disinfection.

Requirements by Source/Treatment type:

Source/Treatment	Routine Standard	Max. Allowable Exceedance Duration	Absolute Maximum
Surface water [1,2] source with monthly average source turbidity greater than or equal to 1.5 NTU, employing chemically assisted filtration	Not to exceed 0.3 NTU, in more than 5% of discrete measurements, each calendar month OR more than 5% of the time each calendar month, if continuous monitoring employed	Not to exceed 0.3 NTU for more than 12 consecutive hours, if continuous monitoring employed	Never to exceed 1.0 NTU
Surface water [1,2] source with monthly average source turbidity less than 1.5 NTU and employing chemically assisted filtration.	Not to exceed 0.2 NTU, in more than 5% of discrete measurements, each calendar month or more than 5% of the time each calendar month if continuous monitoring employed.	Not to exceed 0.2 NTU for more than 12 consecutive hours if continuous monitoring employed	Never to exceed 1.0 NTU
[1] Includes surface waters and groundwater under the influence of surface water [2] Turbidity value measured from each filter effluent			

Chemical – Health	**Parameter**	**MAC[1] (mg/L)**	**IMAC[2] (mg/L)**
	Arsenic	0.01	
	Barium	1.0	
	Benzene	0.005	
	Benzo(a)pyrene	0.00001	
	Boron		5
	Bromate	0.01	
	Cadmium	0.005	
	Carbon tetrachloride	0.005	
	Chlorate	1.0	
	Chlorite	1.0	
	Chromium	0.05	
	Cyanide	0.2	
	Dichlorobenzene,1,2	0.2	
	Dichlorobenzene,1,4	0.005	
	Dichloroethane,1,2		0.005
	Dichloroethylene,1,1	0.014	

Chemical – Health	**Parameter**	**MAC[1] (mg/L)**	**IMAC[2] (mg/L)**
	Dichloromethane	0.05	
	Dichlorophenol,2,4	0.9	
	Fluoride	1.5	
	Haloacetic Acids[3]	0.08	
	Lead	0.01	
	Mercury	0.001	
	Microcystin-LR	0.0015	
	Monochlorobenzene	0.08	
	Nitrate as NO_3	45	
	Selenium	0.01	
	Tetrachlorophenol,2,3,4,6	0.1	
	Trichloroethylene	0.05	
	Trichlorophenol,2,4,6	0.005	
	Trihalomethanes[4]	0.1	
	Uranium	0.02	
	Vinyl Chloride	0.002	

Radiological[5]	**Parameter**	**MAC (Becquerels/L)**
	Gross Alpha	0.5
	Gross Beta	1.0
	Lead-210 (^{210}Pb)	0.2
	Radium-226 (^{226}Ra)	0.5
	Tritium (^{3}H)	7000
	Strontium-90 (^{90}Sr)	5.0
	Iodine (^{131}I)	6.0
	Cesium-137 (^{137}Cs)	10.0

Chemical – Pesticides	**Parameter**	**MAC (mg/L)**	**IMAC (mg/L)**
	Atrazine		0.005
	Bromoxynil		0.005
	Carbofuran	0.09	
	Chlorpyrifos	0.09	
	Dicamba	0.12	
	2,4-D[6]		0.1
	Diclofop-methyl	0.009	
	Dimethoate		0.02
	Malathion	0.19	
	MCPA[7]	0.10	
	Pentachlorophenol	0.06	
	Picloram		0.19
	Trifluralin		0.045

[1] Maximum Acceptable Concentration

[2] Interim Maximum Acceptable Concentration

[3] Haloacetic acids refer to the total levels of monochloroacetic acid, dichloroacetic acid, trichlororacetic acid, monobromoacetic acid and dibromoacetic acid and is based on a locational running average of a minimum of quarterly samples taken from the water mains within a distribution system.

[4] Trihalomethanes refers to the total levels of chloroform, bromodichloromethane, dibromochloromethane, and bromoform and is based on an annual average of 4 seasonal samples collected from the water mains within the distribution system.

[5] Radiological - Water samples may be initially screened for radioactivity using gross alpha and gross beta activity determinations. Compliance with the standards may be inferred if the measurements for gross alpha and gross beta activity are less than 0.5 Bq/L (becquerels per litre) and 1.0 Bq/L, respectively, as these are lower than the strictest Maximum Acceptable Concentrations. If these values are exceeded then Table 3 of the *Guidelines for Canadian Drinking Water Quality*—Summary Table, Health Canada, 2012, as amended from time to time, applies.

[6] 2,4 Dichlorophenoxyacetic Acid

[7] 2-Methyl-4-Chlorophenoxyacetic Acid

[8] A minimum free chlorine residual of not less than 0.3 milligrams per litre is required to ensure 0.5 log giardia inactivation when chlorine is being utilized for primary disinfection. If Ultraviolet Light is providing 0.5 log giardia inactivation then a minimum of 0.1 milligrams per litre free chlorine is required in the water entering the distribution system.

