

Core Area Inflow & Infiltration Program - 2023 Report



Capital Regional District | October 2023



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CORE AREA INFLOW & INFILTRATION PROGRAM

2023 REPORT

EXECUTIVE SUMMARY

The Core Area Liquid Waste Management Plan (CALWMP) sets out goals and commitments for the municipalities, First Nations and Capital Regional District (CRD) to manage I&I through the Core Area I&I Management Plan. Each year, the Core Area I&I Program documents progress toward meeting these commitments in an annual report that is distributed to each of the core area municipalities and First Nations. Overviews of municipal I&I actions, along with specific actions from this reporting period, are as follows:

- Colwood diligently inspects its new underground infrastructure to manage and prevent I&I. In 2022 to mid-2023, Colwood identified and corrected two cross connections, found two manholes with I&I issues (fixes in progress), and camera inspected 7.6 kilometers of sewer pipe.
- Esquimalt developed a plan for I&I reduction in the Colville Catchment, which was identified as the top priority in its I&I Management Plan. Detailed designs for the work will be prepared in the second half of 2023 with construction to follow. In 2022 to mid-2023, Esquimalt lined 80 meters of sewer main and repaired or replaced 21 sewer laterals and seven stormwater laterals. Working with the CRD Source Control program, Esquimalt removed a cross-connection that was a source of contaminants to the Gorge Waterway
- Langford has a young sewer system and proactively keeps its I&I low to preserve sewer capacity for future growth. In 2022 to mid-2023, Langford completed numerous inspections in the Happy Valley Catchment and Phelps catchments to ensure that the inspection chambers in low lying areas were tight throughout the wet weather season. Langford also inspected 92 manholes and 5028 meters of sewer main for I&I. Follow-up work included plugging manholes suspected of being sources of I&I during large storms and repairing or upgrading inspection chambers.
- Oak Bay will soon be starting construction of the Uplands Sewer Separation Project. The first phase with focus on the Humber catchment and will include new stormwater infrastructure (mains, manholes, catch basins, laterals) and the relining of three kilometers of sewer main. It's anticipated that construction will start in Fall of 2023 and be completed by December 2025. In 2022/2023, Oak Bay found 18 sewer cross-connections, nine of which have already been fixed. Oak Bay currently has several sanitary/stormwater upgrade projects in progress or in the pipeline. Oak Bay records show that 25 new sewer laterals were installed, and three unused sewer laterals were capped.
- Saanich continues its sewer maintenance and repair program, including camera inspections, sewer relining, smoke testing and flow monitoring. In 2022 to mid-2023, Saanich removed five stormwater cross-connections to the sewer system. It repaired or replaced 2,000 meters of sanitary sewer (including 134 new sewer service connections with inspection chambers), 15 sewer connections (with inspection chambers) and 19 manholes. It camera-inspected 18,400 meters of sewer main and completed eight spot repairs. Saanich also updated its Sewer Master Plan and sewer model, developed a replacement strategy for "no-corrode" (tarpaper) sewer laterals, and is developing an ongoing camera inspection program for critical sewers and trunk sanitary sewers.
- Victoria continues to manage its sewer repair and replacement work according to its sewer master plan. In 2022 to mid-2023, Victoria relined or replaced 1,510 meters of sewer pipe, eight manholes and 63 sewer laterals. T-liner technology, which focuses on sealing the interface of the sewer main and laterals, was used at 27 locations. Victoria camera inspected 34 kilometers of sanitary sewer mains. 470 meters of sewer mains were replaced by open trench excavation along with 16 sanitary laterals.

- View Royal continued its programs related to sewer maintenance and repairs, camera inspections, sewer flushing and flow monitoring. In 2022 to mid-2023, View Royal upgraded the Helmcken Bay pump station, including the addition of a flow meter.
- Esquimalt Nation had its sewer system inspected in 2018. Follow-up work included removing/capping four unused sewer laterals, repairing a manhole, doing a sewer main spot repair, and renewal of the Nation's sewer pump station. The Nation's sewer flows are not currently measured but the CRD plans to install a permanent sewer flow meter for the Nation in late 2023/2024. Amongst other things, the meter will be useful for determining if additional I&I reduction work is needed.
- Songhees Nation does routine sewer maintenance and repairs, as needed. In 2015, the Nation hired a consultant to investigate its sewer system for I&I sources and to provide detailed designs for remediation. For years, the work was ready for tender and awaiting funding from Indigenous Services Canada. It's been indicated that construction will start in 2024.

