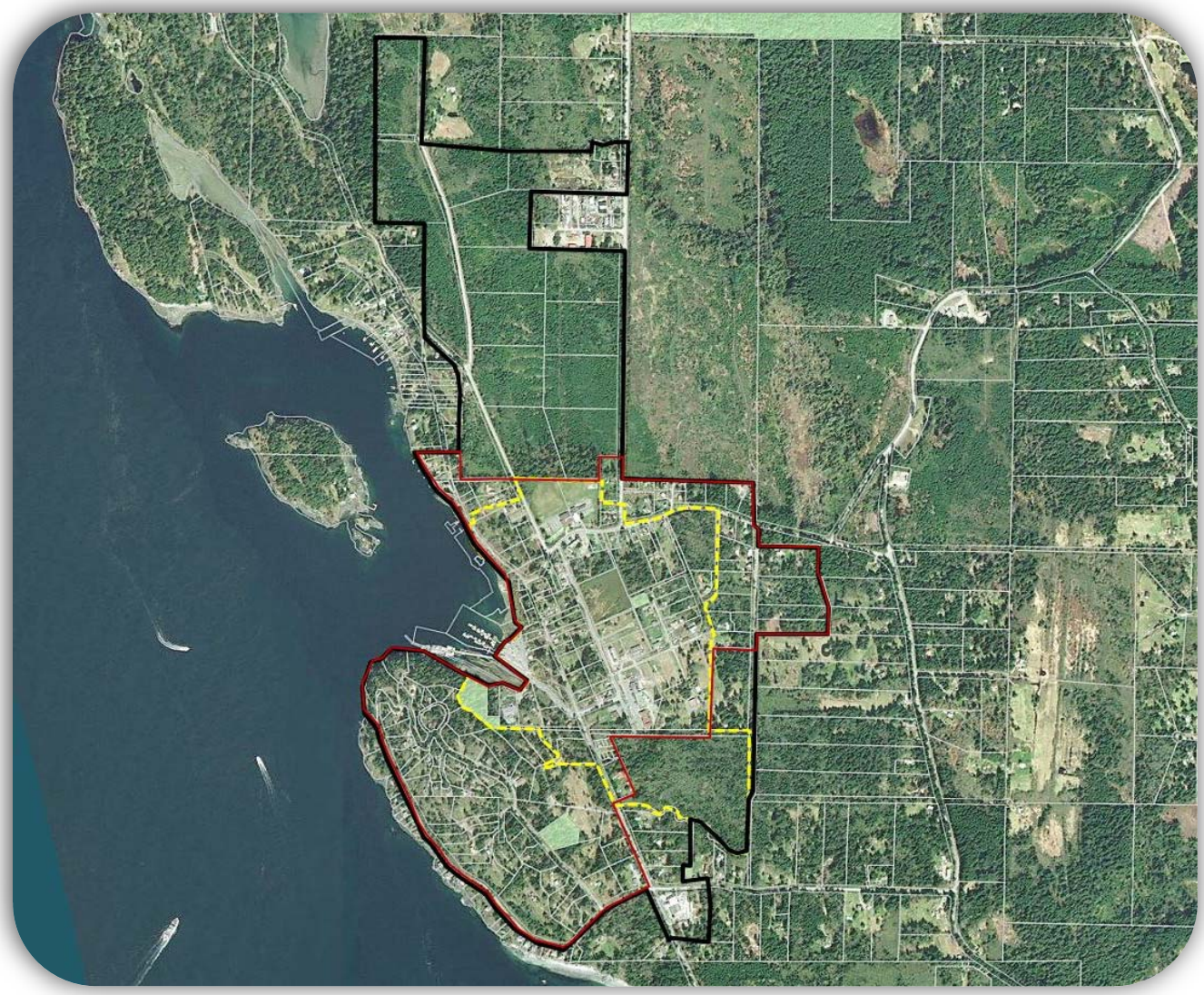
Strathcona REGIONAL DISTRICT

Quathiaski Cove Sewer Local Service Area
Sewer System Capacity Review



- FINAL REPORT -
October 27, 2023

KOERS & ASSOCIATES ENGINEERING LTD.
Consulting Engineers

Parksville, BC

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October 27, 2023
1924-231-02

Strathcona Regional District
301-990 Cedar Street
Campbell River, BC V9W 7Z8

Attention: **Ms. Sheena Fisher**
Engineering Services Coordinator

Re: Quathiaski Cove Sewer Local Service Area
Sewer System Capacity Review – Final Report

We are pleased to submit an electronic copy (pdf format) of our Final Report entitled: Quathiaski Cove Sewer Local Service Area Sewer System Capacity Review, Oct 27, 2023.

The principle findings of the study include:

- Modelling of the collection system under existing and future conditions, indicates that:
  - ✓ All gravity mains have sufficient capacity to convey the design flows and the vast majority of the mains were calculated to flow less than 5% full.
  - ✓ The gravity main calculated to have the greatest depth of flow, was the main that crosses Pidcock Creek and discharges into the sewage treatment plant (primary clarifier). Under peak hour design flow, this main was calculated to be flowing only:
    - i) existing conditions: 25% full
    - ii) future conditions: 42% full
- Infiltration/Inflow (I/I) is occurring in the collection system. Works have been proposed for the identification and reduction of I/I, including:
  - i) Raising of manhole lids in low lying areas where runoff would pond or where manhole lids are located adjacent to drainage ditches flowing full or overflowing, such as perhaps along Harper Road and Plaza Road.
  - ii) Video inspection and smoke testing of the gravity system.
  - iii) Development of an I/I reduction program based on the findings of the video inspection and smoke testing.
  - iv) Ongoing review and analyses of the sewage treatment plant flow metering data to assess and quantity the impact of the I/I reduction works as they are carried out.

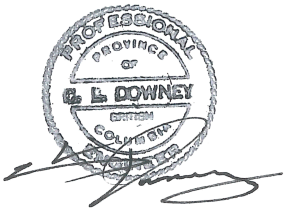
.../2

Strathcona Regional District
Shenna Fisher

We thank you for the opportunity to work on this interesting project and welcome the opportunity to assist the SRD in implementing the study recommendations.

Yours truly,

KOERS & ASSOCIATES ENGINEERING LTD.



Chris Downey, P.Eng.
Project Manager

Chris Holmes, P.Eng.
Project Engineer

Permit to Practice No. 1001658

Encls.

QUATHIASKI COVE SEWER LOCAL SERVICE AREA
SYSTEM CAPACITY REVIEW

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DRAWINGS

APPENDICIES

1 INTRODUCTION

1.1 Authorization

In May 2023, the Strathcona Regional District authorized Koers & Associates Engineering Ltd. to carry out a capacity review of the Quathiaski Cove Sanitary Sewer Collection, Treatment and Discharge system.

1.2 Sewerage System History

The Strathcona Regional District (SRD) manages the Quathiaski Cove Local Sewer Service Area (Service Area) on Quadra Island. The Service Area was established in 1994 with the passage of Bylaw No. 1588 for the establishment of a community sewage collection, treatment, and discharge system. The system became operational in 1996.

In 2017, the service area was expanded, and the collection system extended to service an additional 43 properties.

In 2019, an emergency power generator was installed at the sewage treatment plant, and the flow meter on the discharge from the sewage treatment plant was replaced. Prior to the replacement of the flow meter, the accuracy of the meter readings was in question because of the relatively low flow for the number of properties serviced and the positioning of the meter. It was suspected the meter was under recording flows (by not recording or under recording during periods of low flow). A preliminary review of STP flow metering data shows higher flows are being recorded for each day compared to before the meter was replaced.

At present, the Service Area encompasses approximately 208 ha containing 211 lots. Not all of the properties are connected to the collection system. The current area that is connected to the collection system encompasses approximately 120 ha containing 140 lots.

The SRD continues to see development within the sewer local service area as well as requests for connection to the local sewage collection system from either new development or existing development. The boundary of the Sewer Local Service Area, the extent of the collection, treatment and disposal system, and the properties presently serviced by it are shown in **Figure 1**.

The sewerage system compliments key sustainability goals for the community with respect to:

- protecting the environment, and
- supporting/enhancing a village hub in the Quathiaski Cove area.

The Official Community Plan (OCP) for Quadra Island supports and encourages development and densification within the Quathiaski Cove Village Containment Boundary located with the Service Area of the sewage system. The extent of the containment boundary is shown on the attached **Map 1** of the OCP.

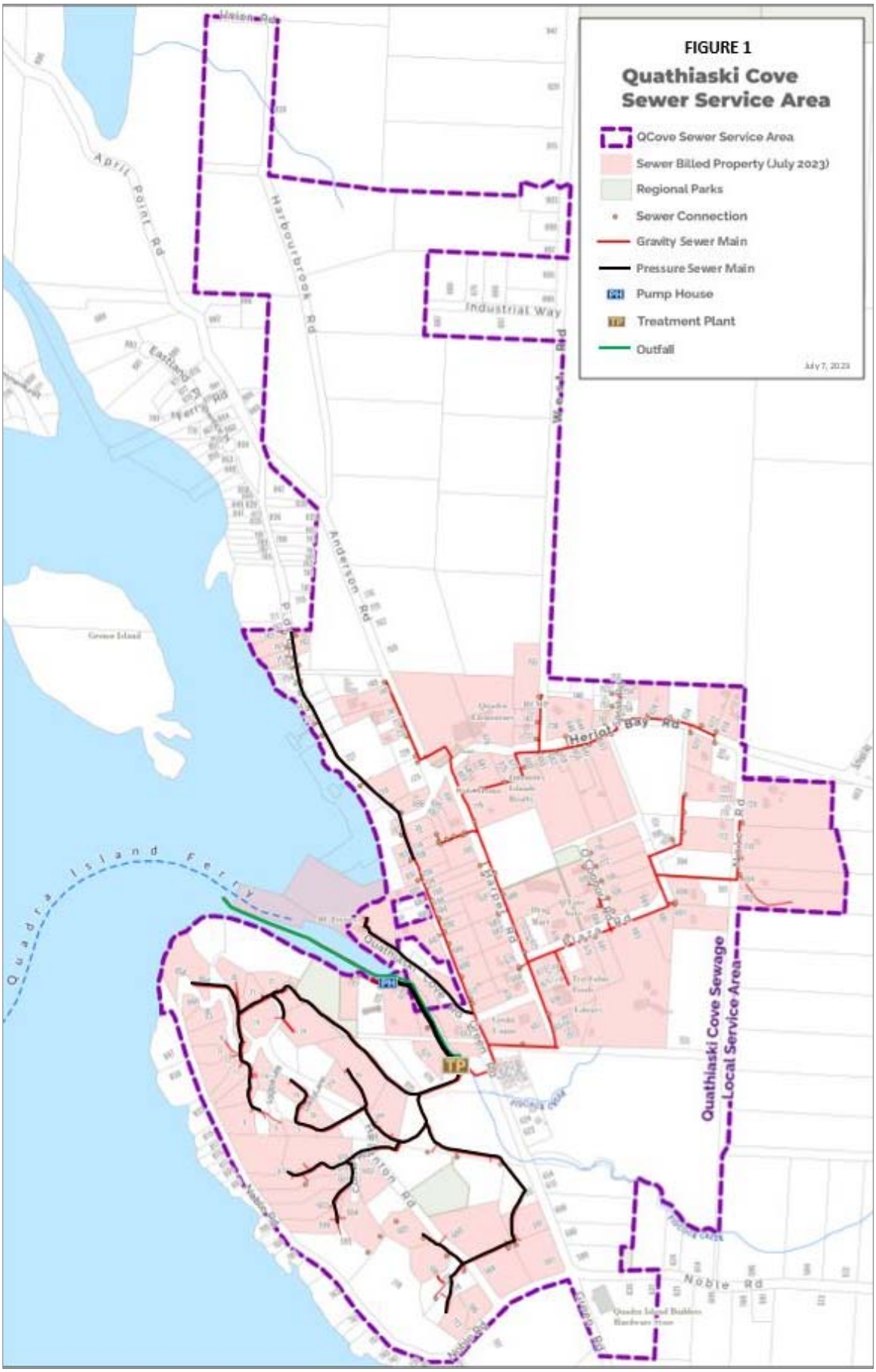
FIGURE 1
Quathiaski Cove Sewer Service Area
QCove Sewer Service Area
Sewer Billed Property (July 2023)
Regional Parks
Sewer Connection
Gravity Sewer Main
Pressure Sewer Main
PH Pump House
TP Treatment Plant
Outfall
July 7, 2023
April Point Rd
Harbourbrook Rd
Industrial Way
Anderson Rd
Heriot Bay Rd
Quadra Island Ferry
Quathiaski Cove Sewage Local Service Area
Noble Rd

1.3 Study Need/Objectives

The SRD wishes to undertake a study to:

i) Assess the ability of the sanitary sewer system (collection, treatment, and discharge) to service the development envisioned by the OCP, and

ii) Identify the extent and timing of upgrading works required, if any.

1.4 Scope of Work

The Scope of Work for this study included:

- Review Relevant Background Information
- Review Sewage Treatment Plant Flows & Local Rainfall Data
- Establish Historical Flows (Average & Maximum Day, Dry vs Wet Weather, Amount of I/I)
- Develop Future Design Flows
- Review Collection System Capacity
- Review STP Capacity & Discharge Permit Limit
- Review Outfall Capacity
- Develop Cost Estimate (Class D) for Identified Projects
- Present Findings in a Summary Report

1.5 Background Information

The development of this report utilized a number of documents. They are listed below in **Table 1**.

Table 1 – Reference Documents

No.	Document Description	Date	Author
	Bylaws		
1	*Bylaw No. 173, Quathiaski Cove Sewer Rates and Regulations, 2013*	*2013 Jun*	*Strathcona Regional District*
2	*Bylaw No. 120, bylaw to amend Quadra Island Official Community Plan Bylaw, 2007 (Bylaw No. 3050)*	*2012 Sep*	*Strathcona Regional District*
	Reports & Studies		
3	*Quathiaski Cove Water System Feasibility Study*	*2021 Feb*	*Koers & Associates Engineering Ltd.*
4	*Quathiaski Cove Wastewater Treatment Plant Replacement, Preliminary Design Report*	*2020 Feb*	*Koers & Associates Engineering Ltd.*
5	*Quathiaski Cove Sewer Service Area Sewage Treatment Plant Replacement Options Review – Draft Report*	*2018 Jun*	*Koers & Associates Engineering Ltd.*

No.	Document Description	Date	Author
6	*Quathiaski Cove Outfall Video and Dye Test Inspection & Repairs Report*	*2016 Dec*	*Seaway Diving Ltd.*
7	*Quathiaski Cove Sewage Local Service Area Expansion Study*	*2011 Feb*	*Koers & Associates Engineering Ltd.*
8	*Quathiaski Cove Wastewater Management Condition and Treatment Capacity Assessment Study*	*2010 Dec*	*Worley Parsons Canada Ltd.*
9	*Quathiaski Cove Wastewater Treatment Plant Operating Plan*	*2008*	*Graeme Faris / SW4 Solutions*
	Construction Drawings		
10	*Quathiaski Cove Sanitary Sewer Collection System Extension Record Dwgs No. 1478-01 to 11*	*2019 Jun*	*Koers & Associates Engineering Ltd.*
11	*Quathiaski Cove Ferry Terminal Civil Site Services Record Dwgs No. 39-92-C01 to C03*	*2007 Apr*	*Herold Engineering Ltd.*
12	*Quathiaski Cove Community Sewer System Record Dwgs No. 459-01-03 to 11, 09a, S-1*	*1996 Nov*	*Chislett Manson & Company.*
13	*Quathiaski Cove Plaza & O'Connor Roads Sanitary Sewers For Approval Dwgs No. C696-001-00, 01 & 02*	*1996 Aug*	*UMA Engineering Ltd.*

1.6 Acknowledgements

Koers & Associates Engineering Ltd. acknowledges with thanks the assistance provided by the following Strathcona Regional District Staff during the course of preparing this report:

- Mr. Wolfang Parada, P.Eng., Sr Manager Engineering Services
- Ms. Sheena Fisher, Engineering Services Coordinator

2 SERVICE AREA

2.1 Physical Characteristics

2.1.1 Location and Size

The Quathiaski Cove Sewer Local Service Area is approximately 0.8 km wide (east to west) by 2.6 km long (north to south). It is bounded by Quathiaski Cove to the west, West Road and Nole Road to the east, Union Road to the north, and Noble Road to the south.

The service area encompasses 208 ha, containing 211 properties. Not all properties within the service area are connected to the collection system on have a sewer main installed in front of or nearby it. Just over 75% (140) of 182 the properties that front the sanitary sewer collection system are connected to it.

The area presently serviced by the sanitary sewer system encompasses 120 ha, which equates to 57% of the 208 ha that is within the boundary of the Quathiaski Cove Local Sewer Service Area.

Future extensions of the collection system will be required to service all the properties within the boundaries of the local sewer service area. The extent of the collection system, the area it presently services, the lots presently connected to it, and the boundary of the Quathiaski Cove Local Sewer Service Area are shown in **Figure 1**.

2.1.2 Topography

In general, the topography of the Sewer Local Service Area is moderately sloping, rising from sea level on the western side, to ±76 m off Nole Road on the eastern side. The highest point of land in the service area is ±93 m in the Whiskey Point Estates residential strata development which is located south of the BC Ferries dock and accessed off of Helanton Road.

Ground elevation contours at 20 m interval and spot elevations obtained from GoogleEarth® within and adjacent to the service area are presented in **Figure 2**.

2.1.3 Type of Development

The majority of the development connected to the sewage collection system consists of single family residential homes. Other types of serviced development include commercial businesses (e.g., gas station, coffee shop, restaurants, auto repair, car wash, real estate office, laundry mat, bookstore, pharmacy), credit union, 24-room resort, bed & breakfasts, elementary school, and government facilities/businesses (RCMP detachment, Canada Post office, BC Ferries terminal, federal government dock/wharf). There are two multi-family developments, and both are owned by the Quadra Island Seniors Society. One consists of two duplexes. The other consists of two prefabricated modular single level buildings with a total of 16 units.

Quadra Elementary has a reported enrollment of 100 students from kindergarten to grade five. The Whiskey Point Resort is a 24-room resort overlooking the BC Ferry terminal and the Quathiaski Cove harbour.

Figure 2 – Ground Contours & Spot Elevations in and Around Quathiaski Cove

2.2 Collection System

The extent of the existing collection system, the area it presently services and the lots presently connected to it are shown in **Figure 1**. The area presently serviced by the sanitary sewer system encompasses a total of 120 ha. This equates to 57% of the 208 ha that is within the boundary of the Quathiaski Cove Local Sewer Service Area (**Figure 2**). Future extensions of the collection system will be required to service all the properties within the boundaries of the local sewer service area.

The collection system is comprised of both gravity mains and pressure mains. A total of 56% (67 ha) of the area is serviced by gravity mains. The remaining 44% (53 ha) is serviced by pressure mains in three locations as shown in **Figure 3**.

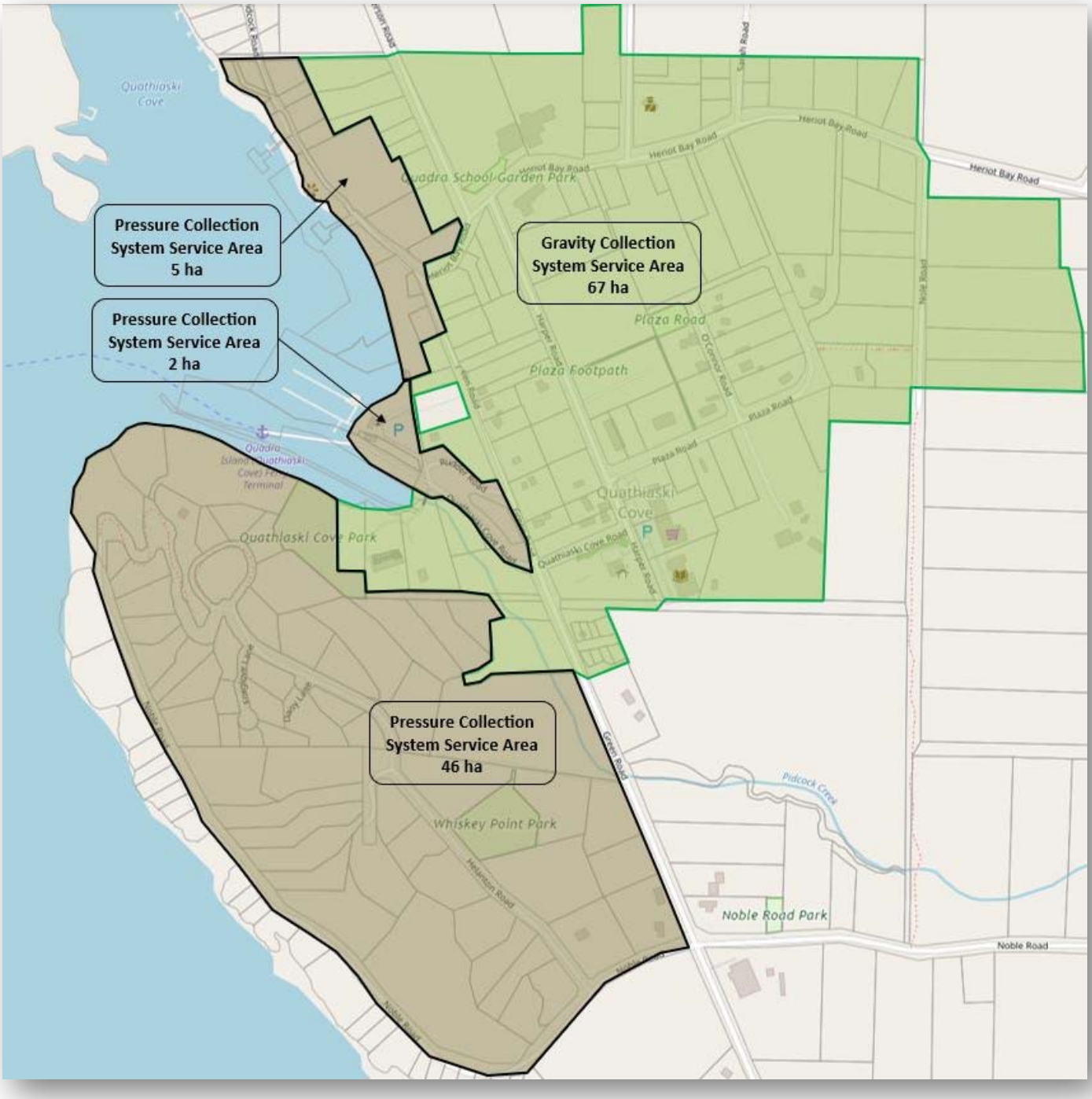

Figure 3 – Gravity and Pressure Collection Systems Service Areas

2.3 Land-Use

2.3.1 Current Zoning

There are twelve land-use/zonings within the Quathiaski Cove Sewer Local Service Area as shown in **Figure 4**.