Appendix C

Permit to Operate a Sewage Works

Permit to Operate a Sewage Works

Environmental and Municipal Management Services

Altered pursuant to section 28(9) of *The Environmental Management and Protection Act, 2010*

Permit No.: 00050460-05-00
File: 21050-50/WWW/OP/Kindersley

ISSUED TO **the Town of Kindersley (the Permittee)** the person/entity responsible for the sewage works consisting of a Class One (1) wastewater treatment facility and a Class Two (2) wastewater collection facility, located in the Town of Kindersley and at the sewage treatment works located at Blk/Par B-Plan FL4033 Ext 1 As described on Certificate of Title 90S29149, which provides sewage collection and treatment to the Town of Kindersley in the Province of Saskatchewan.

PURSUANT to section 28(9) of *The Environmental Management and Protection Act, 2010*, the Permit to Operate a Sewage Works No. 00050460-04-00 issued to the permittee on June 9, 2021, whose sewage works is located at North East ¼ of Section 3 Township 29, Range 23, West of the 3rd Meridian, in the Province of Saskatchewan, and which operation involves the discharge of effluent onto Teo Lake located on Sections 4 & 5, Township 26, Range 24, West of the 3rd Meridian, in the Province of Saskatchewan, is hereby altered and amended, subject to the terms and conditions attached to this permit.

This permit takes effect on the **1st day of January, 2022**.

This permit expires on the **1st day of January, 2027**, unless cancelled or suspended before that date.

Issued

_____*

Environment Officer
Water Security Agency

*☑ This digital signature affixed to the permit is legally binding and is considered a sufficient electronic signature as required under *The Electronic Information and Documents Act*, 2000. The original copy is retained by the Water Security Agency and shall be considered the official record.

Terms and Conditions

Section One: Definitions

1.1 All words and phrases have the same definitions as set out in *The Environmental Management and Protection Act, 2010*, or *The Waterworks and Sewage Works Regulations*, as the case may be.

1.2 In this permit:

(a) "*Act*" means *The Environmental Management and Protection Act, 2010;*

(b) "Accredited laboratory" means a laboratory that is accredited under the International Organization for Standardization standard ISO/IEC 17025:2005 entitled *General requirements for the competence of testing and calibration laboratories*, as amended from time to time, by an accrediting body that is a signatory to the *International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement* or a laboratory that is accredited under the *Environment Quality Act,* R.S.Q., c. Q-2, as amended from time to time, by an accredited body that is recognized in accordance with the *Environment Quality Act*;

(c) "Adverse effect" has the same meaning as defined in the *Act*;

(d) "*Regulations*" means *The Waterworks and Sewage Works Regulations;*

(e) "Environmental and Municipal Management Services" means the Environmental and Municipal Management Services Branch of the Water Security Agency;

(f) "Environment" has the same meaning as defined in the *Act*; and

(g) "Environment officer" has the same meaning as defined in the *Act*.

Section Two: Operation

2.1 The permittee shall comply with the *Act* and the *Regulations*, and the terms and conditions of this permit.

2.2 In the event of an inconsistency between the *Act* and this permit, or the *Regulations* and this permit, the more stringent requirement shall apply.

2.3 The permittee shall not extend or alter the sewage works without approval of Environmental and Municipal Management Services.

2.4 The permittee shall ensure that the operation, repair and maintenance of the sewage works is under the direction of an operator who holds at least the corresponding certificate for the classification of the sewage works as set out in the Saskatchewan Water and Wastewater Works Operator Certification Standards, December 2016.

2.5 The permittee shall ensure that the facility, for which this permit is issued, is inspected on a semi-annual basis and that inspection should include, but not be limited to, dyke integrity, liquid levels in all cells, valve operation, and primary cell to storage cell overflow structure condition.

2.6 The permittee shall ensure that all downstream landowners that may be impacted by the sewage treatment facility discharge are notified at least 1 week prior to the intended discharge of treated effluent.

2.7 In the event of an upset or bypass condition, the permittee shall ensure all downstream water users that may be adversely impacted by the sewage works discharge are notified.

2.8 Pursuant to section 8 of the *Act*, no person shall discharge or allow the discharge of a substance into the environment in an amount, concentration or level or at a rate of release that may cause or is causing an adverse effect unless otherwise expressly authorized pursuant to this permit.

2.9 The Permittee shall ensure three (3) monitoring wells are installed as identified in the August 2021 Town of Kindersley Lagoon and Wastewater Upgrades – Post Construction – Completion Report in the Lagoon Expansion Key Plan - Proposed Lagoon Expansion Sheet 01-C1002 with well data provided to the minister by June 30, 2022.

Section Three: Sampling, Monitoring and Effluent Quality

3.1 The permittee shall cause samples to be taken from the sewage works and receiving environment and tested for the parameters listed in Appendix A, at the locations, times and frequency set out in Appendix A.