Through the Core Area I&I Program, the CRD continues to work with its municipal and First Nations partners on I&I-related management and reduction efforts. This includes regional flow monitoring, standardizing I&I approaches, preparing management plans and annual reports, education programs and private property I&I initiatives. This also involves coordination with municipalities and national organizations that are dealing with similar issues. Key actions completed in 2022-2023 included:

- Flow data vetting and analyses including a comparison of measured sewer flows to the flow allocations in CRD Bylaw No. 4304.
- Supporting the CRD update of Section 5 of the CALWMP, which deals I&I and overflows. (The Province required this update as part of its conditional approval of Amendment 12 of the LWMP.)
- A 1.5 hour webinar to the Canadian Association of Home and Property Inspectors regarding the CRD's educational materials related to "inspecting and maintaining underground pipes to reduce the risk of basement flooding".
- Work with the Saanich Peninsula municipalities to prepare initial I&I management plans (draft), including pump station derived sewer flow data, using tools and techniques from the Core Area I&I Program. (This work was funded through a separate budget.)

The following table summarizes the keys I&I related stats for each of the core are municipalities and First Nations.

Jurisdiction	Ave. Pipe Age ¹ (years)	Contributes to Overflows (for sub 5yr. storms)	Peak 24hr Flow (for a statistical 5yr. storm)	
			Compared to ADWF ²	Compared to CRD Bylaw Flow Allocation ³
Colwood	20	No	2.3 x ADWF	41% Allocated Flow
Esquimalt	87	No	6.9 x ADWF	106% Allocated Flow
Langford	17	No	2.0 x ADWF	30% Allocated Flow
Oak Bay	76	Yes	~9.0 x ADWF	>143% Allocated Flow
Saanich	48	No	3.4 x ADWF	63% Allocated Flow
Victoria	95	Yes	5.4x ADWF	98% Allocated Flow

Jurisdiction	Ave. Pipe Age ¹ (years)	Contributes to Overflows (for sub 5yr. storms)	Peak 24hr Flow (for a statistical 5yr. storm)	
			Compared to ADWF ²	Compared to CRD Bylaw Flow Allocation ³
View Royal	35	No	3.5 x ADWF	~50% Allocated Flow
Esquimalt First Nation ⁴	43	No	5.1x ADWF	101% Allocated Flow
Songhees First Nation	43	No	5.1x ADWF	106% Allocated Flow

¹ Average pipe age directly correlates to I&I as pipes deteriorate over time. Additionally, pipe materials and installation practices have improved greatly over time.

² The key I&I commitment in the Liquid Waste Management Plan is to be under 4x ADWF by 2030.

³ The peak 24-hour flow allocations in CRD Bylaw 4304 were setup based on requests from each municipality/First Nation, the core area sewer model and consultant expertise. If the allocations aren't exceeded, sub-5-year overflows should not occur.

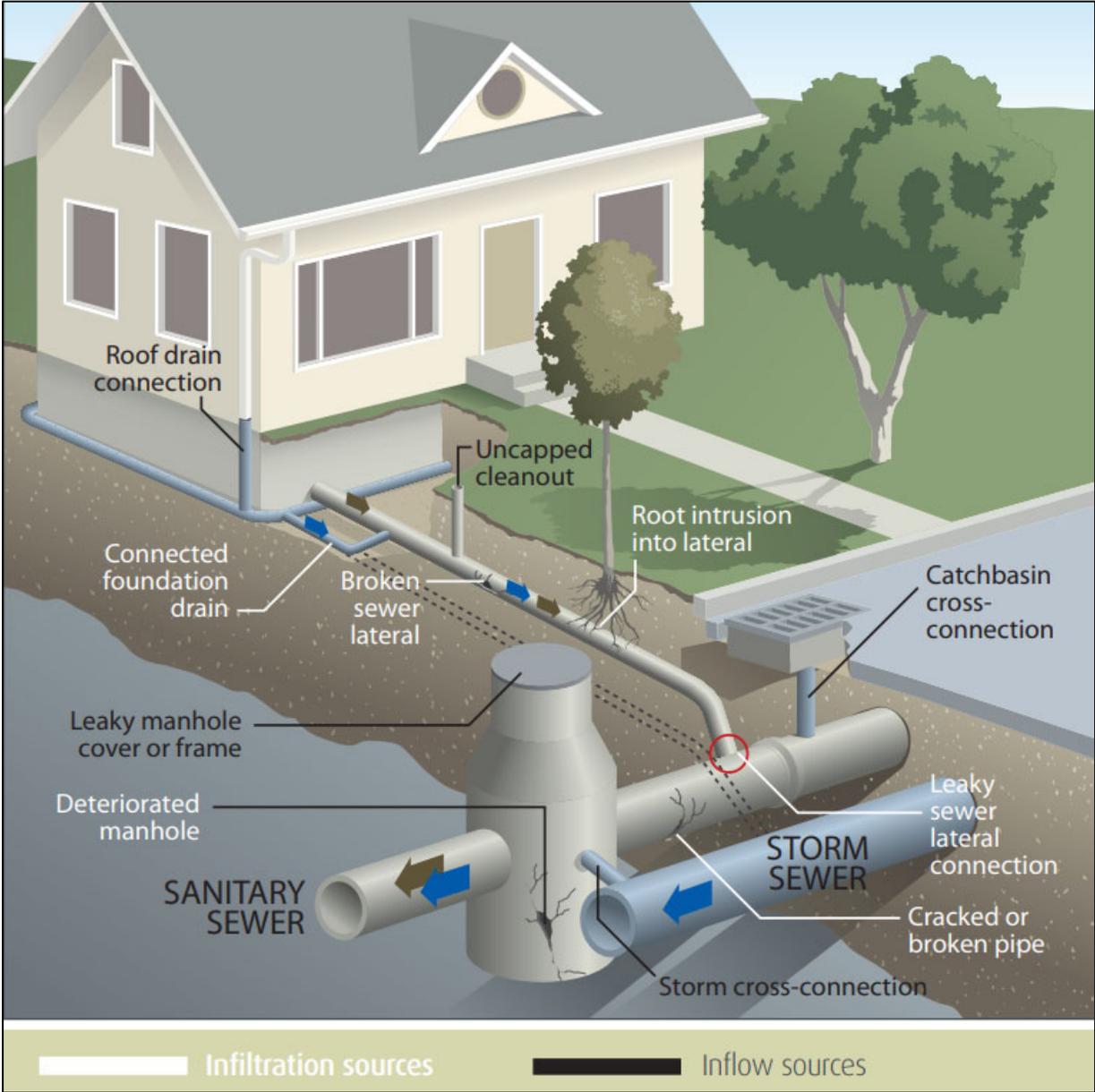
⁴ Jurisdiction is not flow metered. The flows are based on a correlation with a nearby catchment as recommended by a consultant.