The R-1 zoning (residential) covers the largest area, ±122 ha, and encompasses the greatest number of properties. The 2nd largest zoning category, by area, is RU-1 (rural residential) at ±67 ha and encompasses 17 properties; all of which are located outside (to the north) of the sewage collection system current service area.

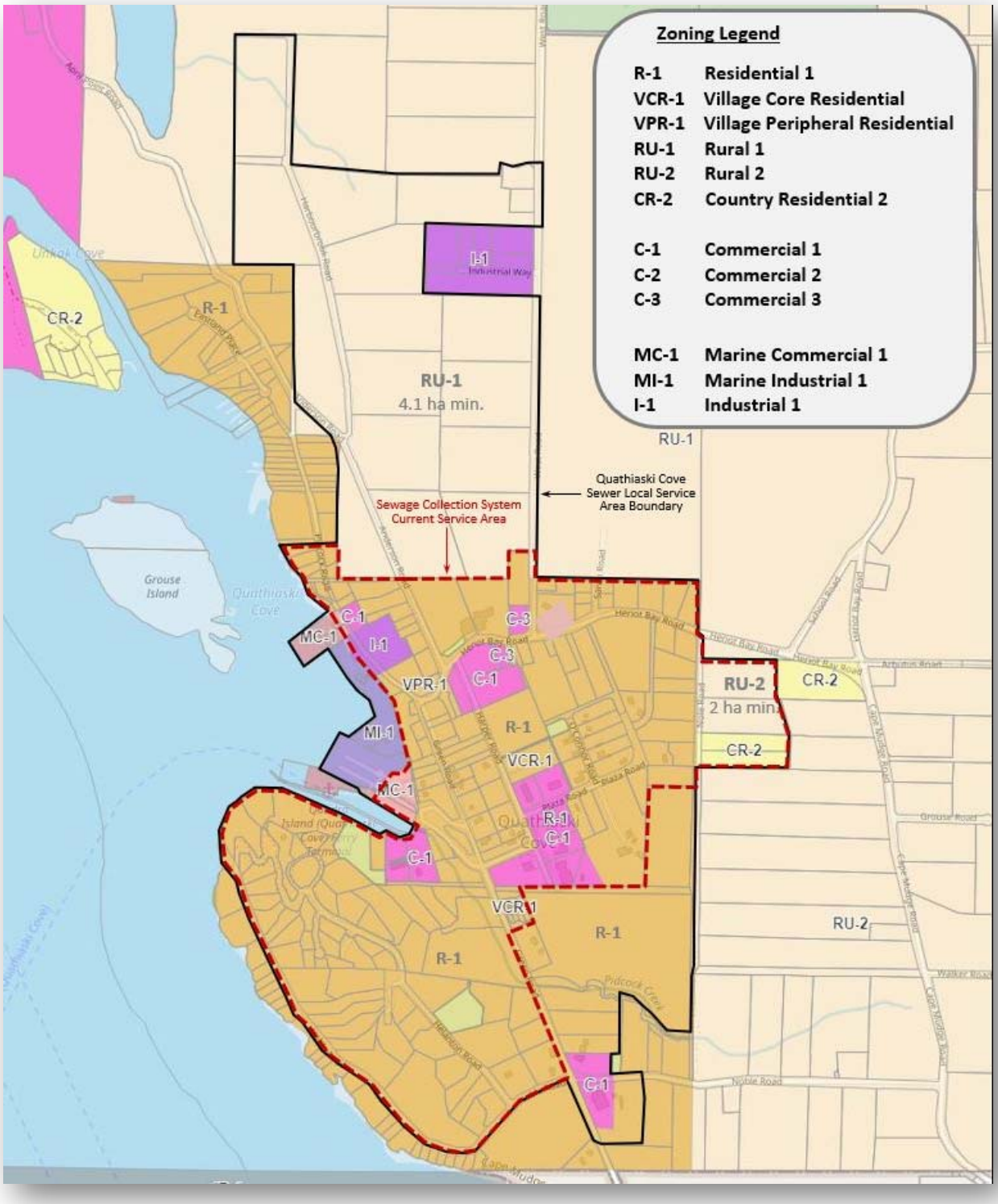

Figure 4 – Current Land-Use (Zoning) Map

2.3.2 Official Community Plan

The Quadra Island Official Community Plan (OCP) Bylaw, 2007 (Bylaw No. 3050) puts forward the vision for development of Quadra Island and includes the *Quathiaski Cove Village Plan* which was developed in 2010/11 and incorporated in bylaw in September 2012. The Quathiaski Cove *Village Plan* envisions a sustainable, walkable village and encourages the concentration of residential and commercial development with a containment boundary. This boundary corresponds to the extent of the constructed sanitary sewer collection system at that time and is referred to as the *Quathiaski Cove Village Containment Boundary*.

The *Quathiaski Cove Village Plan* encourages the concentration of residential and commercial development within the containment boundary. The *Plan* envisions a *Village Centre* area comprised of mixed use and residential surrounded by peripheral residential to the east, south and west, and public assembly (elementary school) to the north. Mixed use and aquatic activities are envisioned along the waterfront within Quathiaski Cove. North of the northern boundary of the *Village Containment Boundary*, land-uses of Silviculture, Rural, and a small amount of Residential are envisioned. The land-use designations of the OCP are presented in **Figure 5**.

The *Quathiaski Cove Village Plan* has six land-use designations within the Village Cove Containment Boundary with allowances for density bonusing ranging from an additional 5 to 10 dwelling units/ha, subject to the meeting of certain requirements, for three of them (Village Centre Mixed Use, Village Centre Residential and Village Peripheral Residential).

A summary of the estimated number of dwelling units and permanent population for the Quathiaski Cove Sewer Local Service Area for existing service properties, expansion of the collection system to all lands within the Sewer Local Service Area, and for three OCP Build-Out scenarios is presented in **Table 2**.

Table 2 – Existing & Future Dwelling Units & Permanent Population Estimates

Description	Dwelling Units (1)	Permanent Population (1)
Current Conditions		
Existing Serviced Properties	144	281 (2)
Future		
Servicing all Lands within the Sewer Local Service Area	266	530 (2)
Official Community Plan		
OCP Build-Out	740	1,300 (3)
OCP Build-Out, with density bonusing	980	1,700 (3)
OCP Build-out, with added density bonusing	1,220	2,200 (3)

Notes:

1 Estimated.

2 Based on Canada Census Year 2021 population density of 1.95 capita/dwelling unit.

3 Based on assumed population densities ranging from 1.5 to 1.95 capita/dwelling unit.

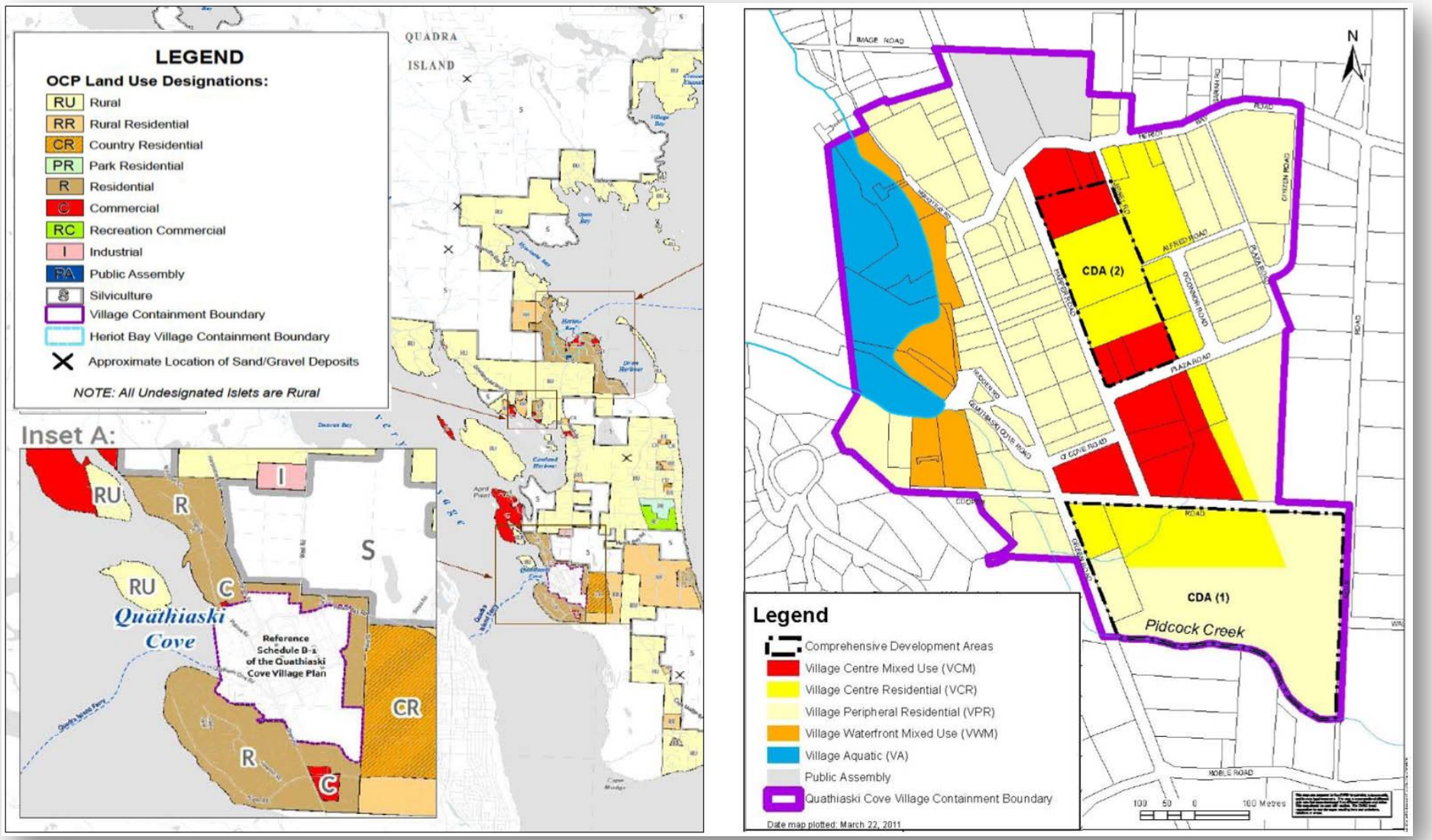

Figure 5 – Official Community Plan Quathiaski Cove Area Land-Use Designation Map

3 POPULATION

3.1 Quathiaski Cove Area Census Data

Statistics Canada records the countries population in 5 year intervals, with the most recent census occurring in Year 2021. The country is broken down into numerous census areas. One of these areas is Quathiaski Cove, Unincorporated Place (UNP). It encompasses 2.77 km^2 (277 ha) and includes some but not of all the lands within the SRD's Quathiaski Cove Sewer Local Service Area as shown in **Figure 6.**

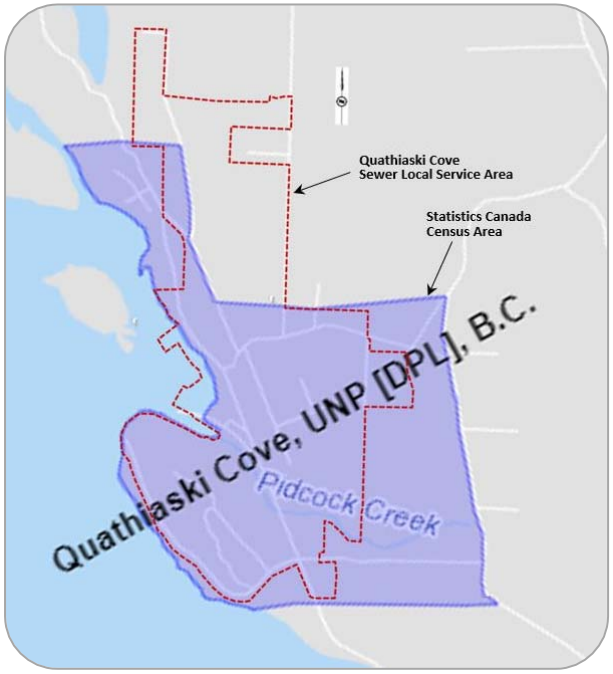

Figure 6 – Quathiaski Cove Canada Census & Sewer Local Service Areas

Census data (population and number of occupied dwellings) for the past 20 years (2001 to 2021) was reviewed to identify historical trends. The review showed that since 2006, the population and number of dwelling units has steady increased. The population grew at a compounded annual rate of 3.02%, resulting in a population increase of 134 capita. The number of occupied dwelling units increased by 104, equating to an average annual increase of 6.9 dwelling units per year. The census data is summarized in **Table 3** and graphically shown in **Figure 7**.

Table 3 – QCove Area Population, Occupied Dwellings, and Capita per Dwelling, 2001 to 2021

Census Year	Population (1)	Occupied Dwellings (1, 2)	Capita per Dwelling (1, 2, 3)
2001	409	n/a (4)	n/a (4)
2006	382	160	2.39
2011	430	206	2.09
2016	449	223	2.01
2021	516	264	1.95
Increase 2006 - 2021	134 35 %	104 65 %	-0.44 -18 %

Notes:

1 From Statistics Canada Census data.

2 A Dwelling Unit is defined as a separate set of living quarters with a private entrance either from outside the building or from a common hall, lobby, vestibule or stairway inside the building. The entrance to the dwelling must be one that can be used without passing through the living quarters of some other person or group of persons.

3 Capita per Dwelling means number of individuals per Dwelling.

4 Occupied Dwellings count and Capita per Dwelling not available for Year 2001.

3.2 Quathiaski Cove Sewer Local Service Area Population Estimate

There is no published population or residential dwelling unit count for the Quathiaski Cove Sewer Local Service Area.

A review of information provided by the SRD indicates that there are 211 properties within the Quathiaski Cove Sewer Local Service Area, not including the three parkland parcels. Of these:

- 134 properties are connected to the sewerage system, and
- 77 properties are not yet connected.

Of the 134 connected properties, it is estimated that there are ±144 residential dwelling units including:

- two seniors living duplexes at 709 O'Connor Road (4 dwelling units total), and
- 16 seniors living dwelling units at 688 Harper Road.

Based on the 2021 Canada Census population density of 1.95 capita per dwelling unit, the permanent population living in ±144 residential dwelling units that are connected to the Quathiaski Cove Sewer Local Service Area is estimated to be ±281 which is graphically shown in **Figure 7**.

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Quathiaski Cove Area
Population & Occupied Dwellings
Year 2001 to 2023

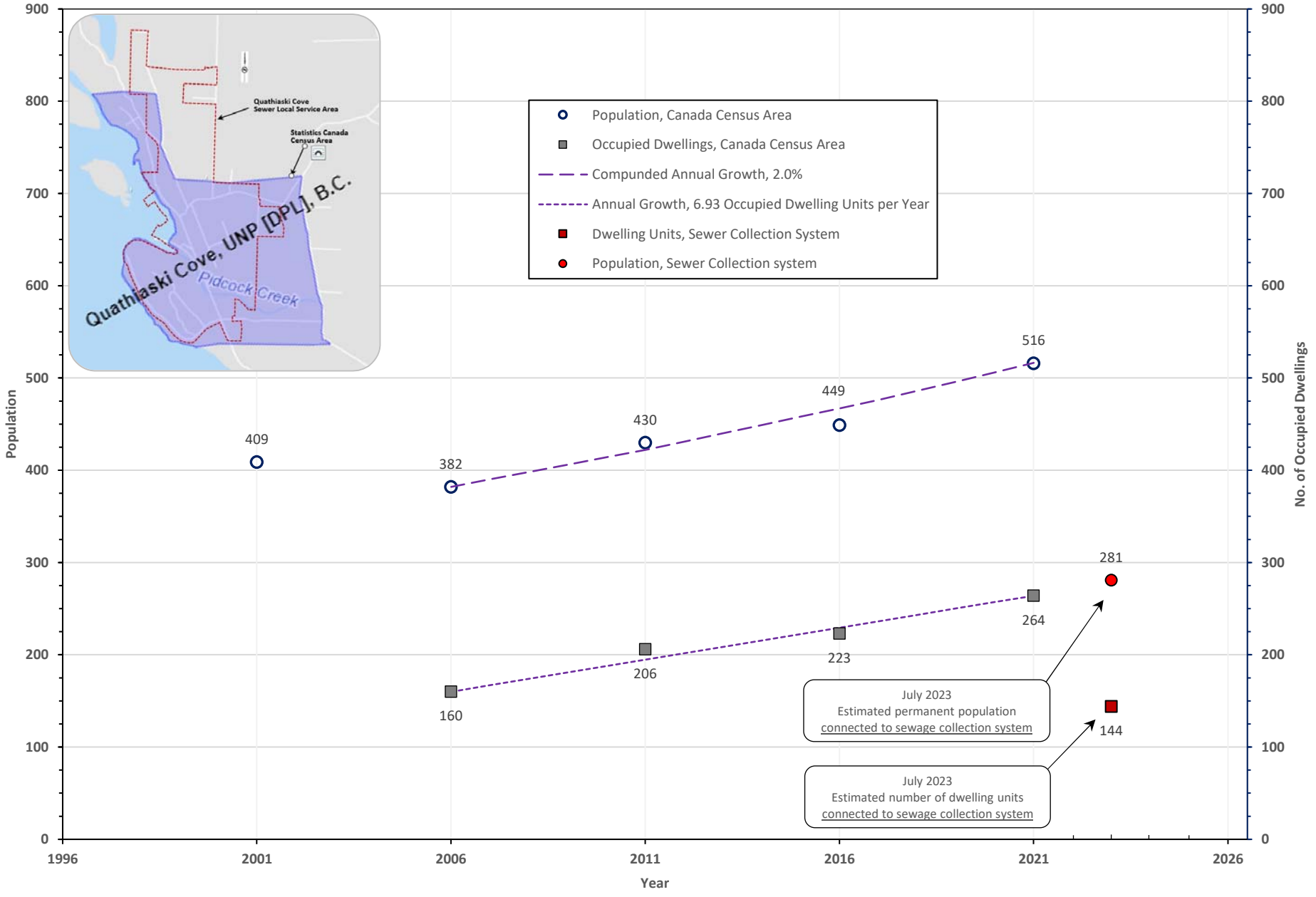

FIGURE 7

4 SEWAGE FLOWS

4.1 Historic

Flows discharged from the sewage treatment plant are measured recorded by the flow meter (50 mm dia. mag meter) that was installed on the discharge line in early 2019; replacing the original flow meter that was not recording accurately.

Flow data available from March 27, 2019 to present were downloaded from a website provided by the SRD. The data was reviewed for year over year trends, seasonal changes, maximum month, maximum day, annual average day, monthly average day, and dry weather average day volumes. The findings are presented below.

4.1.1 Annual & Monthly Volumes

Sewage flows are lowest during the summer months when rainfall is the lowest and highest during the fall/winter/spring months when rainfall is the highest as shown in **Table 4** and in **Figure 8**. **Figure 9** presents the average day flow for each month, which allows for a uniform comparison between the months and reasons in response to or lack of rainfall.

Table 4 – Annual & Monthly Volumes, 2019 - 2023

Month	Flow Meter Total, m^3				
	2019 (1)	2020 (2)	2021 (2)	2022 (2)	2023
January	n/a	3,041	2,687	2,906	2,900
February	n/a	2,249	2,175	2,169	2,297
March	n/a	2,336	2,307	2,590	2,586
April	2,195	1,859	2,029	2,793	2,427
May	2,049	2,059	2,141	2,564	2,293
June	1,887	1,988	2,013	2,231	2,015
July	2,135	2,101	2,080	2,216	2,057
August	2,255	2,101	(3) 1,484	2,186	2,106
September	2,788	1,931	2,249	1,873	2,005
October	2,413	2,347	3,034	**1,746**	-
November	2,258	2,666	**3,303**	2,094	-
December	2,398	2,659	2,782	3,127	-
Annual Volume	20,379	**27,337**	28,282	**28,495**	-

Notes:

1 Flow meter (50 mm dia. mag meter) installed March 2019.
2 Covid-19 travel restrictions in place during Years 2020, 2021 and 2022 (commenced in March 2020).
3 August 2021 monthly total missing 11 days of flow data (Aug 17 thru 27).

4 Blue hi-lited cell indicates the lowest monthly volume for that year.
5 **Bold black value** indicates the **lowest volume for the period of record**.
6 Tan hi-lited cell indicates the highest monthly volume for that year.
7 **Bold red value** indicates the **highest volume for the period of record**.