3.2 The permittee shall ensure that the effluent quality results for those samples required by 3.1 do not exceed the limits set out in Appendix B for the chemical parameters listed in Appendix B.

3.3 The permittee shall take samples in accordance with the instructions provided by the institution or laboratory that provides the sampling bottles or containers.

3.4 The permittee shall have all effluent and receiving environment samples analyzed by an accredited laboratory.

Section Four: Recordkeeping

4.1 The permittee shall cause operational records or logs to be maintained, including information respecting:

(a) tests conducted and the information to be collected as required by this permit;

(b) site inspections required by 2.5, maintenance work and any failure of treatment components;

(c) types, dosages and total amount of chemicals or other substances added to the sewage;

(d) dates and volumes of sewage effluent discharges;

(e) locations from which samples for any tests are taken;

(f) the results of any tests conducted on the samples taken pursuant to 3.1; and

(g) records of public complaints including complaints over impacts from suspected seepage from the facility and/or complaints over impacts resulting from discharge practices.

4.2 The permittee shall cause the operational records or logs mentioned in 4.1 to be recorded and maintained in the following manner:

(a) operational records or logs must be made in chronological order, with the dates, times and testing locations clearly indicated;

(b) entries in an operational record or log must only be made by the permittee, which includes, by definition, any principal or agent of a permittee;

(c) any person making an entry in an operational record or log must do so in a manner that allows the person to

be unambiguously identified as the maker of the entry;

(d) operational records or logs must be maintained on a daily basis and retained for at least five years;

(e) any anomalies or instances of missing entries in an operational record or log must be accompanied by explanatory notes;

(f) operational records or logs must only contain data or information that is actually observed or produced;

(g) operational records or logs must not contain default values generated manually or by automated means; and

(h) operational records or logs maintained pursuant to clause (e) must be made available promptly on request of the Water Security Agency.

4.3 The permittee shall review the records and logs mentioned in 4.1 on an annual basis to ensure that the operating parameters are being achieved and that the limits set out in Appendix B are not exceeded.

4.4 The permittee shall report the findings to the minister as soon as is reasonably practicable after each review required by 4.3, should the review of the records and logs indicate that the operating parameters have not been achieved and effluent quality limits have been exceeded.

Section Five: Reporting

5.1 The permittee shall submit the results of water sampling analyses performed in accordance with this permit to Environmental and Municipal Management Services, within 7 days following completion of the sampling analyses.

5.2 The permittee shall direct the laboratory performing its water sampling analyses to submit the results within the timeframes mentioned in 5.1. The results must be provided directly to Environmental and Municipal Management Services, in a format compatible with the EPB 383 Water Security Agency and Ministry of Environment - Environmental Management System (SEEMS) Lab-Operator (LAB-OPR) Data File Format, in addition to submitting the written results to the permittee.

5.3 The permittee shall report to the minister any known or anticipated upset condition, bypass condition or events at or affecting the sewage works that could adversely affect the quality of effluent produced by the sewage works.

5.4 The permittee shall immediately report to the minister any instance where:

(a) any parameter level identified in Appendix B is not achieved or is not anticipated to be achieved; and

(b) there is a retirement, suspension, resignation, scheduled absence or termination of employment of any certified sewage works collection or sewage works treatment operator, or any anticipated retirement, suspension, resignation or termination that results in the sewage works not being under the direction of a certified operator.

5.5 The permittee shall instruct its employees, agents and contractors performing work or service in relation to the sewage works of their obligation, under section 13(2) of the *Regulations,* to report to the minister any instance described in 5.4 and any known or anticipated upset condition, bypass condition or events at or affecting a sewage works that could adversely affect the quality of effluent discharged into the environment.

5.6 The permittee shall, as soon as reasonably practical, report any of the events mentioned in 5.3 or 5.4 to the minister**.**

Section Six: Inspection

6.1 An environment officer may enter the sewage works at any time to conduct an inspection to ensure that the permittee is complying with this permit, the *Act* or the *Regulations*.

6.2 Upon the request of an environment officer, the permittee shall immediately provide any books, records, logs, graphs, papers, documents, or data, including any computer, digital or electronic records, logs, graphs, files or data maintained with respect to the sewage works.

Section Seven: General

7.1 A copy of this permit shall be posted in a conspicuous place at the sewage works or administration office.

7.2 The permittee shall provide each operator of the sewage works with a copy of this permit and the *Regulations.*

7.3 The minister may cancel, alter or suspend this permit for the reasons and in the manner set out in the *Act*.

7.4 The permittee shall apply for renewal/alteration of this permit at least 60 days prior to its expiry.

7.5 In the event of any inconsistency between a previously issued Permit to Operate a Sewage Works, and the terms and conditions of this Permit to Operate a Sewage Works, the terms and conditions of this permit prevail.