1. BACKGROUND

1.1 Inflow & Infiltration

Inflow and infiltration (I&I) refers to rainwater and groundwater that enters the sanitary sewer through a variety of defects (Figure 1.1). Inflow sources allow rainwater to enter the sanitary sewer through improper plumbing connections such as cross-connected roof drains or catch basins. Infiltration sources allow groundwater to seep into the sanitary sewer through cracks or bad joints in sewer pipes and manholes. A certain amount of I&I is unavoidable and is accounted for in routine sewer design. However, when I&I exceeds design allowances, sewer capacity is consumed and may result in overflows, risks to health, damage to the environment and increased conveyance treatment and disposal costs.

Figure 1.1: Common Sources of I&I



1.2 Drivers for I&I Reduction

Municipalities have finite resources and budgets which must be allocated based on their council's priorities and direction. For an I&I related capital project to be approved, it generally needs to strongly support one or more of the following interrelated "drivers".

- Regulatory compliance (i.e., preventing overflows and excessive I&I).
- Asset management (i.e., maintaining sanitary sewer systems and replacing components at the end of their service life).
- Future growth (i.e. maintaining or creating sewer capacity for future development / densification).
- Climate change (i.e. climate models predict more extreme rainfall events in the future. As such, sewer capacity needs to be maintained or created to accommodate this to prevent overflows).
- Synergistic upgrades (i.e. combining related when doing upgrades (i.e. if a road needs to be dug up to replace sewers, there is an opportunity to cost effectively replace other buried infrastructure at the same time).

1.3 Study Area

The CRD's core area is a partnership of seven local governments and two First Nations. These include Colwood, Esquimalt, Langford, Oak Bay, Saanich, Victoria, View Royal, the Esquimalt Nation and the Songhees Nation. Sewer flows from these jurisdictions discharge to CRD trunk sewers. The flows are then conveyed to the McLaughlin wastewater treatment plant (Figure 1.2). Table 1.1 summarizes the sewer infrastructure in the core area.

Figure 1.2 Map of the Capital Regional District Core Area Highlighting the CRD Trunk Sewers



Table 1.1: Sewer Infrastructure in the CRD Core Area

* Excludes Hartland Landfill site, but includes Hartland Leachate Line

Jurisdiction		Gravity Sewers (km)	Force Mains (km)	Man holes	Pump Stations	Laterals **	Average Pipe Age *** (years)	% Developed Properties Connected to Sewer
Colwood	Municipal	37	7.3	568	10	2,159	19	45%
	Private	5.2	3.7	120	12		20	
	Gov't of Canada	6.7	2.7	125	6		31	
Esquimalt	Municipal	57	4.0	874	12	3,404	55	100%
	Private	0.2	0.0	3	0		86	
	Gov't of Canada	16	4.5	368	23		50	
Langford	Municipal	118	22	1,769	14	8,522	16	83%
	Private	11.4	2.1	167	10		15	
Oak Bay	Municipal	100	2.0	1,312	7	3,813	75	100%
	Private	2.4	1.4	32	3		27	
Saanich	Municipal	550	19	6,503	39	29,475	42	94%
	Private	7.1	0.4	122	153		34	
Victoria	Municipal	233	3.2	2,855	12	13,676	94	100%
	Private	0.0	0.0	3	2		N/A	
View Royal	Municipal	45	5.8	864	17	2,119	34	96%
	Private	2.4	0.6	33	5		17	
First Nations	Esquimalt	1.4	0.3	22	1	N/A	27	100%
	Songhees	N/A	0.3	N/A	1	N/A	N/A	99%
CRD Owned *		52	48	293	16	3	0	N/A
Total		1,247	128	15,979	200	62,646		