4.1.2 Daily, Average Day & Maximum Day

A review of the treated sewage flows recorded daily on the outlet of the sewage treatment plant showed that maximum day flows occurred during the fall/winter months in response to high rainfall and/or rain on snow events. **Figure 10** shows the daily recorded flow vs rainfall for the past 4 ½ years (since March 27, 2019). A summary of the maximum day (wet weather flow), average day dry weather flow, annual average day and the ratio of the annual maximum day to annual average day is presented in **Table 5**.

Table 5 – Average Day & Maximum Day Flows, 2020 - 2022

Description	Year				
	2019 (1)	2020 (2)	2021 (2)	2022 (2)	2023
Maximum Day, m^3/day					
amount (date)	n/a	132 (Jan 23)	157 (Nov 4)	213 (Dec 24 (3))	-
Average Day, m^3/day					
- annual	n/a	77	80	78	-
- dry weather (month)	63 (Jun)	62 (Apr)	67 (Jun/Jul)	56 (Oct (3))	66 (Jul)
Max Day ÷ Annual Ave Day					
Ratio	-	1.7	2.0	2.7	-

Notes:

1 Flow meter (50 mm dia. mag meter) installed March 2019.
2 Covid-19 travel restrictions in place in BC and other provinces and territories, as well as by the Canadian Government and by other countries during the Years 2020, 2021, and 2022 (commencing in March 2020).
3 Year 2022:

The months of August, September, and October were notably dry with very little rainfall. This was followed by snow in late November and the first have of December, which was then followed by eight days of rain (on snow) near the end of the month (Dec 22 - 29, 2022).

The increase/decrease in flows in response to the increase/decrease in rainfall can be clearly seen in **Figure 9**.

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Quathiaski Cove
Sewage Treatment Plant
Monthly Discharge vs Rainfall
Apr 2019 - Sep 2023

Rainfall Data from Environment Canada Weather Station:
2019 - 2022
Heriot Bay SE, ID: 1023462
No data beyond 2022 (operator retired)
2023
Cape Mudge, ID: 1021330

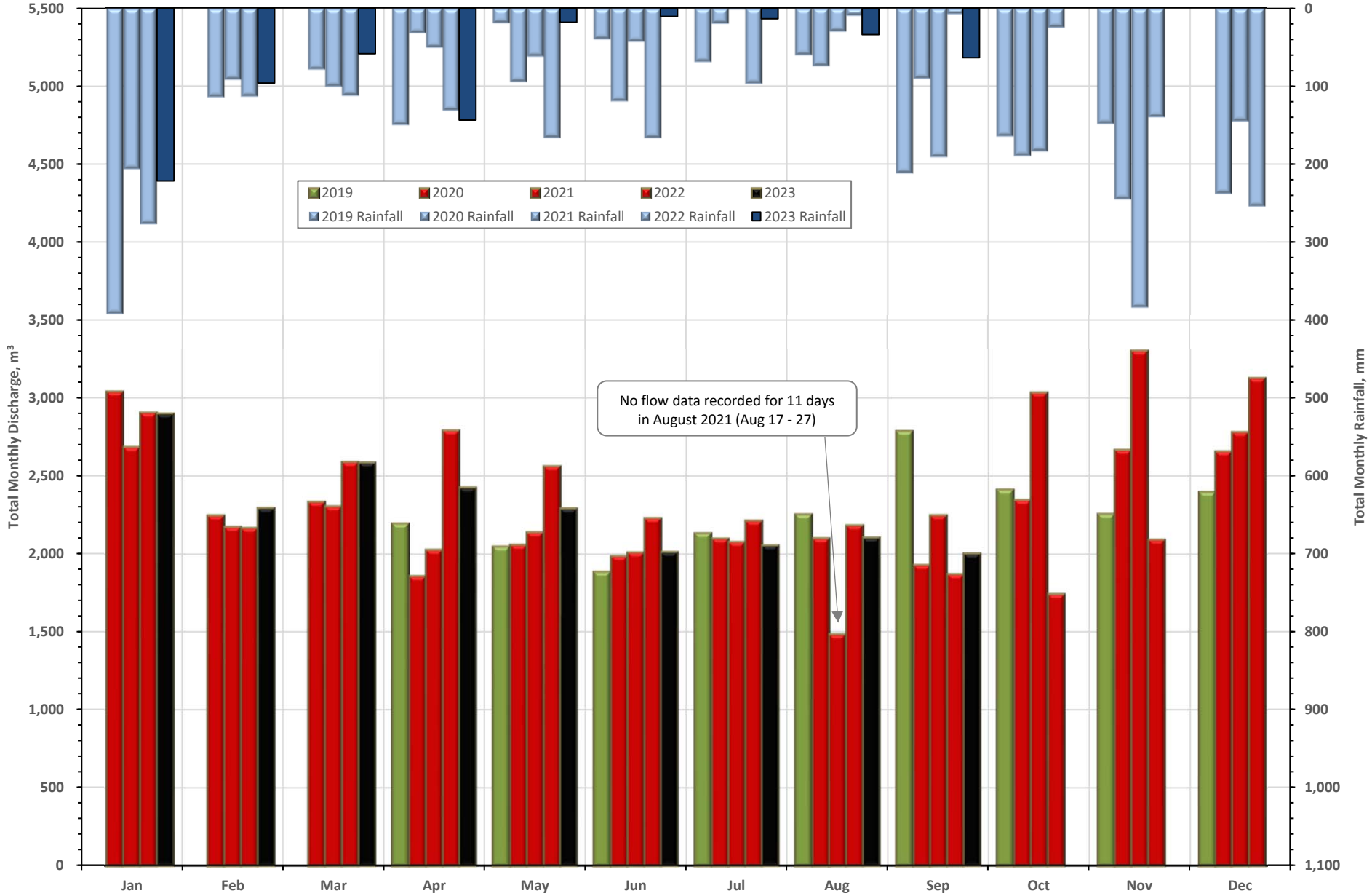

FIGURE 8

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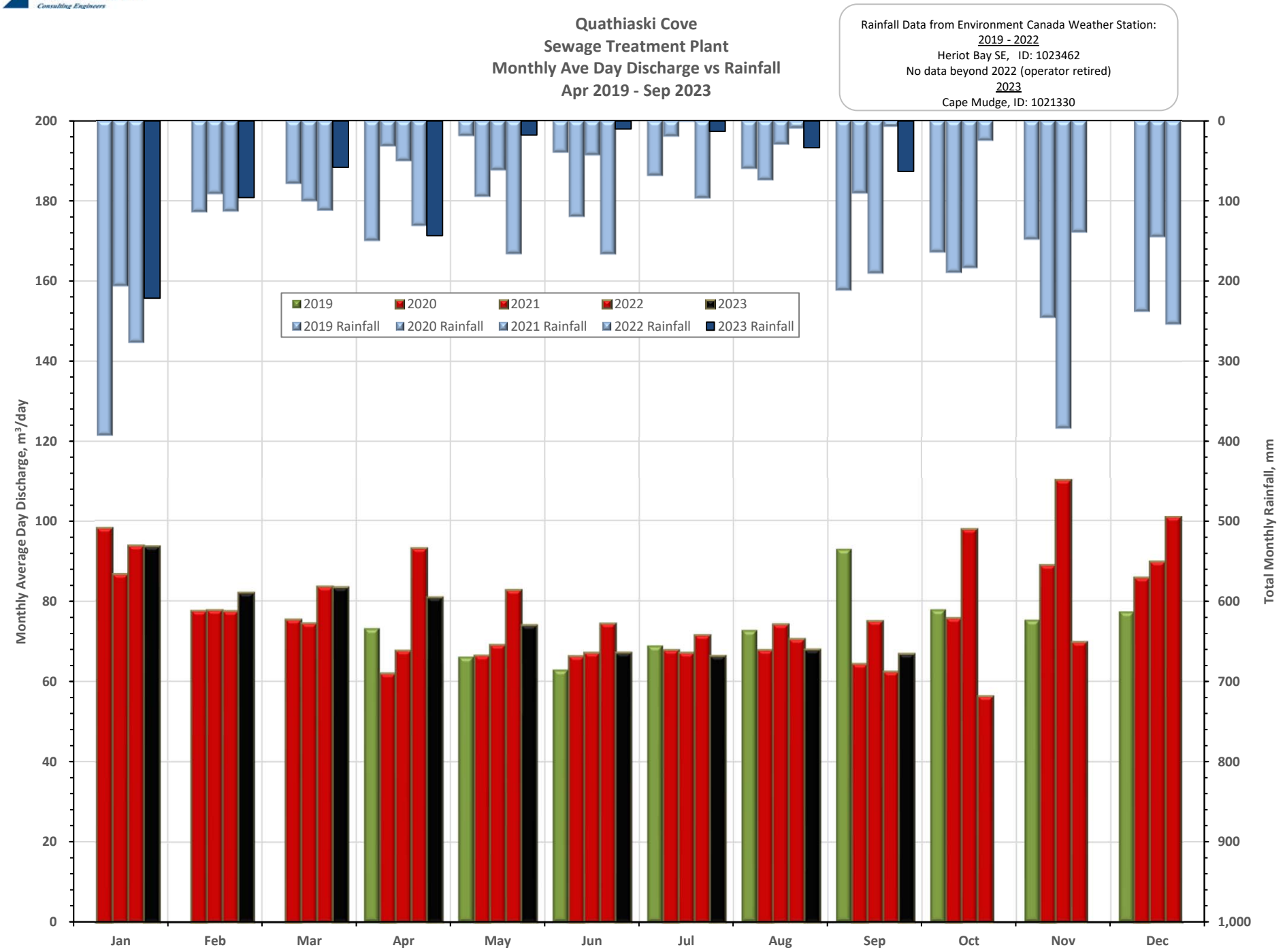

FIGURE 9

KOERS & ASSOCIATES ENGINEERING LTD.
Consulting Engineers

Quathiaski Cove
Sewage Treatment Plant
Daily Discharge Volume vs Rainfall
March 27, 2019 - Oct 26, 2023

Rainfall Data from Environment Canada Weather Station:
2019 - 2022
Heriot Bay SE, ID: 1023462
No data beyond 2022 (operator retired)
2023
Cape Mudge, ID: 1021330

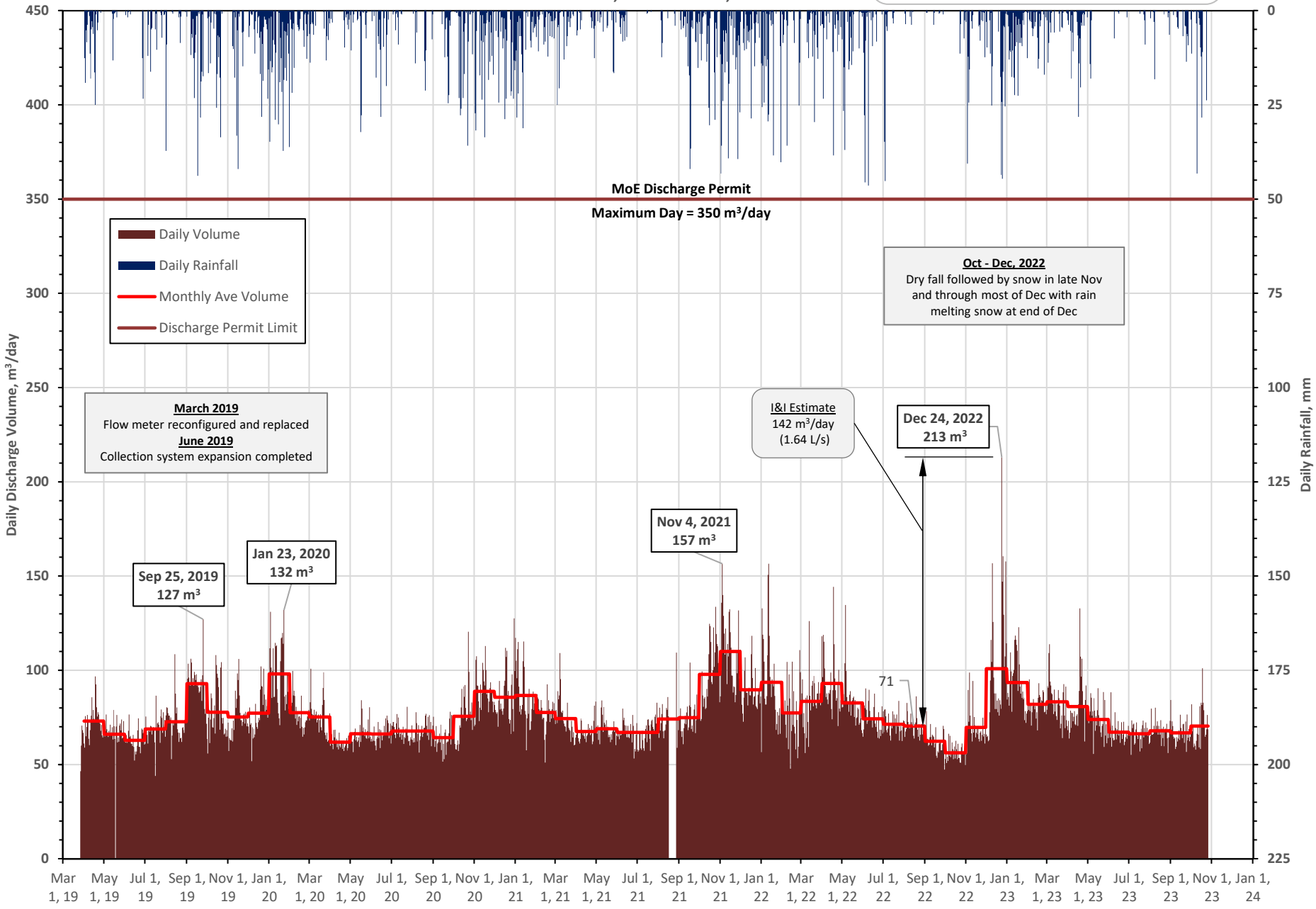

FIGURE 10

4.1.3 Dry Weather Unit Flow Rates, Per Capita & Per Lot

The average day dry weather sewage flow for past three years was converted into a per capita and per lot unit flow rate and are presented below in **Table 6**.

Table 6 – Existing Dry Weather Unit Flow Rates, Per Capita & Per Lot

Description		Recorded Flow m^3/day	Unit Flow Rate [1]	
			Per Capita L/day [2]	Per Lot L/day [3]
Average Day Dry Weather Flow				
- Year 2020:	April	62	220	445
- Year 2021:	June/July	67	240	480
- Year 2022:	October [4]	56	200	400
	3 Year Average:	62	220	400

Notes:

1 Rounded to nearest 5 L.

2 Based on an estimated permanent residential population of 281.

3 Based on 140 properties connected to the sewage collection system.

4 The months of August, September, and October were notably dry with very little rainfall. This was followed by snow in late November and the first have of December, which was then followed by eight days of rain (on snow) near the end of the month (Dec 22 - 29, 2022).

The calculated Dry Weather per capita flow rates in **Table 6** are similar to the MMCD Design Guidelines 2022 value of 240 lpcd which is the recommended value when there are no sanitary sewer flow records for properties that are also serviced by a new municipal universally metered water system. It is suspected that residents within the Quathiaski Cove Sewer Local Service Area are water conservation conscious in part because they obtain their water from their own individual, privately owned (and maintained) groundwater supply well located on (or near) their property.

4.1.4 Infiltration & Inflow

4.1.4.1 Infiltration & Inflow Definitions

Certain amounts of storm water infiltration and inflow (I&I) are unavoidable, but excessive amounts can cause hydraulic overloading, where parts of the sewer system (gravity mains, lift stations, forcemains) can reach their capacity prematurely, requiring large expenditures for capacity upgrading. Excessive storm water entering the sewer system also increases the loadings on the sewage treatment facility, using up unnecessary capacity and increasing operation and maintenance costs. The difference(s) between infiltration and inflow can be explained by the means that rainfall/groundwater enters the sewage collection system:

Infiltration: Groundwater that infiltrates into the sanitary sewer system.

Infiltration is mostly associated with the rainy season when the groundwater table rises. It can occur along the sewer main pipe or service connection piping and at manholes.

Infiltration can occur on pipes that suffer from cracks in the pipe wall (due to age, differential settlement, damage during or after construction) and at joints (due to improper installation/damage to pipe gasket during construction, intrusion of plant roots, deterioration/aging of the gasket).

Manholes are constructed of stacked concrete rings and infiltration can occur when joints separate due to uneven settlement, intrusion of roots between the joints, deterioration/aging of the gasket material between the rings, no gasketing between the rings, damage during construction, deterioration/aging of the concrete.

Inflow: Stormwater that flows directly into the sanitary sewer system.

Inflow can occur from the intentional or unintentional connection of drains (from building gutters, building perimeter drains, building basement floor drains, private and public property catchbasins) to the sanitary sewer system. These connections can be the result of a mistake when the sanitary sewer system is confused with the storm drain system, or illegally, without the District's knowledge or consent. Storm water can also enter sanitary sewer manhole lids that are in low lying locations or gutter areas of the roadway subject to flooding, and through lifting holes in the manhole lids.

During the summer months, I&I decreases as rainfall events become less frequent and the groundwater table drops. During the fall/winter months, I&I increases as rainfall events become more frequent and the groundwater table rises.

4.1.4.2 December 24, 2022

On December 24, 2022 a treated flow volume of 213 m^3 was recorded by the flow meter at the sewage treatment plant. This was the highest recorded daily volume since the flow meter was installed in March 2019 as shown in **Table 5** and **Figure 10**.

Climate Data Review

A review of available daily rainfall data from the three closest Environment Canada weather stations:

- Heriot Bay SE Climate ID: 1023462
- Cape Mudge Climate ID: 1021330
- Quinsam River Hatchery Climate ID: 1026639

Showed snow/rainfall did occur in advance of the December 24, 2022 high flow event but the daily recorded rainfall amount was similar to other rainfall events that recorded lower maximum day volumes in previous years. A closer review of the weather data, revealed:

- the months of August, September, and October were notably dry with very little rainfall, followed by,
- snow in late November and the first have of December, followed by
- a cold snap with continuous temperatures below zero (-3.5 to -6.0 ^oC) from December 18 thru 22) with snowfall on Dec 22, followed by
- snow and rainfall on Dec 23, followed by
- six days of rain from December 24 - 29, 2022.

For the three day period of Dec 22 – 24, 2022 the total precipitation recorded at the three weather stations was:

- Heriot Bay SE 85.4 mm
- Cape Mudge 61.4 mm
- Quinsam River Hatchery 77 mm

At each of these stations, more than ½ of the total precipitation (snow + rainfall) occurred on Dec 23rd.

Estimated I/I Volume

Of the 213 m^3 of flow volume recorded by the sewage treatment plant flow meter for December 24, 2022, it is estimated that up to 33% (71 m^3) was attributable to actual sewage flow. The remaining 67% (142 m^3) would therefore be attributed to I/I as shown in **Figure 10**.

Estimated I/I Unit Rate vs Design Standards

The Master Municipal Contract Documents (MMCD) publishes design guidelines standards (MMCD Design Guidelines 2022) for municipal infrastructure. The guideline includes a unit design standard for infiltration based on the service area and another based on the length and diameter of installed piping. The two standards were compared against the estimated I/I volume for December 24, 2022 event. The comparisons are presented in **Table 7**.

Table 7 – I/I Unit Rate, Dec 24, 2022 Estimate vs Design Standards

Description	Unit Rate I/I	
	L/day per ha	L/day per mm dia. per m length
Historical		
Dec 24, 2022	2,120 (1)	0.145 (2)
MMCD Design Guidelines 2022		
New system with pipes above groundwater table	11,200	0.108
Old system (≥ 25 yrs) and/or pipes below groundwater table	22,500	0.240

Notes:

1 Based on the 67 ha or catchment area serviced by the gravity collection system (see **Figure 3**). Only the gravity catchment area was used as it is assumed that I/I in the pressure system catchment area would be negligible because it is a pressure and not a gravity flow system.

2 Based on the gravity main collection system comprised of:

- 3,650 m of mains (3,567 m of 200 mm dia. and 83 m of 150 mm dia.), and
- 3,000 m of servicing connection piping (85 properties at an assumed average length of 30 m per connection of 100 mm dia. pipe).

Only the gravity catchment area was used as it is assumed that I/I in the pressure system catchment area would be negligible because it is a pressurized system and not a gravity flow system. If only the length of mains is used, a unit rate of 0.20 L/day per mm dia. per m of pipe length is calculated.

The unit rate I/I calculated on the per ha basis is notably lower than both MMCD Design Guidelines 2022 values. It is suspected that this reflects the larger (more rural) lots compared to a typical urban area where development is denser. For the gravity service area, the lot density averaged 2 lots per ha. This compares to a typical urban residential area density of 8 to 10 lots per ha.

The unit rate I/I calculated on a per mm diameter per m of pipe length falls between the MMCD Design Guidelines 2022 values for a new system vs an older system.

Suspected Reason/Source(s) for I/I

It is suspected the snow on the ground combined with frozen ground followed by rain on the snow were reasons for the high flow volume at the sewage treatment plant on December 24, 2022. It is theorized that the frozen ground reduced the amount of runoff that could infiltrate into the ground resulting instead in more than typical surface runoff. This could have resulted in a greater opportunity for the estimated I/I volume (142 m^3) to be more associated with Inflow than Infiltration with runoff entering the system through manhole lids adjacent to low lying areas where runoff would pond or manhole lids adjacent to drainage ditches flowing full or overflowing, such as perhaps along Harper Road and Plaza Road.