7.6 This permit does not replace or supersede any approvals, licenses or authorizations that may be required due to municipal, provincial or federal legislation. The permittee shall maintain in force any and all such approvals, licenses or authorizations that may be required.

7.7 Where any notice or reporting is required to be given by the permittee, it shall be provided to:

Water Security Agency
Scott Klippenstein Environmental Project Officer
306-350 Cheadle Street West
Telephone (306) 741-7718
Fax: (306) 778-8271
Email: WSAEPOKindersley@wsask.ca

After hours, weekends and holidays, the Water Security Agency can be contacted by calling the Upset Report Line at 1.844.536.9494.

Appendix A

Permit to Operate a Sewage Works
Monitoring Schedule
Permit No.: 00050460-05-00

Location	Station Number	Frequency	Type of Sample	Parameter(s)
1. Wastewater Discharge to Teo Lake	SK05GB0031	Semi-Annually, midway though a discharge period. (Once April – September, once October - March)	Grab	**Group 2 Panel** 5-day Carbonaceous Biochemical Oxygen Demand Chloride Total Suspended Solids
		Semi-Annually, midway though a discharge period. (Once April – September, once October - March)	Grab	Total Coliform Bacteria *Escherichia coli*
2. Treated Wastewater Effluent Discharge to Environment	SK05GB0110	Once midway through each discharge period	Grab	**Group 2 Panel** 5-day Carbonaceous Biochemical Oxygen Demand Chloride Total Suspended Solids Total Coliform Bacteria *Escherichia coli*
3. Monitoring Wells	Well 1 (East) SK05GB0107 Well 2 (NW) SK05GB0108 Well 3 (SW) SK05GB0109	Once per year (June to August)	Grab	**Group 1 Panel** Conductivity at 25ºC Chloride Nitrate – N Total Coliform Bacteria *Escherichia Coli*

Appendix B

Permit to Operate a Sewage Works
Permit Limits
Permit No.: 00050460-05-00

Location	Parameter	Limit
Final Treated Wastewater Effluent SK05GB0110 – Teo Lake Discharge	5-day Carbonaceous Biochemical Oxygen Demand	Shall not exceed an annual arithmetic mean of 25 milligrams per litre.
	Total Suspended Solids	Shall not exceed an annual arithmetic mean of 30 milligrams per litre.
	Biological Oxygen Demand	Shall not exceed an annual arithmetic mean of 30 milligrams per litre.

Appendix D

Community Water Use Records

Water Security Agency

Community Water Consumption (Cubic Metres)