** Some estimated

*** Based on gravity and force mains

1.4 Liquid Waste Management Plan I&I Commitments

Section 5 of the CALWMP is entitled “*Management of Infiltration and Inflow and Control of Wastewater Overflows*” (Appendix A). The key commitment is as follows: “the CRD and the participating municipalities commit to the following actions to reduce I&I sufficiently to reduce maximum daily wet weather flows to less than four times the average dry weather flow by 2030.”

As a condition of Amendment 12 to the CALWMP, the CRD is required to update Section 5 of the CALWMP. The current version of Amendment 12 is out of date as the action steps are complete. In the summer of 2023, the CRD initiated a formal process for the update of Section 5 (consultant, technical and community advisory committee, etc.) with the work taking place in the second half of 2023.

Appendix B contains the executive summary for the Core Area I&I Management Plan.

1.5 CRD Bylaw Requirements for I&I

CRD Bylaw 2312, as amended by Bylaw No. 4304 (2020), allocates the maximum allowable average dry weather flow and peak wet weather flow for each municipal / First Nation input into the regional sewer system. The bylaw also includes a process for addressing bylaw exceedances. To help assess compliance

with the bylaw, the CRD continuously measures the flows entering the regional sewer system and once a year sends each municipality / First Nations a summary of how their flows compare to their allocations.

The CRD also informs the core area municipalities and First Nations about their flows into the regional sewer system through monthly sewer reports (key tables, figures, stats, etc.) that are distributed quarterly. Appendix C contains an example of a monthly sewer report.

1.6 Progress on Reducing Overflows and Sewage Discharges to the Environment

Prior to late 2020, all core area sewage was discharged to the marine environment through the CRD's Clover pump station or Macaulay pump station deep sea outfalls. The sewage from both locations was screened for solids but was not treated. These discharges were allowed by permit, through the Ministry of Environment.

Prior to 2022, several CRD sites in the core area routinely overflowed during storm events. When overflows occurred, they were investigated, documented, and reported to Emergency Management BC.

Significant effort and resources have been used to reduce overflows and untreated discharges to the marine environment in the core area. Table 1.2 highlights this work.

Table 1.2: Core Area Projects to Reduce I&I / Overflows

Project	Impact on Overflows	Cost
McLoughlin Treatment Plant (2020)	Treats sewage for the entire core area.	~\$760M Part of core area treatment plant project
Arbutus Storage Tank (2021)	Used during storm events to temporarily store sewer flows from Saanich. Results in additional downstream capacity and reduced overflow frequency/volumes at Clover.	
Trent Forcemain Connector (2021)	Removed a bottleneck in the CRD trunk sewer system. Eliminated overflows from multiple locations for sub-5-year storms.	
Clover Pump Station Upgrade and Forcemain (2020)	Pumps sewage from the east side of the core area to the treatment plant. Before 2020, none of this sewage was treated.	
Craigflower Pump Station Replacement (2015)	The old Craigflower pump station reached the end of its design life and did not have enough capacity for the Westshore's growth. The new pump station has more capacity, but the forcemain will need to be upsized to meet future demand.	
Trent Pump Station and Forcemain (2008)	Eliminated sub-100-year overflows to Bowker Creek, which is a highly sensitive receiving environment.	~\$20M
Installed Screens / Screening Chambers at all CRD Overflow Locations	The screens ensure that any overflowing sewage doesn't have particles over six millimeter in size, reducing impacts on the environment.	
Marigold Storage Tank (2001)	Eliminated sub-5-year overflows to Colquitz Creek and the Gorge Waterway, which are environmentally sensitive to sewage.	

Project	Impact on Overflows	Cost
Municipal PS upgrades (2000 ongoing)	Various projects including adding Supervisory Control and Data Acquisition (SCADA) systems, backup power and storage tanks to help eliminate overflows to nearby waterways; notably the Gorge Waterway.	
Oak Bay's Separation of the Combined Sewers in the Uplands (Ongoing, construction starting in 2023)	These sewers currently overflow during relatively small rainfall events. The Province and Oak Bay have an agreement in place for the separation of these sewers.	~\$20M
Ongoing Flow Monitoring and I&I Analyses	The CRD and municipalities have mature, ongoing programs for sewer investigation, rehabilitation, upsizing, and renewal. The work is supported by the collection of sewer flow data from almost 100 sewer flow meter sites and routine I&I analyses.	