4.1.4.3 Dry vs Wet Weather Flow Comparison: Aug 13, Oct 10, & Dec 24, 2022

The recorded flow meter readings in approximately 1 minute intervals were downloaded and analyzed for dry vs wet weather flow. Three days in 2022 were reviewed:

- Aug 13, 2022 Summertime flow during the summer tourism season
- Oct 10, 2022 Dry fall flow, after summer tourism, school in session, before the beginning of the fall, winter rains
- Dec 24, 2022 Flow during rain on snow

The recorded flow data for each is graphically shown in **Figure 11**.

The data shows that for both Aug 13 and Oct 10, there were periods of flows through the treatment plant followed by periods of no flow. This "plug" flow would correspond to the operation of the pumps in the primary clarifier, with flow occurring when the pumps were on, and no flow occurring after the pumps had shut off and the primary clarifier was refilling. For August 13 flow through the treatment plant was recorded for a combined total of 12.25 hours. For October 10, it was 9.5 hours.

On December 24, there was continuous flow through the treatment plant, with a more than doubling of the flow for a continuous period of six hours. This indicates that more than one pump in the primary clarifier would have been operating. Furthermore, flow through the treatment plant did not stop until the evening of December 31, after 180 hours of continuous operation.

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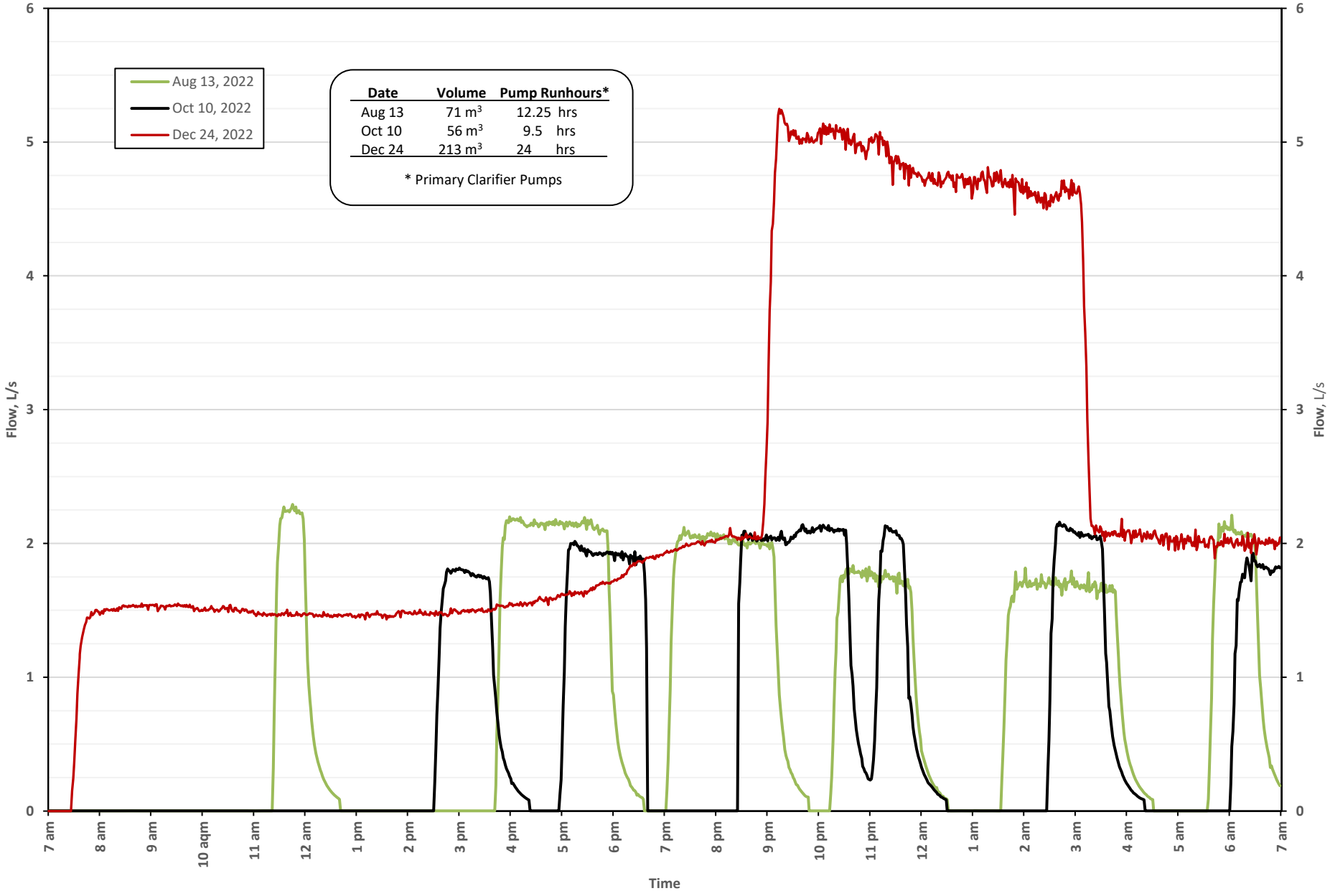
Sewage Treatment Plant
Daily Discharge Comparison
Aug 13, Oct 10, Dec 24, 2022



Date	Volume	Pump Runhours*
Aug 13	71 m^3	12.25 hrs
Oct 10	56 m^3	9.5 hrs
Dec 24	213 m^3	24 hrs

* Primary Clarifier Pumps

FIGURE 11

5 COLLECTION SYSTEM MODEL DEVELOPMENT

Two computer models were developed:

- Existing Conditions
- Future Conditions – All properties within the Quathiaski Cove Sanitary Local Service Area connected to the sewerage system.

5.1 Existing Conditions

A model (Excel spreadsheet) of the existing sanitary sewer collection system was developed as follows:

Collection System, Catchment Areas, Land-Use

1. Pipe lengths, diameters, slopes and manhole locations were obtained from Record Drawings.
2. Manholes were numbered and entered into an Excel spreadsheet along with pipe information between each manhole.
3. Properties connected to the collection system were identified by the SRD (the location of these properties is shown in **Figure 1**), and the areas added into the Excel spreadsheet based on the section of the collection system they are connected to.
4. The size and zoning (land-use) of each property connected to the collection system was obtained from the SRD's on-line GIS program UMapIt and added into the Excel spreadsheet.
5. The number of dwelling units for each property was established by one or more of following approaches:
    - Reported actual land-use on UMapIt
    - UMapIt aerial photograph, Google Maps photographs, Google Streetview
    - Personal knowledge/familiarity with the area
    - Internet search:
        i) Quadra Island Housing Society's Seniors Village, 16 units, 688 Harper Rd
        ii) The High Point Resort, 24 rooms, 725 Quathiaski Cove Rd

Population Density, Unit Flows, Peaking Factor, I/I Allowance

6. A population density of 1.95 capita/dwelling unit was applied.
7. For non-residential zonings, the following equivalent population density were applied:
    - Commercial zoning: 5 capita/ha
    - Industrial zoning: 5 capita/ha
    - Institution zoning: 10 capita/ha

    While these values are significantly lower than the design values (75, 90 and 50 capita/ha; respectively) in the MMCD Design Guidelines, 2022, they are believed to be more reflective of the actual types of land-use on Quadra and that properties have individual wells and are not connected to a municipal water system.
8. A per capita average day dry weather unit flow rate of 220 L/ capita per day (lpcd) was applied (see **Table 6**).

9. The Harmon formula was applied to calculate peak day dry weather flow (MMCD Design Guidelines, 2022).

10. An I/I allowance of 0.20 L/day per mm dia. per m of gravity main piping was applied (see **Table 7** and note 2).

The layout of the existing collection system is shown on **Drawing No. 1924-231-01**.

5.2 Future Conditions

A model (Excel spreadsheet) of a conceptual future sanitary sewer collection system was developed by expanding the existing collection system to service all properties within the Quathiaski Cove Sewer Local Service Area as follows:

Collection System, Catchment Areas, Land-Use

11. Properties fronting the existing collection system that are not yet connected were identified and added into the Excel spreadsheet based on the section of the collection system they are connected to.

12. For properties for which there is presently no sewer collection system fronting it, the collection system was extended. Gravity mains were conceptually extended based on ground elevation contours where possible and assigned a minimum slope of 0.5%. Where gravity main extension was not feasible, i.e., along Harbourbrook Road, north of Anderson Rd, a conceptual pressure main system was used.

13. The size and zoning (land-use) of each property was obtained from the SRD's on-line GIS program UMapIt and added into the Excel spreadsheet.

Number of Residential Dwelling Units

14. For all residential zoned properties, the minimum allowable lot size was compared to the actual lot size and where subdivision was possible, the number of potential residential lots was determined (lot size ÷ minimum lot size).

Population Density, Unit Flows, Peaking Factor, I/I Allowance

15. The same values and peaking factor formula for the existing conditions model were used.

The conceptual layout of the future collection system number of future dwelling units allowed for the properties yet to be connected to the system are shown on **Drawing No. 1924-231-02**.

A summary of the recorded dry and wet weather flows at the sewage treatment plant along with calculated design dry and wet weather flows for the existing and future conditions models is presented in **Table 8** along with the total service area, number of lots connected, estimated number of dwelling units and permanent population.

Table 8 – Sewage Flow Summary: Existing and Future Conditions Model

Description	Total Service Area ha	Number of		Permanent Population Estimate	Dry Weather		I/I Allowance		Wet Weather	
		Lots Connected	Dwelling Units		Average Day m^3/day	Peak Hour L/s	m^3/day	L/s	Average Day m^3/day	Peak Hour L/s
Existing Conditions										
- flow meter	120	134	144	281	71 (1)	> 2.2 (2)	142	1.6	213 (3)	> 5.2 (3)
- modelled	120	134	144	281	90	4.2	144	1.7	234	5.9
Future Conditions (All properties within service area are connected and current zoning land-use applied)										
- modelled	208	263	262	550	155	7	255	2.9	410	9.9

Notes:

1 Average day dry weather of 71 m^3/day was recorded for the months of July and August 2022. The increase in tourism during the during the summer month would be captured in the recorded flows and is believed to be more reflective of typical dry weather flows compared to flows recorded in September which are typically lower and before the onset of the fall/winter rains.

2 Recorded on August 13, 2022. A review of the recorded instantaneous flow data of the flow meter (located at the outlet of the sewage treatment plant) can be used to determine when the primary clarifier pumps were operating; how long they operated; as well as infer if one or more pumps were operating and what the pumping rate was. The data shows a peak flow of ±2.2 L/s which corresponds to one pump operating (in the primary clarifier). The peak flow entering the sewage treatment plant is suspected to have been higher than this as the storage volume in the primary clarifier, the RBC unit, and the secondary clarifier would provide some attenuation of the peak flow recorded at the flow meter.

3 Recorded on December 24, 2022. A review of the recorded instantaneous flow data of the flow meter (located at the outlet of the sewage treatment plant) can be used to determine when the primary clarifier pumps were operating; how long they operated; as well as infer if one or more pumps were operating and what the pumping rate was. The data shows a peak flow of 5.2 L/s which would require more than one pump operating in the primary clarifier. The peak flow entering the sewage treatment plant is suspected to be higher than this as the storage volume in the primary clarifier, the RBC unit, and the secondary clarifier would provide some attenuation of the peak flow recorded at the flow meter.

4 The difference between the authorized discharger permit (350 m^3/day) and the December 24, 2022 recorded flow (213

The difference between the discharge permit limit (350 m^3/day) and the highest wet weather flow recorded to date (213 m^3/day on Dec 24, 2022) was 137 m^3/day. Based on the calcuated average day dry weather flow of 0.53 m/^{3}day per lot (71 m^3/day ÷ 134 connected lots), the volume of 137 m^3/day equates to the projected flow from an 258 additional lots (137 m^3/day ÷ 0.53 m^3/day per connection = 258 lots) within the existing collection system serviced area (120 ha).

6 CAPACITY REVIEW

6.1 Collection System

6.1.1 Existing Conditions

The calculated existing conditions average day and peak hour design flows for each section of gravity main in the collection system is presented in **Table 9**.

With regards to the conveyance capacity, the calculations indicate that:

- All gravity mains have sufficient capacity to convey the peak hour flows.
- The vast majority of the mains are shown to flow less than 5% full.
- Only mains with a slope of 1.0% or less are shown to flow more than 10% full.
- The section of main calculated to have the greatest depth of flows, was the 85 m section of gravity main that crosses Pidcock Creek and discharges into the sewage treatment plant (primary clarifier). This section was calculated to flow between 20% to 25% full.

6.1.2 Future Conditions

The calculated future conditions average day and peak hour flows for each section of gravity main in the future collection system is presented in **Table 10**.

The calculations indicate that:

- All gravity mains have sufficient capacity to convey the peak hour flows.
- The vast majority of the mains are shown to flow less than 5% full.
- Only mains with a slope of 1.0% or less are shown to flow more than 10% full.
- The section of main calculated to have the greatest depth of flow, was the 85 m section of gravity main that crosses Pidcock Creek and discharges into the sewage treatment plant (primary clarifier). This section was calculated to flow between 36% to 42% full.

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Table 9
Sanitary Sewer Collection System Sewage Flows - EXISTING CONDITIONS
QUATHIASKI COVE

Land-Use Population Density

Land-Use	Value	Unit	Land-Use	Value	Unit
SF Res.	1.95	capita/lot	Comm.	5	capita/ha
MF Res.	1.95	capita/unit	Indust.	5	capita/ha
			Institut.	10	capital/ha

Unit Design Flow

Description	Value	Unit
Daily Average Flow	220	l/capita per day
I/I Allowance	0.20	l/ mm dia per m length/day

Peaking Factor Equation (Harmon)

$$PF = 1 + \frac{14}{4 + \sqrt{P}}$$

Where:
P = Population (in 1,000s)

Pipe Sizing Design Parameters

Description	Value	Unit	Comments
Manning's N	0.013		
Minimum Vel.	0.6	m/s	Gravity sewers
	0.75	m/s	Forcemains

Date: Oct 27, 2023
File: 1924-231

SMH No.		Catchment Area, not including road allowances (ha)							No. of Dwelling Units		Total No. of Dev. Lots	Service Population							Peaking Factor	Dry Weather Flow		I&I Allowance		Wet Weather Flow		Existing Pipe Characteristics						
							Total										Total			Ave Day	Peak Hr	Ind.	Cum.	Ave Day	Peak Hr	Length	Dia.	Slope	Capacity	%	Vel.	50% Full
Up	Down	SF	MF	Com	Ind	Instit.	Ind.	Cum.	SF Lots	MF Units		SF	MF	Com	Ind	Instit	Ind.	Cum.		m^3/day	L/s	m^3/day	m^3/day	m^3/day	L/s	m	mm	%	L/s	Full	m/s	m/s
Heriot Bay Rd																																
20	vd	0.9					0.9	0.9	2		2	3.9					3.9	3.9	4.45	1	0.04	2	2	3	0.1	51.6	200	11.0%	109	0.1%		3.5
vd	19	0.4					0.4	1.3	1		1	2.0					2.0	5.9	4.43	1	0.1	3	5	6	0.1	69.3	200	8.3%	94	0.1%		3.0
19	18	0.5					0.5	1.8	1		1	2.0					2.0	7.8	4.42	2	0.1	4	9	10	0.2	93.9	200	8.8%	97	0.2%		3.1
	Sarah Rd																															
21	18	0.1					0.1	0.1	1		1	2.0					2.0	2.0	4.46	0.4	0.02	2	2	3	0.05	54.2	200	9.6%	102	0.0%		3.2
Heriot Bay Rd																																
18	17							2.0										9.8	4.42	2	0.1	0	11	13	0.2	6.0	200	6.9%	86	0.3%		2.7
17	16							2.0										9.8	4.42	2	0.1	1	11	14	0.2	13.5	200	6.5%	84	0.3%		2.7
16	15	0.1					0.1	2.1	1		1	2.0					2.0	11.7	4.41	3	0.1	3	14	17	0.3	66.9	200	8.80%	97	0.3%		3.1
15	vd	1.9					1.9	4.0	4		4	7.8					7.8	19.5	4.38	4	0.2	2	16	20	0.4	48.4	200	11.7%	112	0.4%		3.6
vd	14	2.2		0.4			2.6	6.6	4		4	7.8		2.1			9.9	29.4	4.36	6	0.3	2	18	25	0.5	61.0	200	8.65%	96	0.6%		3.1
	West Rd																															
22	vd	0.8					0.8	0.8	1		1	2.0					2.0	2.0	4.46	0.4	0.02	1	1	2	0.0	32.2	200	8.5%	95	0.0%		3.0
vd	14			0.4			0.4	1.2	2		2	3.9		1.9			5.8	7.8	4.42	2	0.1	3	5	6	0.1	85.0	200	6.7%	85	0.2%		2.7
Heriot Bay Rd																																
14	13							7.8										37.1	4.34	8	0.4	2	25	33	0.7	53.6	200	2.6%	53	1.3%		1.7
Jewel Rd																																
13	12	0.3					0.3	8.1	2		2	3.9					3.9	41.0	4.33	9	0.5	2	28	37	0.8	60.7	200	2.4%	51	1.5%		1.6
Sideyard SRW (Jewel Rd to Harper Rd)																																
12	11			0.9			0.9	9.0	1		2	2.0		4.4			6.4	47.4	4.32	10	0.5	6	33	44	0.9	142.3	200	0.5%	23	4.0%		0.7
	Anderson Rd																															
26	25	1.0					1.0	1.0	3		3	5.9					5.9	5.9	4.43	1	0.1	6	6	7	0.1	146.8	200	4.8%	72	0.2%		2.3
25	24							1.0										5.9	4.43	1	0.1	2	7	9	0.2	38.6	200	2.1%	48	0.3%		1.5
	Quadra El SRW (Anderson Rd to Harper Rd)																															
24	vd							1.0										5.9	4.43	1	0.1	0	8	9	0.2	12.4	200	1.9%	45	0.3%		1.4
vd	23							1.0										5.9	4.43	1	0.1	2	10	11	0.2	56.5	200	7.11%	87	0.2%		2.8
23	vd				3.9		3.9	4.9			2				39.3		39.3	45.2	4.32	10	0.5	1	11	21	0.6	30.0	200	4.3%	68	0.9%		2.2
vd	11							4.9										45.2	4.32	10	0.5	3	14	24	0.7	77.0	200	4.0%	65	1.0%		2.1
Harper Rd																																
11	10			1.0			1.0	14.9			1			5.1			5.1	97.6	4.25	21	1.1	3	51	73	1.6	87.5	200	3.2%	59	2.8%		1.9
	Rearyard SRW (714 Green Rd to Harper Rd)																															
27	vd	1.4		0.4			1.7	1.7	6		7	11.7		1.8			13.5	13.5	4.40	3	0.2	2	2	5	0.2	61.8	150	2.2%	22	0.8%		1.3
vd	10							1.7										13.5	4.40	3	0.2	1	2	5	0.2	21.6	150	0.6%	12	1.5%		0.7
Harper Rd																																
10	9	2.3					2.3	18.9	3		3	5.9					5.9	116.9	4.22	26	1.3	6	60	85	1.9	148.0	200	1.7%	43	4.6%		1.4
9	8	0.8	1.0	0.2			2.0	20.9	2	16	4	3.9	31.2	1.1			36.2	153.1	4.19	34	1.6	6	66	100	2.4	161.0	200	0.7%	27	8.7%		0.9
	Nole Rd																															
37	36	6.2					6.2	6.2	4		4	7.8					7.8	7.8	4.42	2	0.1	5	5	7	0.1	123.4	200	7.9%	92	0.2%		2.9
	Sideyard SRW (Nole Rd to Plaza Rd)																															
36	35							6.2										7.8	4.42	2	0.1	1	6	8	0.2	31.9	200	22.6%	156	0.1%		5.0
35	34							6.2										7.8	4.42	2	0.1	2	8	10	0.2	53.6	200	14.3%	124	0.1%		3.9
34	33							6.2										7.8	4.42	2	0.1	4	12	14	0.2	94.8	200	8.3%	94	0.2%		3.0
	Citizen Rd																															
40	39	1.5					1.5	1.5	3		3	5.9					5.9	5.9	4.43	1	0.1	4	4	5	0.1	97.0	200	7.7%	91	0.1%		2.9
39	38							1.5										5.9	4.43	1	0.1	3	7	8	0.1	76.6	200	8.8%	97	0.2%		3.1
	Plaza Rd																															
38	33							1.5										5.9	4.43	1	0.1	2	9	10	0.2	42.9	200	1.19%	36	0.5%		1.1
33	32	1.1					1.1	8.7	2		2	3.9					3.9	17.6	4.39	4	0.2	3	24	28	0.5	73.9	200	2.0%	47	1.0%		1.5
32	vd	0.4					0.4	9.1	1		1	2.0					2.0	19.5	4.38	4	0.2	5	28	33	0.5	116.1	200	5.7%	78	0.7%		2.5
vd	31							9.1										19.5	4.38	4	0.2	1	29	33	0.6	18.0	200	4.0%	66	0.8%		2.1

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Table 9
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QUATHIASKI COVE

Land-Use Population Density

Land-Use	Value	Unit	Land-Use	Value	Unit
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MF Res.	1.95	capita/unit	Indust.	5	capita/ha
			Institut.	10	capital/ha

Unit Design Flow

Description	Value	Unit
Daily Average Flow	220	l/capita per day
I/I Allowance	0.20	l/ mm dia per m length/day

Peaking Factor Equation (Harmon)

$$PF = 1 + \frac{14}{4 + \sqrt{P}}$$

Where:
P = Population (in 1,000s)