Year	SH Pop	Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year Total	Avg Day	Peak Day	P.D. Factor	Per Capita
Kimosom Pwatinahk Reserve #203																			
2017	1162	R	11,230	10,200	12,195	10,886	10,747	10,702	11,008	11,042	11,782	11,084	11,539	11,047	133,461	366	0	0.00	315
2016	0	R	9,974	9,356	10,536	10,654	12,181	11,561	12,103	11,156	11,280	11,150	12,131	11,520	133,602	366	0	0.00	0
2015	0	R	8,987	8,118	8,987	8,697	8,987	8,697	8,987	8,987	7,099	7,823	8,210	8,853	102,432	281	0	0.00	0
2014	0	R	10,898	9,276	10,326	10,504	10,343	11,233	9,724	9,628	9,010	8,730	9,010	10,463	119,145	326	0	0.00	0
2013	0	R	13,732	12,525	13,845	12,467	13,242	13,177	13,477	10,968 *	9,025 *	9,639 *	10,819 *	11,279 *	144,195	395	0	0.00	0
2012	0	R	7,638 *	8,456 *	13,866 *	14,928 *	13,932	15,115	14,100	8,710	10,851	13,924	14,280	8,456 *	144,256	395	0	0.00	0
2011	0	R	8,456 *	7,638 *	8,456 *	8,183 *	8,456 *	8,183 *	8,456 *	8,456 *	8,183 *	8,456 *	8,183 *	8,456 *	99,562	273	0	0.00	0
2010	0	R	8,456 *	7,638 *	8,456 *	8,183 *	8,456 *	8,183 *	8,456 *	8,456 *	8,183 *	8,456 *	8,183 *	8,456 *	99,562	273	0	0.00	0
Kincaid																			
2022	203	R	1,283	1,191	1,171	1,185	1,170	1,501	1,932	2,039	1,784	1,411	1,597	1,123	17,387	48	0	0.00	235
2021	196	R	1,155	1,190	1,168	1,203	1,463	1,853	2,109	1,341	1,305	1,366	1,306	1,343	16,802	46	132	2.87	235
2020	199	R	1,510	1,606	2,079	2,285	1,389	1,482	1,882	3,232	1,311	1,298	1,219	1,266	20,559	56	132	2.34	283
2019	197	R	1,252	1,422	1,527	1,423	1,263	1,540	1,676	1,375	1,173	1,424	1,403	1,700	17,178	47	123	2.61	239
2018	206	R	1,173	1,304	2,211	1,317	1,861	2,189	1,640	2,763	2,239	1,694	1,250	1,163	20,804	57	201	3.53	277
2017	208	R	1,304	1,079	1,200	1,250	1,383	1,614	2,164	1,749	1,407	1,447	1,391	1,582	17,570	48	142	2.95	231
2016	199	R	1,120	1,122	1,235	1,196	1,316	1,200	1,201	1,437	1,273	1,362	1,273	1,424	15,159	42	100	2.41	209
2015	185	T	1,226	1,048	1,218	1,341	1,526	1,932	1,385	1,294	1,336	1,238	1,171	1,246	15,961	44	0	0.00	236
2014	194	T	1,392	1,709	1,802	1,937	3,129	3,837	1,862	1,398	2,234	1,209	1,232	1,350	23,091	63	189	2.99	326
2012	183	R	1,565	1,618	2,011	2,103	1,390	1,462	2,024	2,347	2,171	1,677	1,358	1,857	21,583	59	178	3.01	323
2011	195	R	1,503	1,357	1,516	1,551	2,011	1,697	1,777	1,875	1,840	1,945	1,408	1,524	20,004	55	158	2.88	281
2010	179	R	1,183	1,337	1,201	1,904	668	1,336	1,720	1,826	1,581	1,390	1,452	1,566	17,164	47	0	0.00	263
2009	152	R	2,227	3,426	2,525	1,274	1,243	1,698	2,091	1,814	1,788	1,342	1,266	1,291	21,985	60	0	0.00	396
2008	165	R	1,707	1,712	1,743	1,558	2,085	1,965	2,619	2,710	1,927	1,916	1,791	1,282	23,015	63	182	2.89	382
Kindersley																			
2022	5239	T	41,443	39,032	43,116	41,233	58,799	79,840	74,758	64,752	53,978	44,301	38,109	39,870	619,231	1568	2661	1.70	324
2021	5207	R	58,009	48,938	51,163	53,095	66,167	87,750	88,965	87,575	84,536	56,788	48,704	37,327	769,018				405
2020	5422	R	65,665	62,743	63,263	58,722	72,147	73,548	79,269	78,898	62,260	62,223	51,658	51,927	782,323	2143	0	0.00	395
2019	5421	R	62,962	52,450	58,993	56,399	77,369	81,466	79,551	83,932	73,098	63,845	55,541	55,361	800,967	2194	3,325	1.52	405
2018	5340	R	63,857	53,750	52,756	48,927	74,088	82,253	80,296	77,505	62,178	60,687	58,296	53,950	768,543	2106	0	0.00	394
2017	5526	R	83,970	75,844	83,970	81,262	83,970	81,262	83,970	83,970	81,262	83,970	81,262	83,970	988,682	2709	2,885	1.07	490
2016	5441	R	85,923	129,957	32,219	114,242	56,008	84,045	74,860	73,361	66,500	64,002	58,833	63,718	903,668	2476	3,543	1.43	455
2015	5357	R	83,608	83,621	74,889	107,788	107,924	103,476	113,271	117,892	88,258	105,347	68,381	108,871	1,163,326	3187	4,906	1.54	595
2014	5462	R	102,481	94,749	82,814	69,733	105,165	105,669	112,456	109,313	104,707	100,893	95,068	91,451	1,174,499	3218	5,192	1.61	589
2013	5349	R	62,635	87,702	74,166	74,818	80,983	72,475	117,690	136,603	82,430	82,959	76,613	76,973	1,026,047	2811	0	0.00	526
2012	5321	R	79,802	71,875	63,880	56,355	93,588	65,570	74,012	104,960	116,962	95,096	64,236	89,193	975,529	2673	3,361	1.26	502
2011	5330	T	49,346	44,654	50,550	39,193	59,183	68,296	69,498	70,841	60,939	55,233	48,018	52,270	668,021	1830	3,012	1.65	343
2010	5273	T	58,082	44,821	75,416	51,637	62,765	57,933	62,518	60,989	54,494	56,780	51,123	51,282	687,840	1884	3,541	1.88	357
2009	4894	T	49,990	43,016	50,982	50,259	75,572	76,471	68,057	73,709	71,467	53,723	50,379	53,342	716,967	1964	3,590	1.83	401
2008	4966	T	47,079	46,472	49,348	46,020	63,451	64,541	62,323	67,857	60,739	54,548	50,720	50,346	663,444	1818	2,973	1.64	366