With the work in Table 1.2 largely complete, the core area sewer model predicts that the only location that should overflow for sub-5-year rainfall events is the Clover pump station long outfall; the same outfall that discharged sewage continuously from the 1970's to 2020. The model estimates that overflows would be at least 4x dilute (equivalent to primary treatment levels) for approximately 80 hours annually (less than 1% of the total annual flow). *Note that Oak Bay's combined sewers in the Uplands also overflow during rainfall events but Oak Bay has submitted a Combined Sewer Separation Plan to the Province for their approval.*

Future overflow reductions would need to come from a combination of the following:

- I&I reduction work at the defect-by-defect level, which is expensive and time consuming. Ideally, this work would be addressed long term through Sewer Master Plans and Asset Management Plans due to the high cost. (For reference, its estimated that it would take less than \$200 million to eliminate sub-5-year overflows from Clover, with work focused on municipal sewers and private laterals in Oak Bay and Victoria).
- Storage tanks, which are difficult to site and don't fix the underlying issues related to sewer condition and I&I. (For context, the core area "Sanitary Model Update and Flow Study" report notes that the peak overflow volume for a 5-year storm at Clover Point is 57,000 cubic meters, a volume roughly equivalent to 11 Arbutus storage tanks.
- Wet weather treatment plant(s), which would operate for approximately 80 hours per year and don't fix the underlying issues related to sewer condition and I&I.

Complicating things is the commonly accepted notion that half of all I&I comes from private property.

1.7 Public Property vs. Private Property I&I (PPI&I)

Property owners own and are responsible for maintaining their sewer laterals from their home/building to the property line. Municipalities own and are responsible for maintaining the municipal sewers as well as laterals located between the property line and the municipal sewer main (Figure 1.3). The exception to this is Oak Bay (Figure 1.4), where property owners own and are responsible for maintaining the entire lateral from their home/building to the municipal sewer main.

Figure 1.3: Sewer Lateral Ownership and Responsibility *(except Oak Bay)*

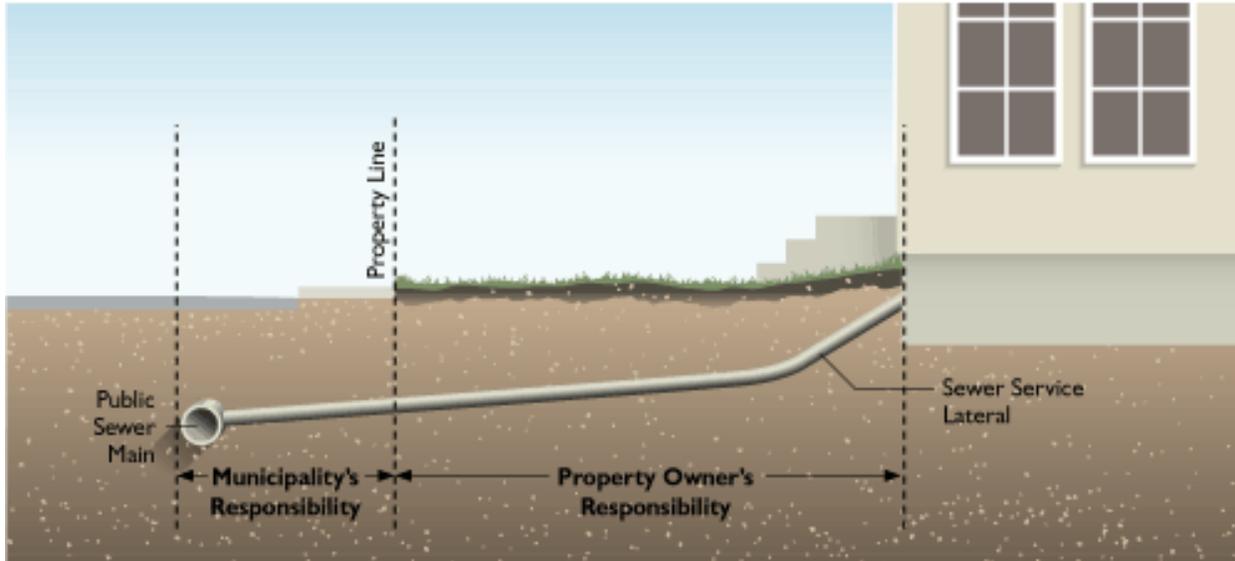
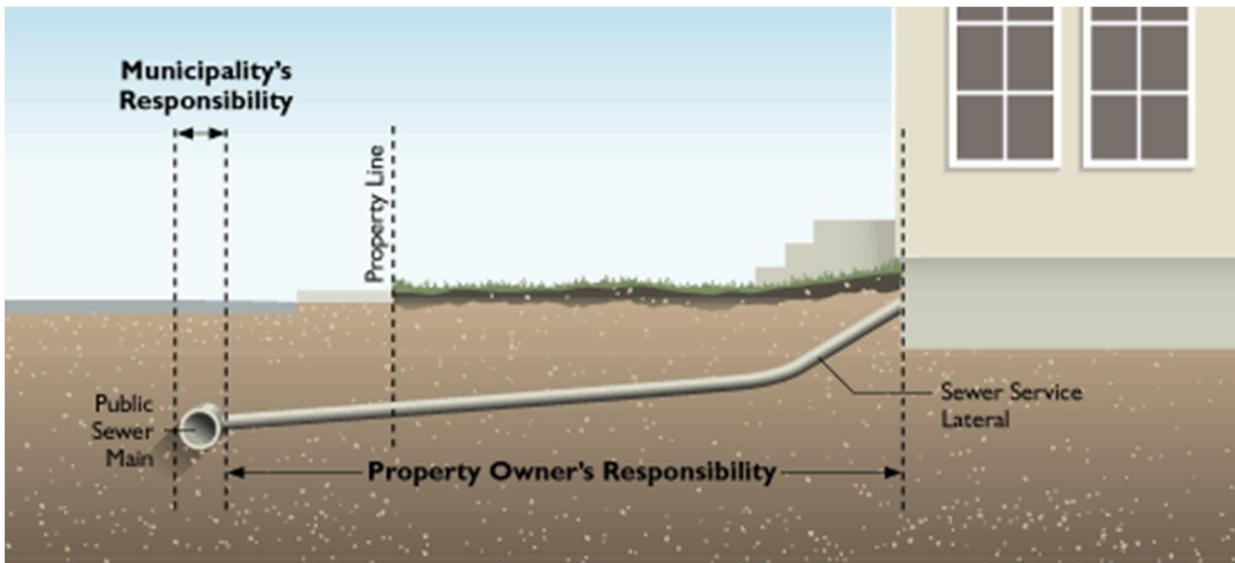