Pipe Sizing Design Parameters

Description	Value	Unit	Comments
Manning's N	0.013		
Minimum Vel.	0.6	m/s	Gravity sewers
	0.75	m/s	Forcemains

Date: Oct 27, 2023
File: 1924-231

SMH No.		Catchment Area, not including road allowances (ha)							No. of Dwelling Units		Total No. of	Service Population							Peaking	Dry Weather Flow		I&I Allowance		Wet Weather Flow		Existing Pipe Characteristics						
							Total										Total			Ave Day	Peak Hr	Ind.	Cum.	Ave Day	Peak Hr	Length	Dia.	Slope	Capacity	%	Vel.	50% Full
Up	Down	SF	MF	Com	Ind	Instit.	Ind.	Cum.	SF Lots	MF Units	Dev. Lots	SF	MF	Com	Ind	Instit	Ind.	Cum.	Factor	m^3/day	L/s	m^3/day	m^3/day	m^3/day	L/s	m	mm	%	L/s	Full	m/s	m/s
	O'Connor Rd																														
42	41	1.6					1.6	1.6	3	4	3	5.9	7.8				13.7	13.7	4.40	3	0.2	3	3	6	0.2	64.0	200	0.5%	23	0.8%		0.7
41	31	1.2					1.2	2.8	3		3	5.9					5.9	19.5	4.38	4	0.2	4	6	11	0.3	93.8	200	0.5%	23	1.3%		0.7
	Plaza Rd																														
31	30	4.2					4.2	16.1	2		2	3.9					3.9	42.9	4.33	9	0.5	2	38	47	0.9	57.4	200	4.0%	66	1.4%		2.1
30	29	0.4		0.6			1.0	17.1	1		1	2.0		2.9			4.9	47.8	4.32	11	0.5	3	40	51	1.0	70.0	200	2.2%	49	2.0%		1.5
29	28			1.0			1.0	18.1			2.5			4.9			4.9	52.7	4.31	12	0.6	2	42	54	1.1	45.7	200	2.4%	51	2.1%		1.6
28	8							39.0										205.7	4.14	45	2.2	1	43	88	2.7	21.0	200	3.8%	64	4.2%		2.0
Harper Rd																															
8	7	0.6		0.3			0.9	39.9	2		2.5	3.9		1.5			5.4	211.1	4.14	46	2.2	5	114	160	3.5	121.0	200	0.4%	21	**17.1%**		0.7
7	6			0.6			0.6	40.5			1			3.1			3.1	214.2	4.14	47	2.3	4	118	165	3.6	97.0	200	0.4%	19	**18.7%**		0.6
Cooper Rd																															
6	5			1.0			1.0	41.5			1			5.0			5.0	219.2	4.13	48	2.3	3	121	169	3.7	73.0	200	1.0%	32	11.5%		1.0
5	4							41.5										219.2	4.13	48	2.3	3	124	172	3.7	76.5	200	3.7%	63	5.9%		2.0
	Pidcock Rd																														
forcemain	46	0.9					0.9	0.9	9		9	17.6					17.6	17.6	4.39	4	0.2			4	0.2		100					
	Green Rd																														
46	45	1.2					1.2	2.1	7		7	13.7					13.7	31.2	4.35	7	0.3	2	2	9	0.4	60.9	200	4.1%	66	0.6%		2.1
45	44	1.3					1.3	3.4	4		4	7.8					7.8	39.0	4.34	9	0.4	6	8	17	0.5	140.0	200	2.3%	50	1.1%		1.6
44	43	0.9					0.9	4.3	3		3	5.9					5.9	44.9	4.32	10	0.5	5	13	23	0.6	119.3	200	3.9%	65	1.0%		2.1
43	4	0.4			0.8	0.3	1.5	5.8	1		3	2.0			3.8	3.3	9.0	53.9	4.31	12	0.6	3	15	27	0.8	63.2	200	1.4%	39	2.0%		1.2
Green Rd																															
4	3							47.3										273.0	4.10	60	2.8	2	141	201	4.5	54.5	200	3.1%	57	7.8%		1.8
To STP																															
3	2	0.3					0.3	47.6	4		4	7.8					7.8	280.8	4.09	62	2.9	2	143	205	4.6	48.7	200	0.5%	23	**19.8%**		0.7
2	1							47.6										280.8	4.09	62	2.9	1	144	206	4.6	34.0	200	0.5%	23	**19.8%**		0.7
	Quathiaski Cove Rd (foreshore pump station forcemain to STP)																														
PS	1	0.4	0.7	0.9			1.9	1.9	1		3	2.0		48.0			50.0	50.0	4.31	11	0.5		144	155	2.2							
	Helanton Rd & Colter Rd forcemain to STP																														
homes	1	10.6					10.6	10.6	16		16	31.2					31.2	31.2	4.35	7	0.3		144	151	2.0							
	Strata forcemain to STP																														
homes	1	9.6					9.6	9.6	24		24	46.8					46.8	46.8	4.32	10	0.5		144	155	2.2							
To STP																															
1	STP							69.7										408.8	4.02	90	4.2	0	144	234	5.9	2.0	200	0.5%	23	**25.3%**		0.7
	Totals:	55.4	1.7	7.6	0.8	4.3	69.7		124	20	140	241.8	39.0	81.6	3.8	42.6	408.8		4.02	90	4.2	144	144	234	5.9	3,650	**Totals**					
						Check:	69.7			144			281			Check:	408.8						1.67									

Notes:

1 SMH No. with "vd" indicates a Vertical Deflection in the pipe as reported on the design/record drawings. There is no manhole at this location.

2 Pipe diameters and slopes based on information on design/record drawings by others.

KOERS & ASSOCIATES ENGINEERING LTD.

Table 10
Sanitary Sewer Collection System Sewage Flows - FUTURE CONDITIONS
(All properties connected, Existing Zoning Land-use)
QUATHIASKI COVE

Land-Use Population Density

Land-Use	Value	Unit
SF Res.	1.95	capita/lot
MF Res.	1.95	capita/unit

Land-Use	Value	Unit
Comm.	5	capita/ha
Indust.	5	capita/ha
Institut.	10	capital/ha

Unit Design Flow

Description	Value	Unit
Daily Average Flow	220	l/capita per day
I/I Allowance	0.20	l/ mm dia. per m length/day

Peaking Factor Equation (Harmon)

$$PF = 1 + \frac{14}{4 + \sqrt{P}}$$

Where:
P = Population (in 1,000s)

Pipe Sizing Design Parameters

Description	Value	Unit	Comments
Manning's N	0.013		
Minimum Vel.	0.6	m/s	Gravity sewers
	0.75	m/s	Forcemains

Date: Oct 27, 2023
File: 1924-231

SMH No.		Catchment Arment Area (ha)									No. of Dwelling Units			Total No. of Dev. Lots		Service Population							Peaking	Dry Weather Flow		I&I Allowance		Wet Weather Flow		Existing Pipe Characteristics						
		SF			Com				Total		SF Lots		MF								Total			Ave Day	Peak Hr	Ind.	Cum.	Ave Day	Peak Hr	Length	Dia.	Slope	Capacity	%	Vel.	50% Full
Up	Down	Exist	Future	MF	Exist	Future	Ind	Instit.	Ind.	Cum.	Exist	Ftre	Units	Exist	Ftre	SF	MF	Com	Ind	Instit	Ind.	Cum.	Factor	m^3/day	L/s	m^3/day	m^3/day	m^3/day	L/s	m	mm	%	L/s	Full	m/s	m/s
Heriot Bay Rd																																				
20	vd	0.9	0.4						1.3	1.3	2	1		2	1	5.9					5.9	5.9	4.43	1	0.1	2	2	3	0.1	51.6	200	11.0%	109	0.1%		3.5
vd	19	0.4	0.5						0.9	2.3	1	1		1	1	3.9					3.9	9.8	4.42	2	0.1	3	5	7	0.2	69.3	200	8.3%	94	0.2%		3.0
19	18	0.5							0.5	2.7	1			1		2.0					2.0	11.7	4.41	3	0.1	4	9	11	0.2	93.9	200	8.8%	97	0.2%		3.1
	Sarah Rd																																			
21	18	0.1	0.4						0.6	0.6	1	3		1	3	7.8					7.8	7.8	4.42	2	0.1	2	2	4	0.1	54.2	200	9.6%	102	0.1%		3.2
Heriot Bay Rd																																				
18	17									3.3												19.5	4.38	4	0.2	0	11	15	0.3	6.0	200	6.9%	86	0.4%		2.7
17	16									3.3												19.5	4.38	4	0.2	1	11	16	0.4	13.5	200	6.5%	84	0.4%		2.7
16	15	0.1							0.1	3.4	1			1		2.0					2.0	21.5	4.38	5	0.2	3	14	19	0.4	66.9	200	8.80%	97	0.4%		3.1
15	vd	1.9							1.9	5.3	4			4		7.8					7.8	29.3	4.36	6	0.3	2	16	23	0.5	48.4	200	11.7%	112	0.5%		3.6
vd	14	2.2			0.4				2.6	8.0	4			4		7.8		2.1			9.9	39.1	4.34	9	0.4	2	18	27	0.6	61.0	200	8.65%	96	0.7%		3.1
	West Rd																																			
22	vd	0.8	0.3			0.2			1.2	1.2	1	1		1	1	3.9		0.8			4.7	4.7	4.44	1	0.1	1	1	2	0.1	32.2	200	8.5%	95	0.1%		3.0
vd	14				0.4				0.4	1.6	2			2		3.9		1.9			5.8	10.5	4.41	2	0.1	3	5	7	0.2	85.0	200	6.7%	85	0.2%		2.7
Heriot Bay Rd																																				
14	13									9.6												49.6	4.32	11	0.5	2	25	36	0.8	53.6	200	2.6%	53	1.6%		1.7
Jewel Rd																																				
13	12	0.3							0.3	9.8	2			2		3.9					3.9	53.5	4.31	12	0.6	2	28	39	0.9	60.7	200	2.4%	51	1.8%		1.6
Sideyard SRW (Jewel Rd to Harper Rd)																																				
12	11				0.9				0.9	10.7	1			2		2.0		4.4			6.4	59.8	4.30	13	0.7	6	33	47	1.0	142.3	200	0.5%	23	4.5%		0.7
	Harbourbrook Rd																																			
forcemain	401		29.8						29.8	29.8		14			14	27.3					27.3	27.3	4.36	6	0.3											
	Anderson Rd																																			
401	26		11.2						11.2	11.2		5			5	9.8					9.8	37.1	4.34	8	0.4	12	12	20	0.5	300	200	0.5%	23	2.4%		0.7
26	25	1.0	0.6						1.57	12.8	3	2		3	2	9.8					9.8	46.8	4.32	10	0.5	6	18	28	0.7	146.8	200	4.8%	72	1.0%		2.3
501	502		21.2						21.2	21.2		12			12	23.4					23.4	23.4	4.37	5	0.3	24	24	29	0.5	600	200	0.5%	23	2.3%		0.7
502	25									21.2												23.4	4.37	5	0.3	8	32	37	0.6	200	200	0.5%	23	2.7%		0.7
25	24		0.5						0.5	34.5		2			2	3.9					3.9	74.1	4.28	16	0.8	2	51	67	1.4	38.6	200	2.1%	48	2.9%		1.5
	Quadra El SRW (Anderson Rd to Harper Rd)																																			
24	vd									34.5												74.1	4.28	16	0.8	0	52	68	1.4	12.4	200	1.9%	45	3.1%		1.4
vd	23									34.5												74.1	4.28	16	0.8	2	54	70	1.4	56.5	200	7.11%	87	1.6%		2.8
23	vd							3.9	3.9	38.5				2						39.3	39.3	113.4	4.23	25	1.2	1	55	80	1.9	30.0	200	4.3%	68	2.7%		2.2
vd	11									38.5												113.4	4.23	25	1.2	3	58	83	1.9	77.0	200	4.0%	65	2.9%		2.1
Harper Rd																																				
11	10					1.0			1.0	50.2				1				5.1			5.1	178.3	4.17	39	1.9	3	95	134	3.0	87.5	200	3.2%	59	5.1%		1.9
	Rearyard SRW (714 Green Rd to Harper Rd)																																			
27	vd	1.4			0.4				1.7	1.7	6			7		11.7		1.8			13.5	13.5	4.40	3	0.2	2	2	5	0.2	61.8	150	2.2%	22	0.8%		1.3
vd	10									1.7												13.5	4.40	3	0.2	1	2	5	0.2	21.6	150	0.6%	12	1.5%		0.7
Harper Rd																																				
10	9	2.3	2.0						4.2	56.1	3	4		3	4	13.7					13.7	205.4	4.14	45	2.2	6	103	149	3.4	148.0	200	1.7%	43	7.9%		1.4
9	8	0.8		1.0	0.2				2.0	58.2	2		16	4		3.9	31.2	1.1			36.2	241.6	4.12	53	2.5	6	110	163	3.8	161.0	200	0.7%	27	13.9%		0.9
	Nole Rd																																			
37	36	6.2							6.2	6.2	4			4		7.8					7.8	7.8	4.42	2	0.1	5	5	7	0.1	123.4	200	7.9%	92	0.2%		2.9
	Sideyard SRW (Nole Rd to Plaza Rd)																																			
36	35									6.2												7.8	4.42	2	0.1	1	6	8	0.2	31.9	200	22.6%	156	0.1%		5.0
35	34		0.4						0.4	6.5		1			1	2.0					2.0	9.8	4.42	2	0.1	2	8	10	0.2	53.6	200	14.3%	124	0.2%		3.9
34	33									6.5												9.8	4.42	2	0.1	4	12	14	0.2	94.8	200	8.3%	94	0.3%		3.0
	Citizen Rd																																			
40	39	1.5							1.5	1.5	3	1		3	1	7.8					7.8	7.8	4.42	2	0.1	4	4	6	0.1	97.0	200	7.7%	91	0.1%		2.9
39	38		1.2						1.2	2.7		2			2	3.9					3.9	11.7	4.41	3	0.1	3	7	9	0.2	76.6	200	8.8%	97	0.2%		3.1
	Plaza Rd																																			
301	302		2.4						2.4	2.4		6			6	11.7					11.7	11.7	4.41	3	0.1	3	3	6	0.2	75	200	0.50%	23	0.7%		0.7
302	303									2.4												11.7	4.41	3	0.1	4	7	10	0.2	100	200	0.50%	23	0.9%		0.7
303	38									2.4												11.7	4.41	3	0.1	4	11	14	0.3	100	200	0.50%	23	1.1%		0.7
38	33									5.1												23.4	4.37	5	0.3	2	20	25	0.5	42.9	200	1.19%	36	1.4%		1.1
33	32	1.1							1.1	12.7	2			2		3.9					3.9	37.1	4.34	8	0.4	3	35	43	0.8	73.9	200	2.0%	47	1.7%		1.5
32	vd	0.4							0.4	13.1	1			1		2.0					2.0	39.0	4.34	9	0.4	5	39	48	0.9	116.1	200	5.7%	78	1.1%		2.5
vd	31									13.1												39.0	4.34	9	0.4	1	40	49	0.9	18.0	200	4.0%	66	1.4%		2.1

KOERS & ASSOCIATES ENGINEERING LTD.

Table 10
Sanitary Sewer Collection System Sewage Flows - FUTURE CONDITIONS
(All properties connected, Existing Zoning Land-use)
QUATHIASKI COVE

Land-Use Population Density

Land-Use	Value	Unit	Land-Use	Value	Unit
SF Res.	1.95	capita/lot	Comm.	5	capita/ha
MF Res.	1.95	capita/unit	Indust.	5	capita/ha
			Institut.	10	capital/ha

Unit Design Flow

Description	Value	Unit
Daily Average Flow	220	l/capita per day
I/I Allowance	0.20	l/ mm dia. per m length/day

Peaking Factor Equation (Harmon)

$$PF = 1 + \frac{14}{4 + \sqrt{P}}$$

Where:
P = Population (in 1,000s)

Pipe Sizing Design Parameters

Description	Value	Unit	Comments
Manning's N	0.013		
Minimum Vel.	0.6	m/s	Gravity sewers
	0.75	m/s	Forcemains

Date: Oct 27, 2023
File: 1924-231

SMH No.		Catchment Arment Area (ha)									No. of Dwelling Units			Total No. of Dev. Lots		Service Population							Peaking	Dry Weather Flow		I&I Allowance		Wet Weather Flow		Existing Pipe Characteristics						
		SF			Com				Total		SF Lots		MF								Total			Ave Day	Peak Hr	Ind.	Cum.	Ave Day	Peak Hr	Length	Dia.	Slope	Capacity	%	Vel.	50% Full
Up	Down	Exist	Future	MF	Exist	Future	Ind	Instit.	Ind.	Cum.	Exist	Ftre	Units	Exist	Ftre	SF	MF	Com	Ind	Instit	Ind.	Cum.	Factor	m^3/day	L/s	m^3/day	m^3/day	m^3/day	L/s	m	mm	%	L/s	% Full	m/s	m/s
		O'Connor Rd																																		
42	41	1.6							1.6	1.6	3		4	3		5.9	7.8				13.7	13.7	4.40	3	0.2	3	3	6	0.2	64.0	200	0.5%	23	0.8%		0.7
41	31	1.2							1.2	2.8	3			3		5.9					5.9	19.5	4.38	4	0.2	4	6	11	0.3	93.8	200	0.5%	23	1.3%		0.7
		Plaza Rd																																		
31	30	4.2							4.2	20.1	2			2		3.9					3.9	62.4	4.29	14	0.7	2	48	62	1.2	57.4	200	4.0%	66	1.9%		2.1
30	29	0.4			0.6				1.0	21.1	1			1		2.0		2.9			4.9	67.3	4.29	15	0.7	3	51	66	1.3	70.0	200	2.2%	49	2.7%		1.5
29	28				1.0	0.4			1.4	22.5				2.5				7.1			7.1	74.3	4.28	16	0.8	2	53	69	1.4	45.7	200	2.4%	51	2.8%		1.6
28	8									80.7												315.9	4.07	69	3.3	1	54	123	3.9	21.0	200	3.8%	64	6.1%		2.0
Harper Rd																																				
8	7	0.6			0.3				0.9	81.6	2			2.5		3.9		1.5			5.4	321.3	4.07	71	3.3	5	169	239	5.3	121.0	200	0.4%	21	**25.5%**		0.7
7	6				0.6				0.6	82.2				1				3.1			3.1	324.4	4.06	71	3.4	4	172	244	5.4	97.0	200	0.4%	19	**27.6%**		0.6
Cooper Rd																																				
201	202		3.2						3.2	3.2		7				13.7					13.7	13.7	4.40	3	0.2	8	8	11	0.2	200	200	0.5%	23	1.1%		0.7
202	203									3.2												13.7	4.40	3	0.2	6	14	17	0.3	150	200	0.5%	23	1.4%		0.7
204	203									3.2												13.7	4.40	3	0.2	8	22	25	0.4	200	200	0.5%	23	1.8%		0.7
203	6									3.2		8				15.6					15.6	29.3	4.36	6	0.3	4	26	32	0.6	100	200	0.5%	23	2.7%		0.7
6	5				1.0				1.0	86.4				1				5.0			5.0	358.6	4.04	79	3.7	3	201	280	6.0	73.0	200	1.0%	32	18.8%		1.0
5	4									86.4												358.6	4.04	79	3.7	3	204	283	6.1	76.5	200	3.7%	63	9.6%		2.0
		Pidcock Rd																																		
forcemain	46	0.9	2.4			0.4	1.5		5.2	5.2	9	8		9	8	33.2		2.2	7.5		42.9	42.9	4.33	9	0.5			9	0.5		100					
		Green Rd																																		
46	45	1.2							1.2	6.4	7			7		13.7					13.7	56.5	4.30	12	0.6	2	2	15	0.6	60.9	200	4.1%	66	1.0%		2.1
45	44	1.3							1.3	7.8	4			4		7.8					7.8	64.3	4.29	14	0.7	6	8	22	0.8	140.0	200	2.3%	50	1.6%		1.6
44	43	0.9							0.9	8.7	3			3		5.9					5.9	70.2	4.28	15	0.8	5	13	28	0.9	119.3	200	3.9%	65	1.4%		2.1
43	4	0.4					0.8	0.3	1.5	10.2	1			3		2.0			3.8	3.3	9.0	79.2	4.27	17	0.9	3	15	33	1.0	63.2	200	1.4%	39	2.7%		1.2
Green Rd																																				
4	3									96.6												437.7	4.00	96	4.5	2	222	318	7.0	54.5	200	3.1%	57	12.3%		1.8
To STP																																				
101	102		3.0			2.9			6.0	6.0		8		8		15.6		14.7			30.3	30.3	4.35	7	0.3	10	10	17	0.5	250	200	0.5%	23	1.9%		0.7
103	102		11.3						11.3	11.3		28		28		54.6					54.6	54.6	4.31	12	0.6	12	22	34	0.9	300	200	0.5%	23	3.7%		0.7
102	3		0.7						0.7	18.0		2		2		3.9					3.9	88.8	4.26	20	1.0	8	30	49	1.3	200	200	0.5%	23	5.6%		0.7
3	2	0.3	0.1						0.4	115.0	4	4		4	4	15.6					15.6	542.1	3.96	119	5.5	2	253	373	8.4	48.7	200	0.5%	23	**36.2%**		0.7
2	1									115.0												542.1	3.96	119	5.5	1	255	374	8.4	34.9	200	0.5%	23	**36.3%**		0.7
		Quathiaski Cove Rd (foreshore pump station forcemain to STP)																																		
PS	1	0.4		0.7	0.9				1.9	1.9	1			3		2.0		48.0			50.0	50.0	4.31	11	0.5			11	0.5							
		Helanton Rd & Colter Rd forcemain to STP																																		
homes	1	10.6							10.6	10.6	16			16		31.2					31.2	31.2	4.35	7	0.3			7	0.3							
		Strata forcemain to STP																																		
homes	1	9.6	15.9						25.5	25.5	24	18		24	18	81.9					81.9	81.9	4.27	18	0.9			18	0.9							
To STP																																				
1	STP									153.1												705.2	3.89	155	7.0	0	255	410	9.9	2.0	200	0.5%	23	**42.9%**		0.7
	Totals:	55.4	107.6	1.7	7.6	4.0	2.3	4.3	182.8		124	138	20	140	123	510.9	39.0	101.4	11.3	42.6	705.2		3.89	155	7.0	255	255	410	9.9	6,426	**Totals**					
			163.1				19.7	Check:	182.8			262			263		549.9			Check:	705.2						2.95			2,775	(future pipe length)					
																														3,651	(existing pipe length)					

Notes:

1. SMH No. with "vd" indicates a Vertical Deflection in the pipe as reported on the design/record drawings. There is no manhole at this location.
2. Pipe diameters and slopes of existing gravity mains based on information on design/record drawings by others.
2. Cells with light orange shading indicates future conditions additions.
3. Future gravity mains represented for modelling analyses only as 200 mm diameter with a slope of 0.5% . Actual diameter and slope require detail design.