Appendix E

Road Condition and Age – Figures

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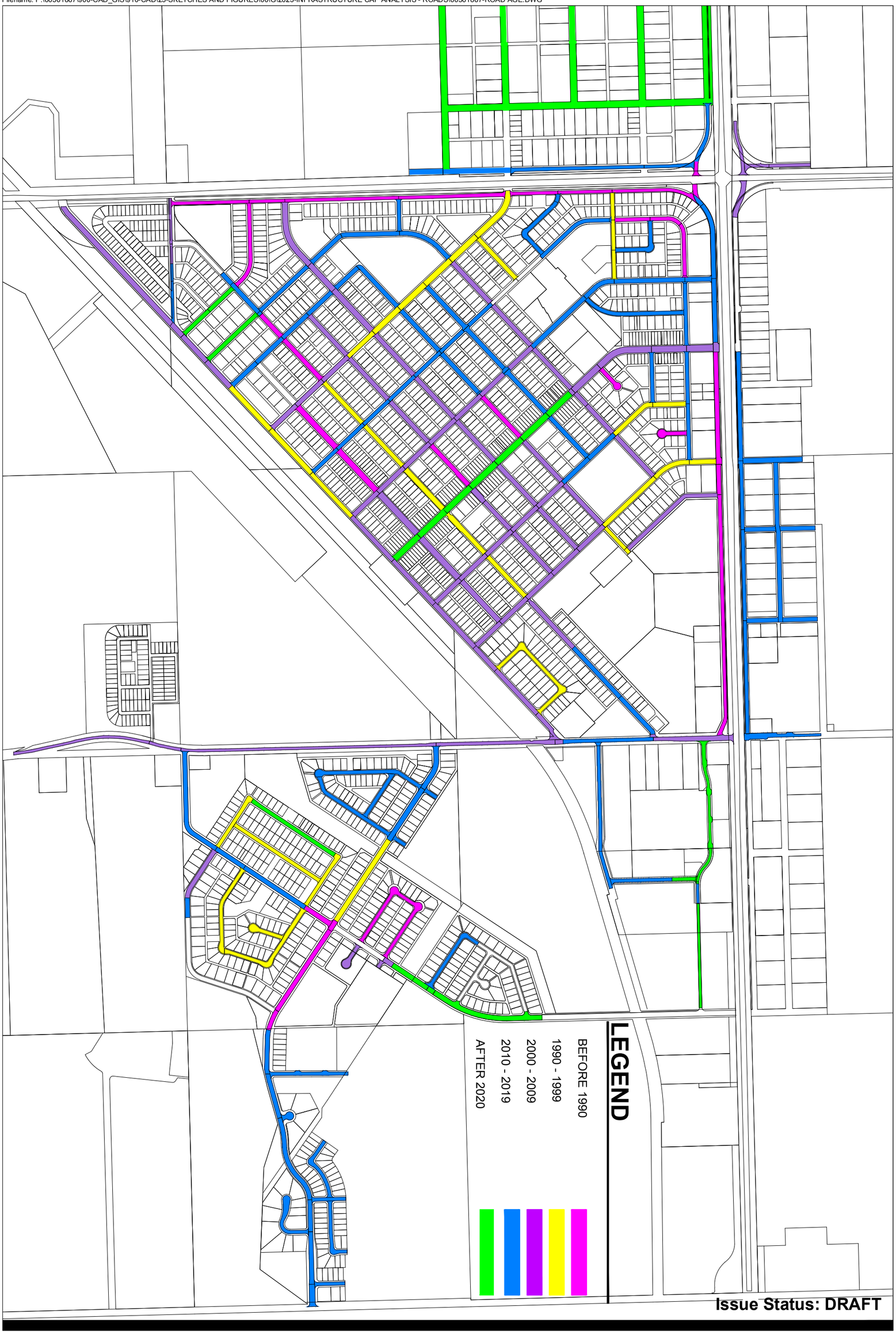

Issue Status: DRAFT

INFRASTRUCTURE CAPACITY ANALYIS
ROADS
Town of Kindersley
Project No.: 60561867 Date: 2024-01-12