Figure 1.4: Sewer Lateral Ownership and Responsibility in Oak Bay



Municipalities and regional districts generally have mature programs for inspecting, maintaining, and replacing their sewer pipes. In contrast, property owners rarely inspect or repair their laterals unless there has been a pipe failure or blockage.

1.8 Private Property I&I Initiatives

In North America, it is commonly estimated that half of all I&I comes from private properties. As such, it is important that municipalities adopt strategies for addressing it. Since 2010, the core area I&I program has worked on education initiatives and options for private property I&I programs for the core area (Appendix D).

The CRD has two sets of well-developed education approaches for I&I. The goal of both approaches is to encourage the inspection and maintenance of sewer laterals. The first approach (2010) provides a general background on I&I and overflows. This approach is typical for I&I education in North America. The second approach (2020) focuses on encouraging the maintenance of underground pipes to prevent basement flooding. This approach is novel and was built through collaboration with stakeholder groups (insurance industry, realtors, plumbers, home inspectors, etc.). It resonates with the target audience, especially at the following times: time of home sale, when applying for a building permit, when interacting with a plumber or during times of flooding.

The CRD has also worked towards establishing private property I&I programs for the core area. This includes reports summarizing private property I&I approaches from around North America in 2011, 2014, and 2022 as well as novel local solutions. However, addressing private property I&I has proven difficult for the following reasons:

- Politically, these programs are hard to implement because it's so rare for municipalities with separated sewer systems (i.e., separate pipes for sewage and stormwater) to have programs that substantially address private property I&I. There are currently no such programs in Canada. The approximately 40 such programs in the USA were mandated by the Environmental Protection Agency.
- The work is expensive. Pipe inspections cost approximately \$250 and fixes typically cost in the thousands.
- Municipalities have liability risks when working on (or requiring work on) private property.
- Municipalities face tough decisions for how they prioritize their finite municipalities resources (i.e., staff time, tax dollars).
- The issue is complicated. For example:
 - Private property I&I is only a problem in catchments with elevated I&I. It's often not a problem in younger catchments/municipalities with low I&I.
 - Fixing cross-connections is the most efficient way to address private property I&I but finding them is complex and time consuming.
 - Voluntary approaches generally have very little uptake.
 - Regulatory programs (i.e. time of sale lateral replacements) have the downside of impacting large numbers of properties that don't contribute to I&I. In addition, efforts to implement these programs consistently fail unless the programs are imposed by a regulator.