6.2 Sewage Treatment Plant & Outfall

A comparison of the reported design capacity of each of the six components of the sewage treatment plant, including the outfall, to the future conditions calculated design flows indicates that only the primary and secondary clarifiers are adequately sized. The four other components (Primary Clarifier Pumps, RBC Unit, UV System, and Outfall would require capacity increases as noted **Table 11**. A schematic of the sewage treatment system components is presented in **Figure 12**.

Table 11 – Sewage Treatment Plant Capacity Review: Design, Historical & Future Conditions

Description	Design	Dec 24, 2022	Future Conditions (5)	
			Dry Weather	Wet Weather
Primary Clarifier (78 m^3) - hydraulic retention time	1.5 to 2.5 hrs (1)	8.8 hrs (for 213 m^3/day)	12.1 hrs (for 155 m^3/day)	4.6 hrs (for 410 m^3/day)
Primary Clarifier Pumps - one pump on - two pumps on	2.65 L/s 4.0 L/s (2)	greater than 1.6 and 5.2 L/s (4)	1.8 L/s, Ave Day to 7 L/s, Peak Hr	4.7 L/s, Ave Day to 9.9 L/s, Peak Hr
RBC Unit	330 m^3/day, winter 366 m^3/day, summer (1)	213 m^3/day	155 m^3/day	410 m^3/day
Secondary Clarifier (30 m^3) - hydraulic retention time	1.5 to 2.5 hrs (1)	3.3 hrs	4.6 hrs (for 155 m^3/day)	1.8 hrs (for 410 m^3/day)
UV System	360 m^3/day (1)	213 m^3/day	155 m^3/day	410 m^3/day
Outfall	7 to 9 L/s (600 to 820 m^3/day) (3)	1.6 to 5.2 L/s (4)	4.2 L/s	9.9 L/s

Notes:

1 Quathiaski Cove Wastewater Management Condition and Treatment Capacity Assessment, Dec 6, 2010, prepared for Strathcona Regional District by Worley Parsons (Table B, page 5, Table D, Table E).

2 Based on type of pumps, static head, and forcemain dia. and length noted on design drawings by Chislett Manson & Company (Nov 1996).

3 Based on outfall dia., length, and elevations noted on design drawings by Chislett Manson & Company (Nov 1996) and allowance for high and low tide.

4 Based on the instantaneous flows recorded by the flow meter which is located on the outlet of the sewage treatment plant. Flows into the sewage treatment plant would be slightly higher as the RBC unit and the secondary clarifier would provide some flow attenuation.

5 See **Table 9** for dry and wet weather design flows.

6 Red text in a red shaded cell indicates the future conditions design flow exceeds the design capacity of that component of the sewage treatment plant.

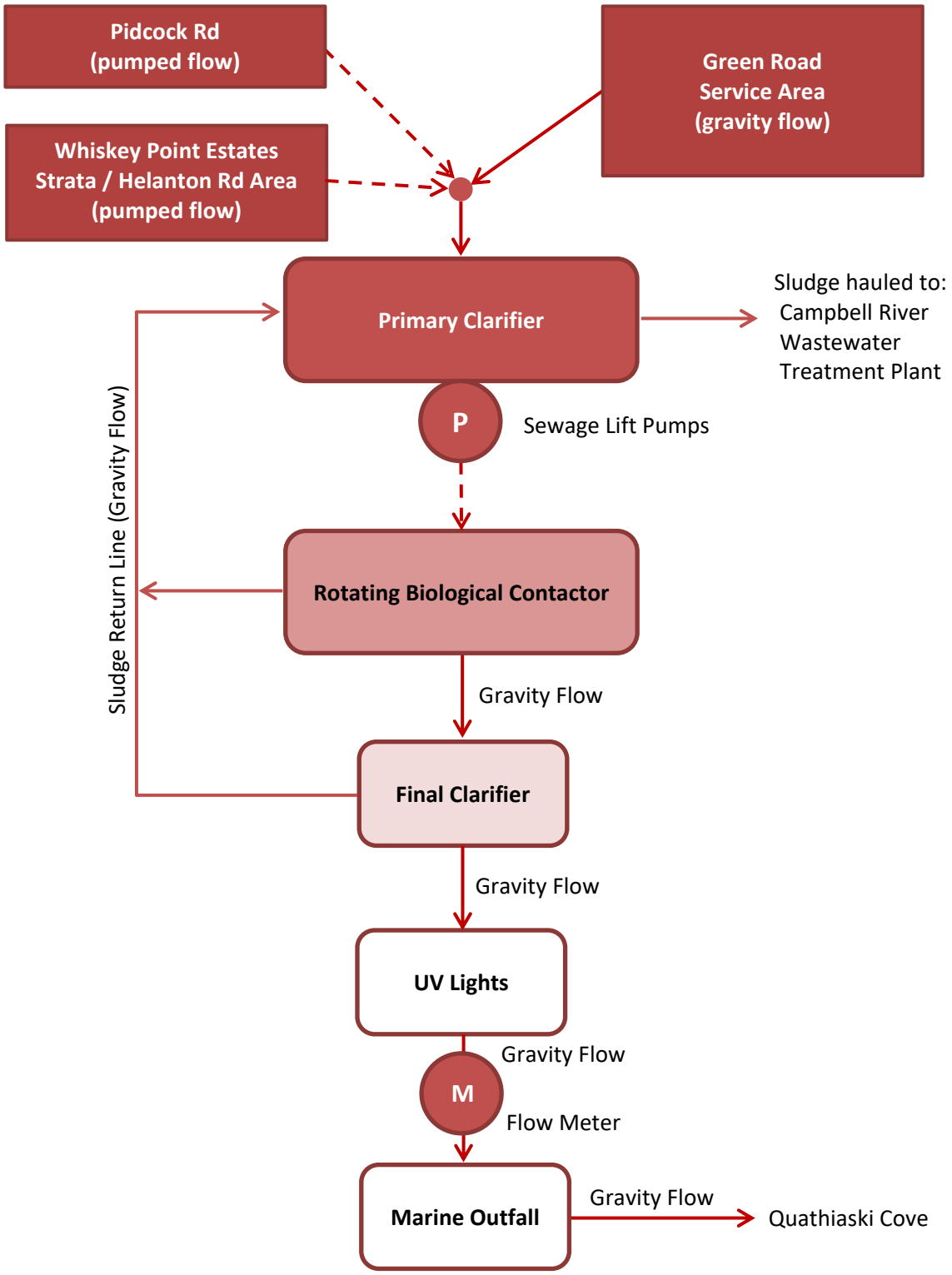


Figure 12 – Quathiaski Cove Sewage Treatment Process Flow Chart

7 COST ESTIMATES

7.1 Basis of Estimates

7.1.1 Class D Cost Estimate Definition

The estimated project costs in this report are **Class D** (±50%) as defined by the Association of Professional Engineers of BC as:

> "Class D estimate (±50%): An estimate which, due to little or no site information, indicates the approximate magnitude of cost of the proposed project, based on the client's broad requirements. This overall cost estimate may be derived from lump sum or unit costs for a similar project. It may be used in developing long term capital plans and for preliminary discussion of proposed capital projects."

7.1.2 Costing Sources

The cost estimates are based on our in-house construction cost database for recent similar projects carried out in the mid-Vancouver Island area.

7.1.3 Time Frame

Construction cost estimates have a limited life span and are subject to inflation and market conditions. The estimates in this report are as of September 2023 when the Engineering News Record Construction Cost Index (ENR CCI) was 13,486 and the local (Vancouver Island) construction market was considered to be active.

7.2 Proposed Works

Works have been proposed to aide in the identification and reduction in Inflow & Infiltration (I/I). Reducing I/I would extend the life of the clarifier pumps and lower power consumption by reducing their operating run times, and free up capacity in the sewage treatment plant. The proposed work is presented in **Table 12** followed by a brief discussion of each item.

No specific work has been identified with regards to the collection system (gravity mains and forcemains) as no capacity issues were identified under the existing and future design flow conditions (see **Table 9** and **Table 10**).

While the future design flow conditions analyses indicates that four of the six components of the sewage treatment plant, including the outfall, would require capacity increases (see **Table 11**), cost estimates have not be developed as the SRD is actively working on the upgrading/replacement of the treatment system in the near future. In addition, the ability to reduce or eliminate the need for upgrading the capacity of one or more of the components may be possible if I/I can be reduced.

Table 12 – Proposed Works Cost Estimates

No.	Description	Quantity	Unit Cost	Class D Cost Estimate (Rounded)
	Infiltration & Inflow Identification and Reduction			
1	Manhole Lid Raising/Rehabilitation	15	$ 7,000	$ 105,000
2	Gravity Main Video Inspection & Smoke Testing	3,650 m	$ 15	$ 55,000
3	I/I Reduction Works	TBD	TBD	TBD
4	Treatment Plant Flow Metering Data Analyses	TBD	TBD	TBD
			Combined Total:	$ 160,000

Item No. Comments:

1 Manhole Rehabilitation - $ 105,000

This estimate allows for the rehabilitation of 1/3rd of the forty-six (46) sanitary sewer manholes in the sewer collection system. Rehabilitation of manholes to reduce infiltration would encompass such things as:

- Raising manhole lids in low lying areas where runoff would pond or manhole lids adjacent to drainage ditches flowing full or overflowing, such as perhaps along Harper Road and Plaza Road.
- Installing carriage bolts in manhole lid lifting holes to reduce surface runoff from flowing into it.
- Sealing of leaks in the manhole barrel/ wall.
- Replacement/installation of gaskets between manhole rings.
- Sealing of the interface between the manhole barrel and the manhole base.
- Sealing of leaks around the pipes where they enter and exit the manhole.

2 Gravity Main Video Inspection & Smoke Testing - $ 55,000

The Unit Cost assumes the entire gravity collection system is video inspected and smoke tested at the same time to reduce mobilization and demobilization costs. This work is to be carried out in the fall/winter months when the groundwater table is high and if possible during or just after rainfall.

3 I/I Reduction Works - $ TBD

Upon completion of the video inspection and smoke testing program, the findings should be used to develop a budget to carry out the works necessary to eliminate the identified sources of I/I.

4 Treatment Plant Flow Metering Data Analyses - $ TBD

The sewage treatment plant flow metering data should continue to be reviewed and analyzed to assess and quantify the impact the completed I/I reduction works have on reducing flows at the sewage treatment plant. Comparison of dry weather vs wet weather flows and instantaneous flows corresponding with larger rainfall events should be carried out to approximate the rate of flow and volume associated with I/I.

8 CONCLUSIONS

Based on the findings of this report, the following conclusions are made:

1 The Quathiaski Cove Sewer Local Service Area encompasses 208 ha containing 211 properties.

2 Not all properties within the service area are developed; connected to the sewer collection system; or have a sewer main installed in front of near the property.

3 The area presently serviced by the sewer system is 120 ha in size (57% of the 208 ha within the Quathiaski Cove Sewer Local Service Area). It contains 182 lots of which approximately 75% (140) are connected to the sewer system.

4 Most of the development connected to the system consists of single family residential homes. Other types of development connected to the system include commercial (13 properties); institutional (3 properties); industrial (1 property); and multi-family (2 properties).

5 The existing collection system is comprised of:
- a gravity system with a serviced area of 67 ha (56% of the 120 ha total), and
- two pressure collection systems with a combined serviced area of 53 ha (44%).

6 The existing sewage collection system presently provides service to:
- 120 ha
- 140 developed properties
- 144 dwelling units
- 281 permanent residents (estimated).

7 Expansion of the sewage collection system to service all land within the boundaries of the Quathiaski Cove Sewer Local Service Area under the current zoning would result in the servicing of:
- 208 ha
- 263 developed properties
- 262 dwelling units
- 550 permanent residents.

For each of these, it equates to more than an 80% increase from existing conditions.

8 For the Year 2022, the flow meter on the outlet of the sewage treatment plant recorded the following flows:
- Dry Weather: 71 m^3/day (Jul/Aug)
- Maximum Day: 213 m^3/day (Dec 24)
- Peak Hour: 5.2 L/s (Dec 24)

9 Allowing for the future servicing of all the 208 ha of land within the boundaries of the Quathiaski Cover Sewer Local Service Area in accordance with the existing zoning, the design sewage flows entering the sewage treatment are projected to be:

- Dry Weather:
  - i) Average Day: 155 m^3/day (1.8 L/s)
  - ii) Peak Hour: 7 L/s
- Wet Weather
  - i) Average Day: 410 m^3/day (4.7 L/s)
  - ii) Peak Hour: 9.9 L/s

10 Modelling of the collection system under existing and future conditions, indicates that:

- All gravity mains have sufficient capacity to convey the design flows and the vast majority of the mains were calculated to flow less than 5% full.
- The gravity main calculated to have the greatest depth of flow, was the main that crosses Pidcock Creek and discharges into the sewage treatment plant (primary clarifier). Under peak hour design flow, this main was calculated to be flowing only:
  - i) Existing Conditions: 25% full
  - ii) Future Conditions: 42% full

11 The calculated future wet weather flow of 410 m^3/day exceeds the maximum discharge rate of 350 m^3/day licensed for the sewage treatment plant under Permit No. PE-12799 issued by the BC Ministry of Environment.

12 The following four of the six components of the existing sewage treatment plant are undersized to process the calculated future wet weather flow of 410 m^3/day:

- Primary Clarifier Pumps
- RBC Unit
- UV System
- Outfall

13 Infiltration/Inflow is occurring in the sewage collection system and of the 213 m^3 flow recorded for December 24, 2022, it is estimated that at least 142 m^3 (67%) was I/I.

14 While certain amounts of storm water infiltration and inflow (I&I) are unavoidable, excessive amounts can cause hydraulic overloading, where parts of the sewer system (gravity mains, lift stations, forcemains) can reach their capacity prematurely, requiring large expenditures for capacity upgrading.

15 A reduction in I/I in the Quathiaski Cove sewage collection system would reduce system operating and maintenance costs and free up capacity in the sewage treatment plant and the outfall to allow additional properties to connect to the system.

16 Works have been proposed for the identification and reduction of I/I. This includes raising of manhole lids in low lying areas where runoff would pond or manhole lids adjacent to drainage ditches flowing full or overflowing, such as perhaps along Harper Road and Plaza Road.

9 RECOMMENDATIONS

Based on the conclusions of this report, the following recommendations are made:

1 That the works proposed listed in in this report to identify and reduce I/I in the gravity collection system (**Table 12**) be carried out.

2 Flow metering data continue to be reviewed and analyzed to assess and quantify the impact the completed I/I reduction works have on reducing I/I flows to the sewage treatment plant.

3 Upon completion of the video inspection and smoke testing program, the findings be used to develop a budget to carry out the works necessary to eliminate the identified sources of I/I.

APPENDIX A

-

Quathiaski Cove Community Sewerage System
Ministry of Environment, Lands & Parks Discharge Permit
PE-12799

BRITISH COLUMBIA

February 17, 2014

Tracking Number: 293399
Authorization Number: 12799

Strathcona Regional District
301-990 Cedar Street
Campbell River, BC V9W 7Z8

Dear Strathcona Regional District,

Re: Your application for a Permit Transfer under the *Environmental Management Act*

In response to your letter dated April 30, 2013, and pursuant to Section 17 of the *Environmental Management Act*, the Director hereby consents to the transfer of Permit PE-12799 from Regional District of Comox-Strathcona to Strathcona Regional District.

Furthermore, pursuant to Section 16 of the *Environmental Management Act*, Permit PE-12799 is hereby amended to reflect the name change from Regional District of Comox-Strathcona to Strathcona Regional District. A copy of the permit is enclosed for your records. Please note that although a revised permit has not been produced at this time, a copy of this letter is being placed on the permit file, as an addendum to the permit, to reflect the change in the name of the permit holder. Strathcona Regional District is now the permittee with all inherent rights and responsibilities. Your attention is respectfully directed to the conditions of the permit. An annual fee for the permit will be determined in accordance with the Permit Fee Regulation.

This permit does not authorize entry upon, crossing over, or use for any purpose of private or Crown lands or works, unless and except as authorized by the owner of such lands or works. The responsibility for obtaining such authority rests with the permittee. This permit is issued pursuant to the provisions of the *Environmental Management Act* to ensure compliance with Section 120(3) of that statute, which makes it an offence to discharge waste, from a prescribed industry or activity, without proper authorization. It is also the responsibility of the permittee to ensure that all activities conducted under this authorization are carried out with regard to the rights of third parties, and comply with other applicable legislation that may be in force.

This decision may be appealed to the Environmental Appeal Board in accordance with Part 8 of the *Environmental Management Act*. An appeal must be delivered within 30 days from the date that notice of this decision is given. For further information, please contact the Environmental Appeal Board at (250) 387-3464.

.../2

Ministry of Environment
Environmental Protection Division 2080A Labieux Road
Nanaimo, BC V9T 6J9
West Coast Region
Telephone: (250) 751-3100
Facsimile: (250) 751-3103

Administration of this permit will be carried out by staff from the regional office. Plans, data and reports pertinent to the permit are to be submitted to the Regional Manager, Environmental Protection, at the address shown on this letter.

Yours truly,

Baljeet Mann

Baljeet Mann
for Director, *Environmental Management Act*
West Coast Region

CC: Environment Canada

Province of
British Columbia

MINISTRY OF
ENVIRONMENT,
LANDS AND PARKS

BC Environment

Vancouver Island Region
Environmental Protection
2569 Kenworth Road
Nanaimo, British Columbia
V9T 4P7
Telephone: (604) 751-3100
Fax: (604) 751-3103

Date: MAR 1 3 1995

File: PE-12799

REGISTERED MAIL

Regional District of Comox-Strathcona
PO Box 3370
Courtenay BC V9N 5N5

Dear Permittee:

Enclosed is Permit PE-12799 issued under the provisions of the Waste Management Act. Your attention is respectfully directed to the conditions outlined in the permit. An annual permit fee will be determined according to the Waste Management Permit Fees Regulation.

This permit does not authorize entry upon, crossing over, or use for any purpose of private or Crown lands or works, unless and except as authorized by the owner of such lands or works. The responsibility for obtaining such authority shall rest with the permittee. This permit is issued pursuant to the provisions of the Waste Management Act to ensure compliance with Section 34(3) of that statute, which makes it an offence to discharge waste without proper authorization. It is also the responsibility of the permittee to ensure that all activities conducted under this authorization are carried out with regard to the rights of third parties, and comply with other applicable legislation that may be in force.

This permit may be appealed by persons who consider themselves aggrieved by this decision in accordance with Part 5 of the Waste Management Act. Written notice of intent to appeal must be received by the Regional Waste Manager within twenty-one (21) days.

Administration of this permit will be carried out by staff from our Regional office located at 2569 Kenworth Road, Nanaimo, British Columbia, V9T 4P7 (telephone 751-3100). Plans, data and reports pertinent to the permit are to be submitted to the Regional Waste Manager at this address.

Yours truly,

G. E. Oldham, P.Eng.
Regional Waste Manager
Vancouver Island Region

Enclosure

PROVINCE OF
BRITISH COLUMBIA

Environmental Protection
2569 Kenworth Road
Nanaimo
British Columbia, V9T 4P7
Telephone: (604) 751-3100

MINISTRY OF ENVIRONMENT,
LANDS AND PARKS

PERMIT
PE-12799

Under the Provisions of the Waste Management Act

Regional District of Comox-Strathcona

PO Box 3370

Courtenay, British Columbia

V9N 5N5

is authorized to discharge effluent to Quathiaski Cove from a community sewerage system located at Quathiaski Cove, Quadra Island, British Columbia, subject to the conditions listed below. Contravention of any of these conditions is a violation of the Waste Management Act and may result in prosecution.

1. AUTHORIZED DISCHARGES

1.1 This subsection applies to the discharge of effluent from the community of Quathiaski Cove as shown on the attached Site Plan A. The site reference number for this discharge is E221559.

1.1.1 The maximum authorized rate of discharge is 350 m^3/d.

1.1.2 The characteristics of the discharge shall be

5-day Biochemical Oxygen Demand	< 45 mg/L
Total Suspended Solids	< 30 mg/L
Fecal Coliform Bacteria	< 1000 CFU/100mL

1.1.3 The authorized works are, a rotating biological contactor secondary treatment plant, ultraviolet disinfection, an outfall discharging to a minimum depth of 24 m below mean low water, and related appurtenances approximately located as shown on attached Site Plan A.