2024 ROAD REHABILITATION SUMMARY

AECOM

0000-G-1003

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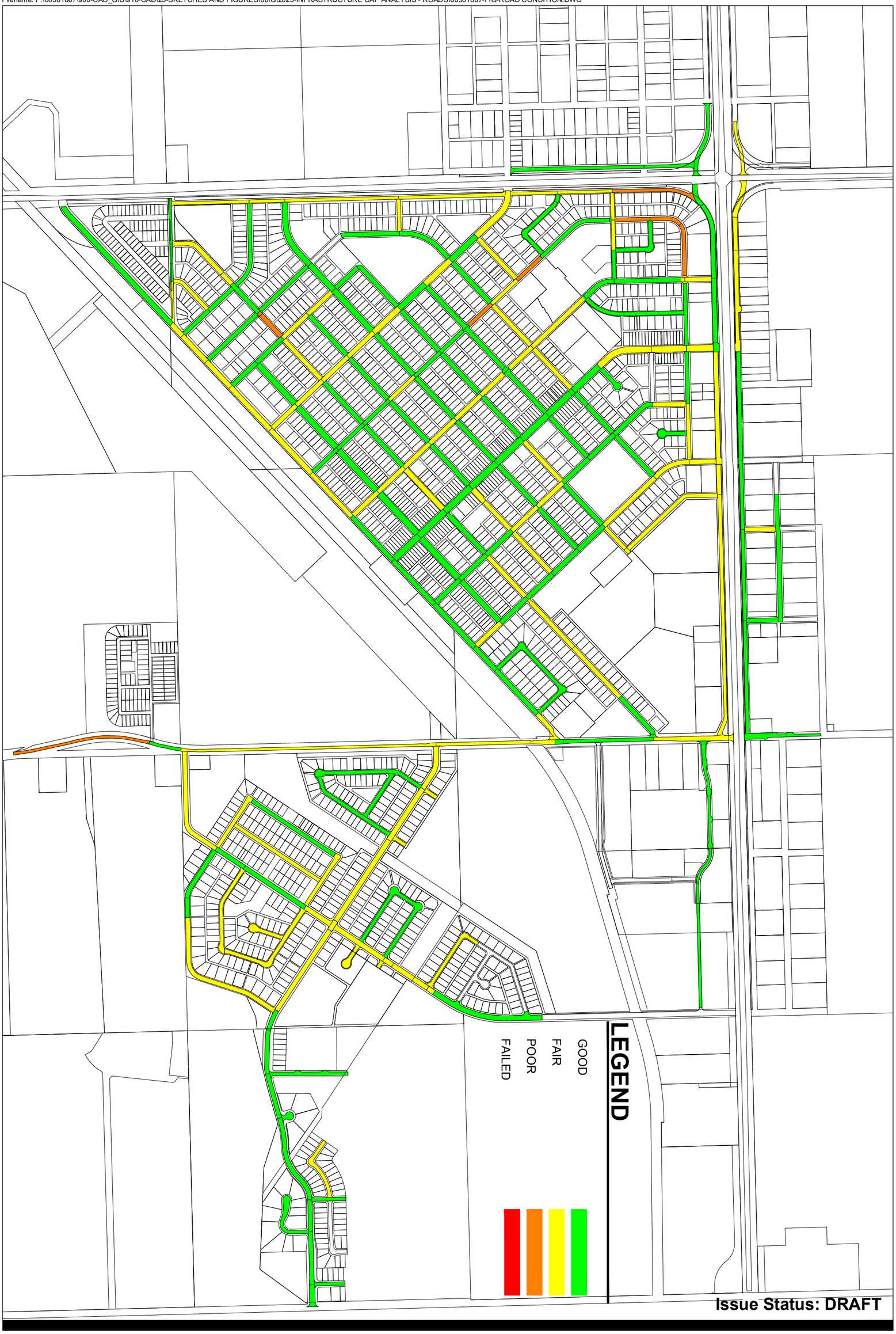

Issue Status: DRAFT

INFRASTRUCTURE CAPACITY ANALYIS
ROADS
Town of Kindersley
Project No.: 60561867 Date: 2024-01-12