1.9 Core Area I&I Program

The I&I program is guided by the Core Area I&I Subcommittee, which was established in the mid-1990s to work regionally to identify various methods of reducing and controlling I&I. The subcommittee comprises representatives from the CRD, Colwood, Esquimalt, Langford, Oak Bay, Saanich, Victoria and View Royal, and typically meets several times per year. The goals of the program are to:

- Prepare annual I&I reports and I&I Management Plans.
- Collect or generate sewer flow data and analyze for I&I.
- Carry out studies to better understand I&I related issues and options for moving forward.
- Assist municipalities with tasks related to I&I.

- Develop strategies to understand and address private property I&I.
- Develop education strategies encouraging the repair and maintenance of private property laterals.
- Work in collaboration with Metro Vancouver and other jurisdictions on issues related to I&I.
- Prepare monthly wastewater flow/I&I reports for each core area municipality and First Nation (aimed at municipal engineering staff and First Nations administration) to help them better understand their sewer flows.

2. KEY ACTIONS: 2022 TO MID 2023

2.1 Colwood

Colwood diligently inspects its new underground infrastructure to manage and prevent I&I. In 2022 to mid-2023, Colwood:

- Discovered and corrected two cross connections.
- Repaired or replaced four sanitary sewer frames and castings.
- Repaired 10 inspection chambers.
- Camera inspected numerous inspection chambers.
- Camera inspected 7,606 meters of municipal sewer mains.
- Identified two sources of I&I in sanitary manholes (fixes in progress).
- Collected long-term flow data from Colwood's Wilfert, Metchosin, and Ocean pump stations along with the DND Belmont pump station (data collected by the CRD's I&I program).

Colwood's is currently drafting a report for council recommending an increase in municipal pump station flow monitoring, to help better understand I&I in the municipality. The plan is to work on this initiative with the CRD's I&I program. (The CRD provided similar support for in the past for Colwood's previous SCADA system).

2.2 Esquimalt

In 2022 to mid-2023, Esquimalt worked on the following I&I-related actions:

- Lined 80 meters of sewer main.
- Removed one cross connection on Gosper Crescent removing a source of contaminants to the Gorge Waterway. (Work was coordinated with the CRD Source Control program.)
- Started investigative work identified in Esquimalt's I&I Management Plan.
- Had a consultant develop a plan for I&I reduction in the Colville Catchment, which was identified as the top priority in the Esquimalt's I&I Management Plan. The plan will be used to hire a consultant for detailed design in the second half of 2023 with construction to follow.
- Procured and installed flow monitoring equipment. Data gathered from the new equipment will help staff narrow down I&I issues.
- Installed 15 new sanitary laterals, 15 new stormwater laterals and 10 catch basins.
- Repaired or replaced 21 sewer laterals and seven stormwater laterals that were impacted by blockages or failures.
- Continued its programs related to sewer cleaning, camera inspections and pipe assessments for the remaining portions of the storm and sanitary collection systems.

2.3 Langford

Langford has a rapidly expanding new sewer system. It diligently inspects new connections and is incentivized to monitor and repair the sewer system to preserve sewer capacity for future growth. In 2022 to mid-2023, Langford worked on the following I&I-related actions:

- Inspected 92 manholes for inflow and infiltration.
- Rehabilitated 37 sewer inspection chambers and inspected a further 54 others for I&I issues.

- Inspected and flushed 500 meters of sewer main for I&I focused camera inspections.
- Plugged suspect manholes in the Happy Valley catchment suspected of being sources of I&I issues during large storms.
- Completed numerous inspections in the Happy Valley Catchment and Phelps catchments to ensure inspection chambers in low lying areas were tight throughout the wet weather season.
- Installed 13 concrete boxes on sewer inspection chambers to protect them against damage and I&I issues.
- Repaired two manholes; one with frame and cover issues, and another with grading issues due to surrounding drainage.
- Camera inspected 5,028 meters of sewer. The inspection identified a municipal sewer pipe that had a significant break/gap in the pipe that was subsequently fixed.

2.4 Oak Bay

Oak Bay will soon be starting construction on the Uplands Sewer Separation Project. The first phase of the project will focus on the Humber catchment. The work will include new stormwater mains, manholes and catch basins on Beach Drive, Norfolk, Midland and Ripon, 53 stormwater catch basins along with 152 new stormwater laterals to each property. It also includes lining three kilometers of sewer main. It's anticipated that construction will start in Fall 2023 and be completed by December 2025.

Oak Bay's public works staff carried out the following I&I related actions:

- Flushed/cut/clean 10.7 kilometers of storm mains and 18.3 kilometers of sewer main.
- Dye tested 71 laterals and found 18 cross connections, nine of which have been fixed.
- Completed 25 storm main spot repairs and 18 sanitary sewer spot repairs.
- Installed seven new catch basins and replaced or repaired an additional 25 catch basins.
- Repaired two sewer laterals and two storm laterals.
- Installed one new stormwater manhole and repaired five storm manholes.