1.1.4 The authorized works must be complete and in operation when discharge commences.

Date Issued: MAR 1 3 1995
Date Amended:
(most recent)

G.E. Oldham
G.E. Oldham, P. Eng.
Regional Waste Manager

1.1.5 The location of the facilities from which the discharge originates is Lot 1, Plan 24015, Sayward Land District.

1.1.6 The location of the point of discharge is Quathiaski Cove.

2. GENERAL REQUIREMENTS

2.1 Maintenance of Works and Emergency Procedures

The permittee shall inspect the pollution control works regularly and maintain them in good working order. In the event of an emergency or condition beyond the control of the permittee which prevents continuing operation of the approved method of pollution control, the permittee shall immediately notify the Regional Waste Manager and take appropriate remedial action.

2.2 Bypasses

The discharge of effluent which has bypassed the designated treatment works is prohibited unless the approval of the Regional Waste Manager is obtained and confirmed in writing.

2.3 Process Modifications

The permittee shall notify the Regional Waste Manager prior to implementing changes to any process that may affect the quality and/or quantity of the discharge.

2.4 Plans - New Works

Plans and specifications of the works authorized in Subsection 1.1.3 shall be submitted to the Regional Waste Manager and his approval obtained before construction commences. The works shall be constructed in accordance with such plans.

2.5 Posting of Outfall

The permittee shall erect a sign along the alignment of the outfall above high water mark. The sign shall identify the nature of the works. The wording and size of the sign requires the approval of the Regional Waste Manager.

2.6 Outfall Inspection

The permittee shall conduct a dye test on the outfall line (or inspect by another method approved by the Regional Waste Manager) every two years or as may otherwise be required by the Regional Waste Manager.

2.7 Sludge Wasting and Disposal

Sludge wasted from the treatment plant shall be disposed of to a site and in a manner approved by the Regional Waste Manager.

The Permittee shall submit a sludge disposal plan to the Regional Waste Manager before discharge commences. The plan shall detail the method for disposal of treatment plant sludge. The method of sludge disposal is subject to the approval of the Regional Waste Manager.

2.8 Effluent Upgrading

Based on receiving environment monitoring data and/or other information obtained in connection with this discharge, the permittee may be required to provide additional treatment facilities.

2.9 Odour

Should objectionable odours, attributable to the operation of the sewage treatment plant, occur beyond the property boundary, as determined by the Regional Waste Manager, measures or additional works will be required to reduce odour to acceptable levels.

2.10 Facility Classification

The permittee shall classify the wastewater treatment facility authorized in Subsection 1.1.3 (the facility) and the classification shall be maintained with the "British Columbia Water and Wastewater Operators Certification Program Society" (BCWWOCPS). The permittee shall submit an application to classify the facility to BCWWOCPS before discharge commences. Although the facility may have already been voluntarily classified previously, an application for classification must be submitted by the above date.

2.11 Operator Certification

For facilities classified by the BCWWOCPS (the Program) at Level I or higher, the permittee shall ensure that all operators of the facility be certified by the Program to a Class I level, at a minimum, by twelve (12) months after commencing discharge.

Operators in Training

The permittee shall ensure that all operators in training (OIT) working at the facility classified by the BCWWOCPS at Level II or higher shall be required to successfully pass an OIT examination within three (3) months of commencement of employment at the facility. The OIT certificate shall be valid for fifteen (15) months from the date of issue. Prior to the expiry date of the OIT certificate, but not sooner than twelve (12) months from the date when the OIT commenced facility operation, the OIT shall successfully complete a Class I certification examination in order to continue to operate at the facility.

Chief Operator: Level II or Higher

For facilities classified by the BCWWOCPS at Level II or higher, the permittee shall designate at least one operator to be the "Chief Operator" of the facility by December 1, 1996. The "Chief Operator" shall be certified at a Class II level, at a minimum.

After December 1, 1996, no person shall have "Direct Responsible Charge", as defined by the BCWWOCPS, of a municipal wastewater treatment facility classified at Level II or higher unless they possess a valid operator's certificate not more than one level below the classification level of the facility.

Chief Operator: Level III and IV

For facilities classified by the BCWWOCPS at Level III, the permittee shall designate a "Chief Operator", certified at a Class III level by December 1, 1998.

If the facility is classified by the BCWWOCPS at Level IV, the permittee shall designate a "Chief Operator" certified at a Class IV level by December 1, 1998.

3. MONITORING AND REPORTING REQUIREMENTS

3.1 Discharge Monitoring

3.1.1 Flow Measurement

Provide and maintain a suitable flow measuring device and record once per day the effluent volume discharged over a 24-hour period.

3.1.2 Sampling And Analysis

The permittee shall install a suitable sampling facility and obtain a sample of the effluent for analysis in accordance with the following schedule:

Parameter	Frequency (type)
5-day Biochemical Oxygen Demand	monthly (composite)
Total Suspended Solids	weekly (composite)
Toxicity (non-acutely toxic)	annually (grab)
Fecal Coliform Bacteria	monthly (grab)

Composite samples are to consist of four grab samples taken over a two-hour period at maximum flow and mixed to form a single sample for subsequent analysis. An approved flow proportional, continuous sampler may be used. Proper care should be taken in sampling, storing and transporting the samples to adequately control temperature and avoid contamination, breakage, etc.

3.2 Receiving Environment Monitoring

During the first two (2) years of discharge, a receiving environment monitoring program shall be carried out by the permittee. The program, to consist of monthly grab samples for bacterial (fecal coliform) analysis at selected sites in Quathiaski Cove, shall be established in consultation with the Regional Waste Manager, who will advise the permittee in writing of the program requirements. Based on the results of this monitoring program, the permittee monitoring requirements may be extended or altered by the Regional Waste Manager.

3.3 Monitoring Procedures

3.3.1 Sampling And Analytical Procedures

Sampling and flow measurement shall be carried out in accordance with the procedures described in "Field Criteria for Sampling Effluents and Receiving Waters", April 1989, or by suitable alternative procedures as authorized by the Regional Waste Manager.

Copies of the above manual are available from the Environmental Protection Division, Ministry of Environment, Lands and Parks, 777 Broughton Street, Victoria, British Columbia, V8V 1X4, at a cost of $20.00, and are also available for inspection at all Environmental Protection offices.

Analyses are to be carried out in accordance with procedures described in the latest version of "British Columbia Environmental Laboratory Manual for the Analysis of Water, Wastewater, Sediment and Biological Materials (March 1994 Permittee Edition)", or by suitable alternative procedures as authorized by the Regional Waste Manager.

Copies of the above manual may be purchased from Queens Printer Publications Centre, 2nd Floor, 563 Superior Street, Victoria, British Columbia, V8V 4R6 (1-800-663-6105). A copy of the manual is also available for inspection at all Environmental Protection offices.

3.3.2 Toxicity

Analyses for determining the toxicity of liquid effluents to fish shall be carried out in accordance with the procedures described in the "Provincial Guidelines and Laboratory Procedures for Measuring Acute Lethal Toxicity of Liquid Effluents to Fish" November 1982. The Regional Waste Manager will advise the permittee which method of measurement for expressing lethal toxicity shall be used. The method of sampling and the method of bioassay will be determined by the Regional Waste Manager.

Copies of the above manual are available from the Environmental Protection Division, 777 Broughton Street, Victoria, British Columbia, V8V 1X4, at a cost of $5.00, and are also available for inspection at all Environmental Protection offices.

3.4 Reporting

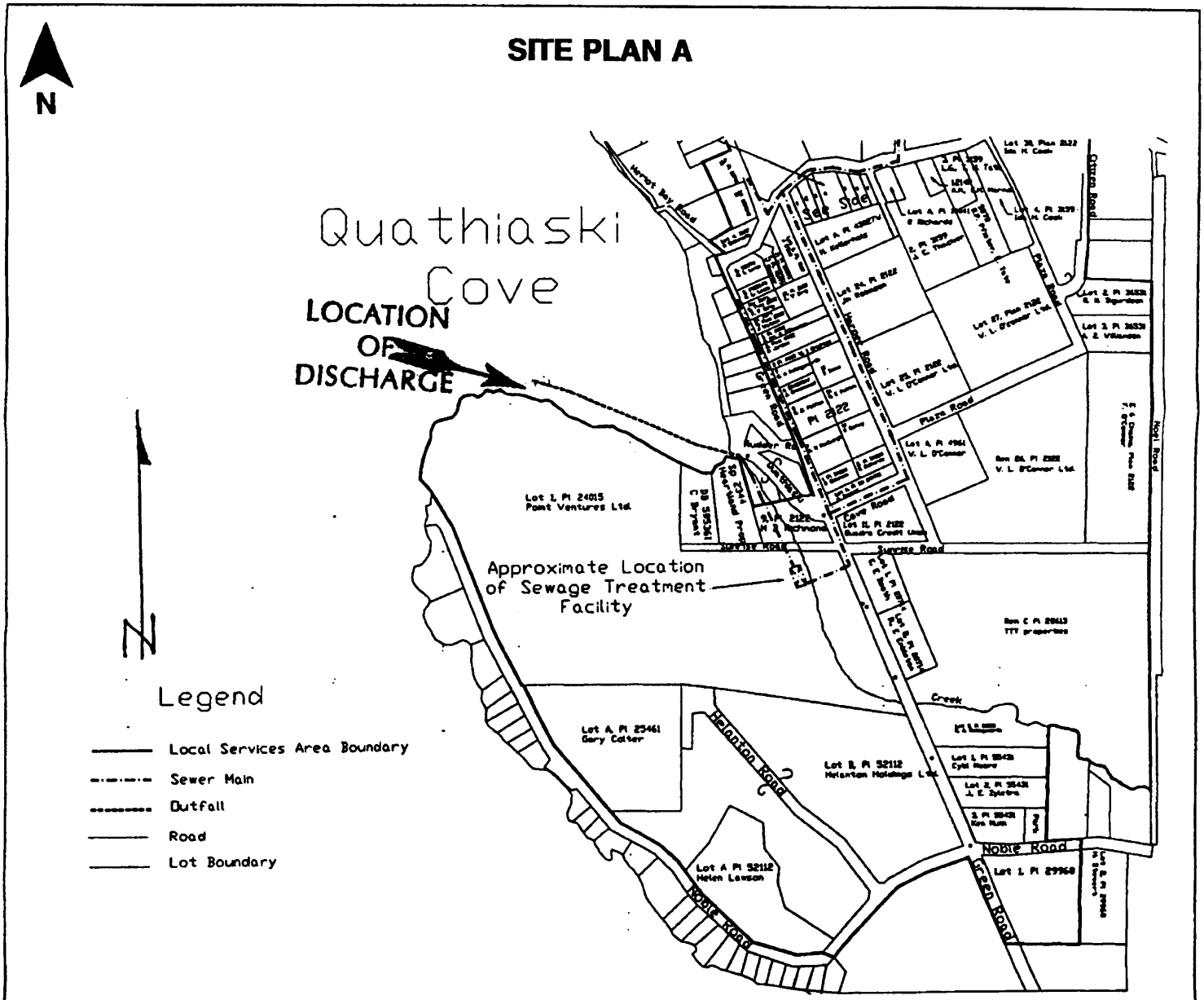
Maintain data of analyses and flow measurements for inspection and every three months submit the data, suitably tabulated, to the Regional Waste Manager for the previous quarter. All reports shall be submitted within 31 days of the end of the quarter.

G.E. Oldham, P. Eng.
Regional Waste Manager

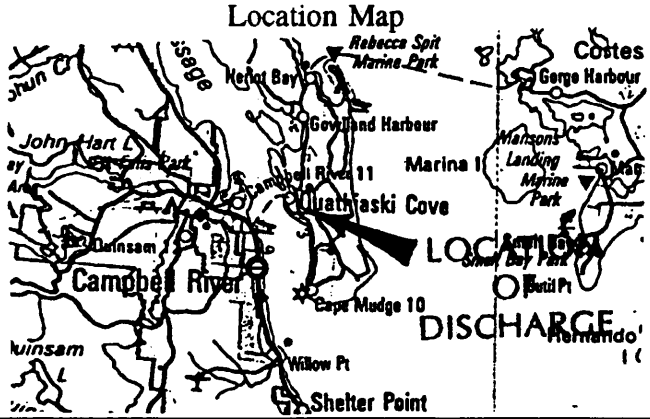
PROVINCE OF
BRITISH COLUMBIA

Environmental Protection

SITE PLAN A



Location Map



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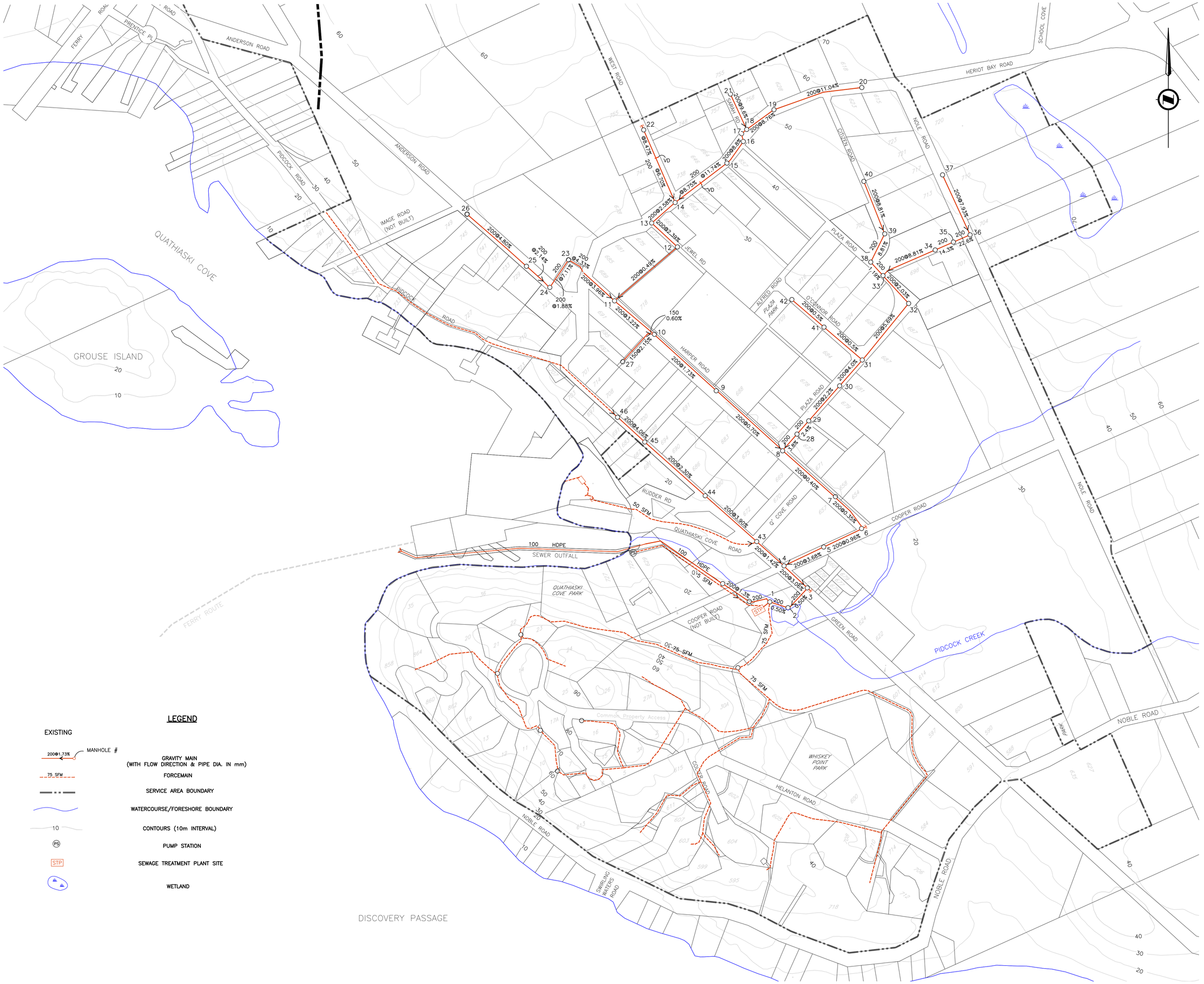
Permit: PE-12799

Date: MAR 1 3 1995

G. E. Oldham

G.E. Oldham, P.Eng.
Regional Waste Manager



LEGEND

EXISTING

- 200@1.73% — MANHOLE # — GRAVITY MAIN (WITH FLOW DIRECTION & PIPE DIA. IN mm)
- 75 SFM — FORCEMAIN
- SERVICE AREA BOUNDARY
- WATERCOURSE/FORESHORE BOUNDARY
- 10 — CONTOURS (10m INTERVAL)
- PS — PUMP STATION
- STP — SEWAGE TREATMENT PLANT SITE
- WETLAND

KOERS & ASSOCIATES ENGINEERING LTD.
Consulting Engineers
P.O. Box 790, 194 Memorial Ave. Ph: 250-248-3151
Parksville, BC V9P 2G8 www.koers-eng.com Fax: 250-248-5362

RECORD OF REVISIONS

REV	DATE	BY	ENG	DESCRIPTION

ISS	DATE	BY	ENG	DESCRIPTION

RECORD OF ISSUE

SEAL

PROJECT NO.	1924-231
DRAWN	DK
DESIGNED	CH
CHECKED	
APPROVED	
DATE	JULY 2023
SCALE	1:3,000

CLIENT

Strathcona REGIONAL DISTRICT

PROJECT

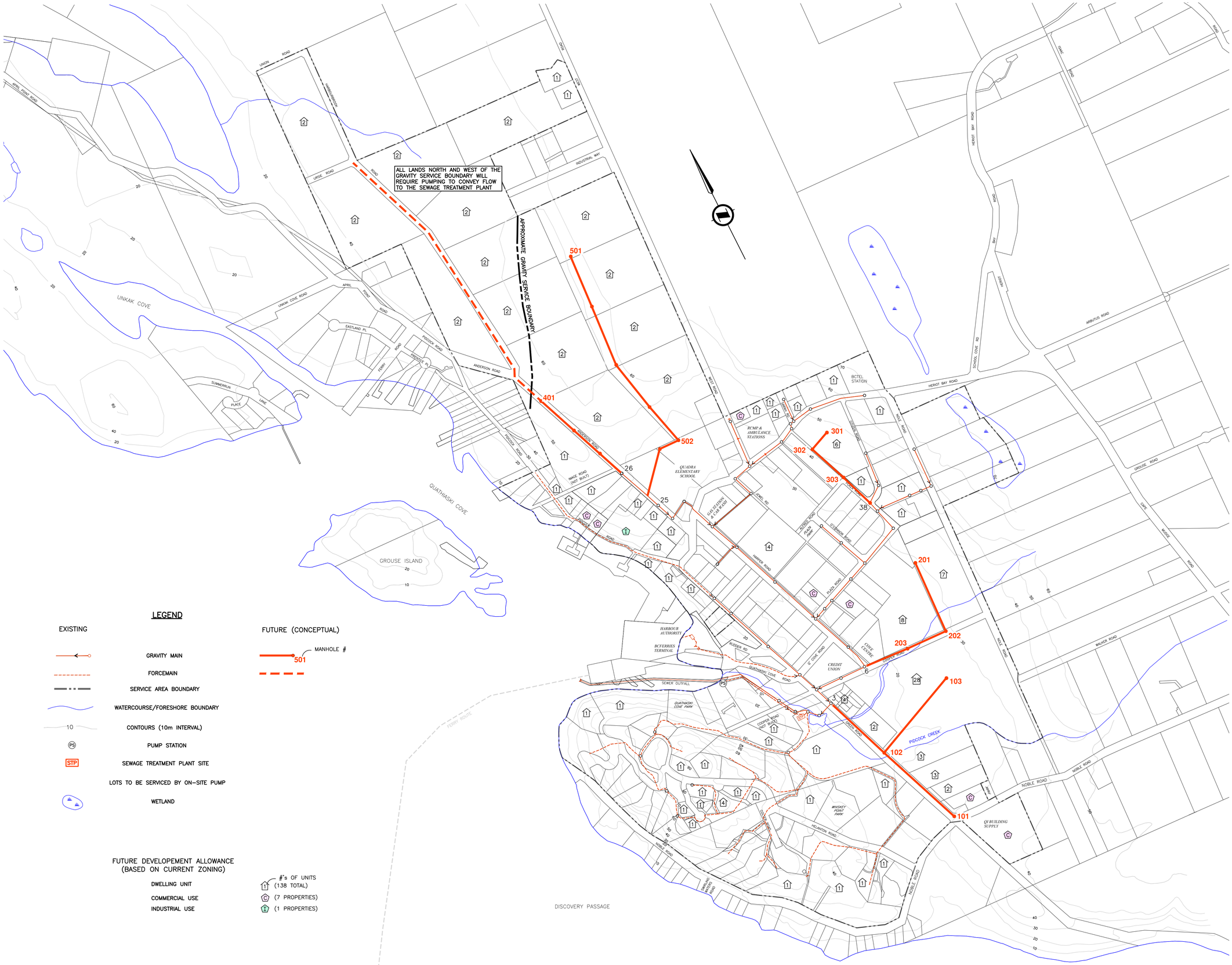
QUATHIASKI COVE LOCAL SANITARY COLLECTION SYSTEM CAPACITY REVIEW

TITLE

EXISTING COLLECTION SYSTEM

DRAWING No.	REV.	SHEET
1924-231-01		1/2

File: 1924-231.dwg Plot Time: Aug 29, 2023 - 8:16am User: dkennedy



LEGEND

EXISTING		FUTURE (CONCEPTUAL)
	GRAVITY MAIN	MANHOLE # 501
	FORCEMAIN	
	SERVICE AREA BOUNDARY	
	WATERCOURSE/FORESHORE BOUNDARY	
10	CONTOURS (10m INTERVAL)	
PS	PUMP STATION	
STP	SEWAGE TREATMENT PLANT SITE	
	LOTS TO BE SERVICED BY ON-SITE PUMP	
	WETLAND	

FUTURE DEVELOPEMENT ALLOWANCE (BASED ON CURRENT ZONING)

DWELLING UNIT	#'s OF UNITS (138 TOTAL)
COMMERCIAL USE	(7 PROPERTIES)
INDUSTRIAL USE	(1 PROPERTIES)

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RECORD OF REVISIONS

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RECORD OF ISSUE

SEAL

PROJECT NO.	1924-231
DRAWN	DK
DESIGNED	CH
CHECKED	
APPROVED	
DATE	JULY 2023
SCALE	1:5,000

CLIENT

Strathcona REGIONAL DISTRICT

PROJECT

QUATHIASKI COVE LOCAL SANITARY COLLECTION SYSTEM CAPACITY REVIEW

TITLE

CONCEPTUAL FUTURE COLLECTION SYSTEM

DRAWING No.	REV.	SHEET
1924-231-02		2/2

File: 1924-231.dwg Plot Time: Aug 29, 2023 - 8:16am User: dkennedy

Terms and Conditions

Attached to the *Local Government Grants Act* (Act) Infrastructure Planning Grant for the Strathcona Regional District.