2023 Condition Assessment Summary

AECOM

0000-G-1003

Appendix F

Infrastructure Upgrades Prioritization Schedule and Capital Cost Estimate

Infrastructure Upgrades Prioritization Schedule and Capital Cost Estimate

AECOM

Upgrade	Description	Priority		Year (Capital Cost) 2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Immediate - Recommendations to be implemented as soon as possible and are highest priority.																				$3,723,500
Wastewater Collection - Immediate																				$97,500
Rosedale Lift Station	Repair level transmitter and install backup floats	1-Immediate		$10,000																
Rosedale Lift Station	Preliminary design of rosedale lift station upgrades	2-Immediate		$65,500																
Hwy 7 & 21 Lift Station	Repair pressure gauge	1-Immediate		$2,000																
Hwy 7 & 21 Lift Station	Service/replace ball check valves after checking on seal	3-Immediate			$2,000															
Hwy 7 & 21 Lift Station	Install backup floats	3-Immediate			$4,000															
Industrial Lift Station Operational Repairs	Service ventilation system	1-Immediate		$5,000																
Industrial Lift Station Operational Repairs	Clean wet well	1-Immediate			$5,000															
Industrial Lift Station Operational Repairs	Service/ replace ball check valves	3-Immediate			$2,000															
Industrial Lift Station Operational Repairs	Flush/swab the existing forcemain	3-Immediate			$2,000															
Water Distribution - Immediate																				$2,335,000
Cast Iron Replacement	Continue to implement cast iron replacement program	3-Immediate	Budget Allocation	$2,200,000																
Water Tower Inspection and Cleaning	Regular cleaning and inspection of water towers are recommended.	2-Immediate		$30,000																
Watermain Assessment Program	Finalize the program to evaluate the condition of aging water mains. Watermain flushing and hydrant testing Watermain break tracking and pipe break material testing	3-Immediate		$20,000																
WTP Upgrades	SaskWater near term upgrades	3-Immediate			$85,000															
Wastewater Treatment - immediate																				$300,000
Old Lagoon Cell Blower Upgrade	Upgrade aeration in old cell, upgrade control panel	1-Immediate		$300,000																
Water Supply																				$36,000
SaskWater Year 1	Cooling system and new production well	1-Immediate		TBD																
SaskWater Year 2-5	VFD replacements x3 and AC Unit	3-Immediate					$36,000													
Stormwater - Immediate																				$300,000
Drainage Issues at 2nd Avenue East and Overlord	Storm water pumping station and forcemain	1-Immediate		$250,000																
East Grid Culvert Upgrade	Increase culvert diameter and roadway improvements improving intersection safety	2-Immediate		$200,000																
Ditson Drive Culvert Repair	Repair of failing culvert	2-Immediate			$200,000															
West Industrial Drainage	Ongoing ditch maintenance (Annual)	3-Immediate	Annual	$5,000																
Priority Road Rehabilitation and Underground Infrastructure Replacement - Immediate																				$655,000
8th St West (Carmichael Ave to 11th Ave W)	Replacement of underground infrastructure and roadway	3-Immediate				$1,100,000														
2nd St W (Carmichael Ave to 1st St W)	Replacement of underground infrastructure and roadway	1-Immediate			$2,000,000															
2nd St W (King Drive to 8th Ave W) 2nd St W (8th Ave W to 7th Ave W) 2nd St W (7th Ave W to 6th Ave W)	Replacement of underground infrastructure and roadway	1-Immediate				$925,000														
2nd Ave W (5th St W to 4th St W)	Replacement of underground infrastructure and roadway	1-Immediate				$380,000														
Annual Road Work	Full road rehabilitation/ spot repair/ resurfacing	1-Immediate	Budget Allocation																	
Moderate - Recommendations for upgrades should be budgeted for with completion within 15 years.																				$5,560,000
Wastewater Collection - Moderate																				$2,420,000
Rosedale Lift Station	Replace generator	4 -Moderate					$75,000													
Rosedale Lift Station	Significant lift station upgrades	4-Moderate					$2,250,000													
Hwy 7 & 21 Lift Station	Temporary HVAC flow monitoring	4-Moderate					$10,000													
Hwy 7 & 21 Lift Station	Increase flow rate of service room ventilation	4-Moderate					$5,000													
Wastewater Hydraulic Modelling	Update the Town wastewater hydraulic model	4-Moderate						$30,000												
CCTV Inspection Program	Inspect areas of aging sewer main via camera annually	4-Moderate	Annual	$50,000																
Water Distribution - Moderate																				$2,630,000
Main Street Watermain Replacement	Upgrade watermain to 250 mm diameter along main street between Eleventh Avenue East and Seventh Avenue East	4-Moderate						$2,000,000												
100 mm Water Main Replacement	Replace 100 mm watermain with 150 mm PVC or HDPE water main Prioritize based on age and material of pipe	4-Moderate	Budget Allocation																	
Highway 21 Crossing	Flow to the Northwest Industrial area is constricted by pipe crossings of HWY 21 at 7th Avenue and 11th Avenue	4-Moderate							$600,000											
Hydraulic Model Update	Build an updated hydraulic model	4-Moderate							$30,000											
Wastewater Treatment - Moderate																				$10,000
Lagoon Desludging Survey	Complete sludge survey for evaluation of desluding	6-Moderate								$10,000										
Stormwater System - Moderate																				$500,000
Drainage Issues along 13th Avenue East	Upgrades to drainage ditch and culvert repairs	4-Moderate					$250,000													
Hwy 7 and Hwy 21 Drainage	Upgrade culverts, assess drainage	4-Moderate					$200,000													
Sidewalk Adjacent to Kindersley Inn	Drainage ditch improvements	4-Moderate					$50,000													
Low - Recommendations based on a 15 year plus outlook, identifying upgrades is for strategic planning.																				$19,600,000
Water Supply - Low																				$13,800,000
Raw Water Upgrades	Stage 1	8-Low																		$6,950,000
Raw Water Upgrades	Stage 2	8-Low																		$6,850,000
Water Treatment - Low																				$5,500,000
WTP – Infrastructure Upgrades	Infrastructure Upgrades	8-Low																		$5,500,000
Wastewater Treatment - Low																				$250,000
Microbiological sludge Removal	Microbiological treatment	9-Low													$250,000					
Stormwater System - Low																				$50,000
Storm Water Model Development	Evaluation of overall existing major and minor storm water system components	8-Low													$50,000					
			Total	$3,137,500	$2,300,000	$2,405,000	$2,876,000	$2,030,000	$630,000	$10,000	$0	$0	$0	$0	$300,000	$0	$0	$0	$0	$28,883,500