Eligible costs:
The grant is payable towards the eligible costs of the **Quathiaski Cove Wastewater System Capacity Study update**. Eligible costs are as defined in the *Act* and its accompanying regulations.

Provincial contribution:
In accordance with the *Act*, grant payments shall not exceed the lesser of the amount of the grant, **$10,000**, or the amount as calculated in accordance with the following formula:

Grant Amount = (A+B), where

A=100% of the first $5,000 of the costs to the Strathcona Regional District; and
B= 50% of the next $10,000 of the costs to the Strathcona Regional District.

Eligible costs do not include administration or administrative overhead, interest or carrying charges.

Expiry Date:
The Province of British Columbia's commitment will expire on **March 31, 2025.**

Deadline Extension:
Should unforeseen circumstances delay the completion of the project, consideration may be given to an extension of one year if a written request is received one month prior to the expiry date.

Project Number:
The project number assigned to this grant is **IPG230033.** This project number should be quoted on all correspondence related to this project.

Payment of Claims:

1. To receive payment of the grant, a claim must be created and submitted in the Local Government Information System (LGIS)* at the completion of the project and prior to the **Expiry Date** noted above. The LGIS Learning Centre contains specific instructions on how to create and submit claims.

2. All required documents must be uploaded in LGIS for claim payment. These documents include:

    - A copy of the study (see program guide for details);
    - Copies of the invoices for all work undertaken to complete the report including details of all times and charges; and

- A schedule detailing the cost (time and charges) for any in-house resources used to prepare the report.

3. The Province reserves the right to reduce or deny payments if the amounts claimed are unreasonable or ineligible.

4. The Province will not pay a claim after the expiry date.

**In order to access LGIS, each user must have a Business BCeID username and password. Your organization BCeID Account Manager or BCeID Profile Manager within your organization can create this account on your behalf. Access to LGIS can be requested after you receive your BCeID.*

Other:
Change in scope requests will only be considered where any substitute study would fulfil the objectives for which the grant was approved.

Release of Information:
With discretion, the Ministry of Municipal Affairs may wish to publish, release or otherwise disseminate information related to the study or plan, including the final report. The Strathcona Regional District will be notified prior to doing so.

Questions can be directed to infra@gov.bc.ca. Please quote your project number in the subject line.

Please indicate your acceptance of these terms and conditions by emailing a signed, scanned copy of this document to the email address below:

Email: INFRA@gov.bc.ca

Attention: Virginia Espinoza, Infrastructure and Engineering

On behalf of the Strathcona Regional District, I accept the afore-mentioned Terms and Conditions.

Signature	Name
Title	Date

Strathcona
REGIONAL DISTRICT

STAFF REPORT

DATE: January 18, 2023 **FILE**: 0550 Board

TO: Chair and Directors,
Regional Board

FROM: David Leitch
Chief Administrative Officer

RE: QUATHIASKI COVE CAPACITY STUDY UPDATE – GRANT OPPORTUNITY

PURPOSE/PROBLEM

To consider the submission of an application to the Provincial Infrastructure Planning Grant Program (IPGP) to complete the Quathiaski Cove Sewer Local Service Area collection, treatment and discharge system capacity study.

EXECUTIVE SUMMARY

In May 2019, Koers and Associates Engineering Ltd. provided a preliminary review of the Quathiaski Cove sewer system capacity using data from the new flow meters installed in March of the same year. The findings suggested that flows from the wastewater treatment plant were higher than what had been recorded by the old meters.

The Official Community Plan (OCP) for Quadra Island supports and encourages development and densification within the Quathiaski Cove Village Containment Boundary which is serviced by the sewage system. This study will assess the ability of the sanitary sewer system (collection, treatment, and discharge) to service the development envisioned by the OCP and identify the extent and timing of upgrading works, if any, that are required.

The IPGP grant will cover up to $10,000 of the $22,855 Koers and Associates estimate to complete the study. The remaining costs have been considered in the 2023 budget for the Service.

RECOMMENDATIONS

1. THAT the report from the Chief Administrative Officer be received.

2. THAT an application to the Infrastructure Planning Grant Program for $10,000 be submitted to assist with funding to update the Quathiaski Cove Sewer Local Service Area collection, treatment and discharge system capacity study.

Respectfully:

Dave Leitch
Chief Administrative Officer

Prepared by *Sheena Fisher., Engineering Services Coordinator*

Attachments: Koers and Associates Engineering Ltd. 2023 Proposal for the Quathiaski Cove Sewer Local Service Area Collection, Treatment & Discharge System Capacity Review
Koers and Associates Engineering Ltd.2019 Draft Quathiaski Cove Sewer System Capacity Review

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& ASSOCIATES
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1924-2022P
January 17, 2023

Strathcona Regional District
301-990 Cedar Street
Campbell River, BC V9W 7Z8

Attention: **Ms. Sheena Fisher**
Engineering Services Coordinator

Re: Proposal for Engineering Services for
Quathiaski Cove Sewer Local Service Area
Collection, Treatment & Discharge System Capacity Review

Koers & Associates Engineering Ltd. is pleased to submit our proposal to carry out a capacity review of the Quathiaski Cove Sanitary Sewer System in response to your request.

1 PROJECT UNDERSTANDING

Quathiaski Cove Local Sewer Service Area

The Strathcona Regional District (SRD) manages the Quathiaski Cove Local Sewer Service Area (Service Area) on Quadra Island. The Service Area was established in 1994 with the passage of Bylaw No. 1588 for the establishment of a community sewage collection, treatment, and discharge system. The system became operational in 1996.

In 2017, the service area was expanded, and the collection system extended to service another 43 properties.

In 2019, an emergency power generator was installed at the sewage treatment plant, and the flow meter on the discharge from the sewage treatment plant was replaced. Prior to the replacement of the flow meter, the accuracy meter readings was in question because of the relatively low flow for number of properties serviced and the positioning of the meter; it was suspected the meter was under recording flows (by not recording or under recording during periods of low flow). A preliminary review of STP flow metering data shows higher flows are being recorded for each day compared to before the meter was replaced in 2019.

At present, the Service Area encompasses approximately 208 ha containing 128 lots. Not all of the properties are connected to the collection system. The serviced area of the collection system encompasses approximately 128 ha containing 91 lots.

The SRD continues to see development within the sewer local service area as well as requests for connection to the local sewage collection system from either new development or existing development within the service area that are not yet connected to the system.

…/2

Strathcona Regional District
Ms. Sheena Fisher

The Official Community Plan (OCP) for Quadra Island supports and encourages development and densification within the Quathiaski Cove Village Containment Boundary located with the Service Area of the sewage system. The extent of the containment boundary is shown on the attached **Map 1** of the OCP.

2 STUDY NEED/OBJECTIVES

The SRD wishes to undertake a study to:

i) Assess the ability of the sanitary sewer system (collection, treatment, and discharge) to service the development envisioned by the OCP, and

ii) Identify the extent and timing of upgrading works required, if any.

3 WORK PLAN

To meet the study need, the following tasks will be undertaken:

Task 1 – Project Start-up, Scope of Work, Information Collection & Review

- Review and confirm project scope or work, schedule, deliverables and lines of communication with client.
- Confirm the SRD will provide the following information in order to meet the study need/objective:
  - i) STP flow data from March 2019 to present
  - ii) number and location of properties presently serviced by the sanitary sewer system. It is envisioned this information will be provided on a plan drawing, such as the attached SRD's Sewer Local Service Area plan.
- Review information provided by SRD and assess for completeness, accuracy, and suitability for the study.

Task 2 – Sewage Treatment Plant Flows & Local Rainfall Data

- Obtain, process and review the flow meter data recorded by the sewage treatment plant flow meter (located on the treated effluent discharge pipe).
- It is understood daily flow data for the past four years (since the new flow meter was installed on March 27, 2019) is available.
- Daily rainfall data will be obtained from the nearby Environment Canada weather recording station (Heriot Bay SE, Climate ID No. 1023462) and overlaid with the daily flow data.
- Daily discharge flows will be compared against the authorized maximum rate of discharge (350 m^3/day; BC Ministry of Environment Permit PE-12799) and the amount of capacity available to service future development identified.

…/3

Strathcona Regional District
Ms. Sheena Fisher

Task 3 – Historical Flows (Average & Maximum Day, Dry vs Wet Weather, Amount of I/I)

- Flow data will be processed to determine; Average Day, Maximum Day, Monthly and Annual Flows for each year.
- Daily, monthly and seasonal variations in flows (summer vs wet weather), will be used to estimate the amount of Inflow/Infiltration (I/I) entering the sewage collection system.
- Calculated I/I unit rates will compared to typical design allowances based on the age, and type of collection system (e.g., new vs greater than 25 years old, gravity vs pressure., with or without gaskets at pipe joints, flexible vs rigid pipe).
- The number and type of properties serviced will be reviewed and used to calculate an average day and maximum day per connection flow. This will be compared against typical land-use based design standards.

Task 4 – Future Design Flows, OCP Build-Out

- Design flows will be developed (average and maximum day) for both dry and wet weather for OCP Build-Out conditions.
- The design water demands developed for the three OCP Build-Out density scenarios presented in the *Quathiaski Cove Water System Feasibility Study, February 19, 2021* by Koers & Associates Engineering Ltd. will be utilized in developing the future design sewage flows.

Task 5 – Collection System Capacity Review

- Material type, diameter and slope of gravity mains will be obtained from available engineering drawings.
- Conveyance capacity of the gravity mains vs future design flows will be reviewed.
- Undersized mains will be identified along with replacement diameter on an overall sanitary sewer system plan drawing.

Task 6 – STP Capacity & Discharge Permit Limit Review

- OCP Build-Out design flows will be compared against the reported design flow capacity of the STP, the UV disinfection system, and the maximum permitted discharge.
- Develop three annual growth rate scenarios (low, medium, high) and project when (Year) discharge permit licenced limit would be reached.

Task 7 – Outfall Capacity Review

- The gravity discharge capacity of the outfall vs the OCP Build-out design flows will be reviewed. If undersized, a replacement diameter would be identified and noted on the overall sanitary sewer system plan drawing

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Ms. Sheena Fisher

Task 8 – Cost Estimate (Class D)

- Order of Magnitude (Class D) cost estimate will be developed for upgrading works.

Task 9 – Summary Report

- Findings will be presented in a summary report. It will include tables, figures, a plan drawing of the overall sewer system with pipe diameters and slopes shown, as well as conclusions and recommendations.
- The report will be sealed and provided in pdf format.

4 DELIVERABLES

A sealed pdf copy of report will be provided.

5 SCHEDULE

We can commence work upon authorization. Submission of the summary report is expected to be in 12 – 16 weeks after authorization to proceed.

6 FEES

The engineering fee, including disbursements, to carry out the proposed work plan is $22,855 plus GST.

A detailed breakdown of the person-hours per task, total hours per individual, fees and disbursements per task is presented on the attached fee estimate spreadsheet. The use of sub-consultants in not anticipated.

6.1 Disbursements

Office disbursements, such as the cost of land and cellular telephone, courier charges, document reproduction, faxes, scans, and drawing plotting and reproduction are charged at a flat 6% of fees.

Out of Pocket Expenses

Out of pocket disbursements, such as meals, are charged at cost plus 10%.

Sub-Consultants

Sub-consultant costs are charged at cost plus 10% to cover handling and overhead, and the additional cost of professional liability insurance on sub-consultant fees.

…/5

Strathcona Regional District
Ms. Sheena Fisher

Vehicle Mileage
Mileage will be charged at $0.60 per km or at a daily rate of $50.00 for less than 83 kms per day.

GST
GST will be charged additional to all fees and disbursements.

6.2 Invoices

Invoices will be submitted monthly, based on the number of hours worked on the project during the previous month.

Total charges on the project will be determined by the hours worked, not exceeding the upper limit detailed above, unless extra work is authorized.

We trust this proposal is sufficient for your needs at this time and meets with your approval. Please call if you have any questions or wish to discuss any matter in greater detail.

We look forward to your response.

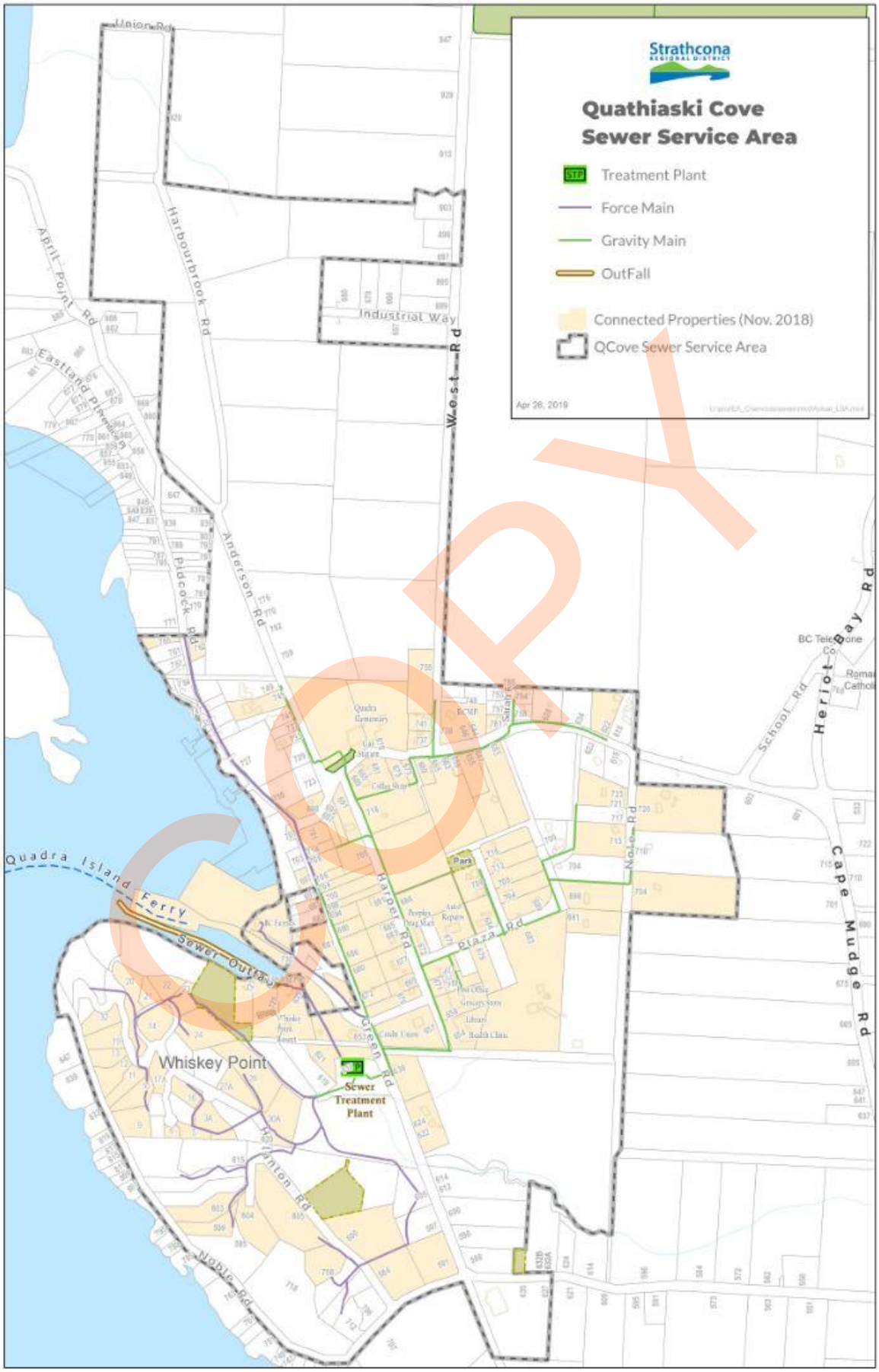
Yours truly,

KOERS & ASSOCIATES ENGINEERING LTD.

Chris Downey, P.Eng.
Principal

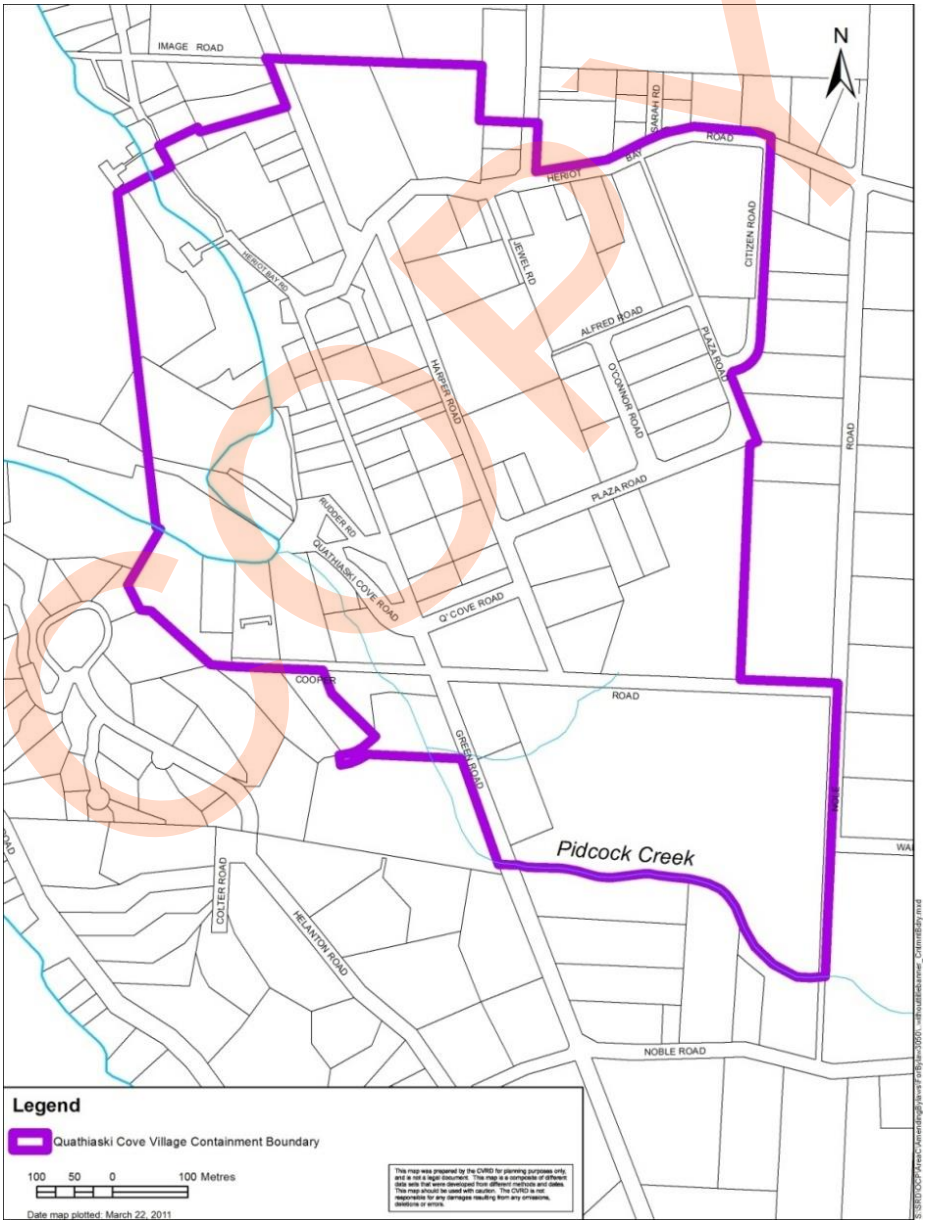
Attachments

- Quathiaski Cove Sewer Local Service Area Plan
- Map 1 – Village Area Plan (from Quadra Island OCP)
- Detailed Fee Estimate Spreadsheet



- *Public Space for People* - the principle that the automobile is under control and that there are public commons, greenways and market squares anchoring the plan.
- *Village Traditions* - the principle that buildings are at a small scale, they provide congenial meeting places, and nature runs throughout.
- *Respecting Natural Systems and Living Within Budgets* - the principle that water flows and soils are protected, and that development is designed to reduce energy use, carbon emissions and waste to well below typical levels.
- *Future Ready* - the principle that designs are adaptable to future changes, new technology local productivity and economic viability.

1.4.2 The Village Plan Area - The Quathiaski Cove Containment Boundary



MAP 1 – VILLAGE PLAN AREA