Oak Bay records show that the following I&I related work was carried out on private property:

- 16 new houses were constructed with new sewer laterals, storm laterals and inspection chambers.
- Three unused sewer laterals and one unused storm lateral were capped.
- Nine sewer laterals, 17 storm laterals were newly installed or replaced.
- Many inspection chambers were installed at existing homes.

Through contracts, Oak Bay:

- Is updating its storm drain master plan (ongoing).
- Completed storm drain infrastructure projects on Lincoln Road and Margate Avenue.
- Is in the process of updating sewer and stormwater infrastructure on Dalhousie Street.
- Completed reports including the Beach Drive Sanitary Sewer Feasibility Study and Options analysis, Windsor Sanitary Phase 1 and 2, Thompson Storm main upgrades, and Mayhew Storm main upgrades.
- Is in the planning stages for sewer and/or storm work on Runnymede Avenue, Topp Avenue, Meadow Place, Cadboro Bay and Estevan with construction anticipated in the second half of 2023 or 2024.

Oak Bay is planning its transition from paper-based asset management to a digitized approach. The new approach will standardize what information is captured, improve how the data integrates with the asset management program, and include procedures for improving workflows between Public Works and Engineering. The approach will be more efficient and make it easier to log and retrieve key data such as maintenance history, break history etc. As such, the approach will improve how I&I related defects are discovered and addressed.

Note that some of this work overlaps calendar years and thus may be documented in I&I Annual Reports for consecutive years.

2.5 Saanich

Saanich replaces and renews its sanitary sewer infrastructure through its capital and maintenance programs. Saanich carried out the following capital and maintenance activities in 2022/2023:

- Camera inspected and assessed 18,431 meters of sanitary sewer main, almost all on sanitary lines requiring frequently scheduled maintenance.
- Replaced or installed 2,003 meters of sanitary sewer, including 134 new sewer service connections with inspection chambers.
- Repaired 15 sewer service connections, including three which required full pipe replacements.
- Repaired 16 manhole and replaced three manholes.
- Completed eight sewer spot repairs.
- Removed five stormwater cross connections to the sanitary sewer system (three in Brett pump station catchment, two in Wetherby pump station catchment, and one in Cordova Bay pump station catchment).
- Repaired three manholes found to be causing I&I in Cordova Bay Lift Station catchment.
- Inspected 70 potential no corrode sanitary service connections.

Saanich carried out the following planning initiatives in 2022/2023:

- Update of the Sewer Master Plan and sanitary sewer model resulting in recommendations for addressing system deficiencies and prioritized planning initiatives.
- Work to address “no-corrode” (tarpaper) pipe in Saanich including field verified that Saanich’s list of no-corrode pipes was correct, input the data into Saanich’s GIS, and developed a no-corrode service connection replacement strategy.
- Flow monitoring investigations within the Garnet Lift Station and Ash Lift Station catchments to identify Peak Wet Weather Flows and I&I values.
- Developed an ongoing Closed-Circuit Television (CCTV) Program for all critical sewers and trunk sanitary sewers.

The following work is currently in progress:

- Sewer camera inspection and analysis of 30,295 meters of sanitary sewer mains including high priority sewers (checklist lines) and large diameter trunk mains.
- Sewer camera inspection program planning for high-risk sanitary sewers and forcemains.
- Planning the replacement of four sanitary sewer lift stations.
- Reviewing discharge points into the CRD trunk sewer system including I&I reviews and system capacity constraints.
- Operational reviews of the Beach Park Lift Station and Albina Lift Station including smoke testing for their catchment areas
- Developing an internal sewer flow monitoring program operating procedure and I&I response strategy.

2.6 Victoria

The City of Victoria continues to manage its sewer repair and replacement of its infrastructure as part of the Sewer Master Plan, which was fully updated in 2018.

Highlights of the I&I-related work carried out in 2022 include:

- Four FloDar flow meters were upgraded to 4G modems.
- 63.9 kilometers of sanitary sewer mains were cleaned by City crews.
- 11 kilometers of sewer mains were camera inspected by City crews.
- 5.4 km of sanitary sewer mains were inspected by contractors along with 755 sewer and stormwater laterals.

- 1,510 meters of sanitary sewer mains were relined using cured-in-place technology under the City's annual lining contract.
- 27 sanitary sewer laterals were relined using T-liner technology with a focus on sealing the main/lateral interface. As part of this work, eight inspection chambers were also installed, and 101 meters of sewer lateral were relined using cured-in-place technology.
- 354 linear meters of sanitary sewer mains, and five sanitary sewer manholes were replaced by open trench excavation by city crews and 29 sanitary sewer laterals were repaired/replaced during construction.
- The Disaster Mitigation and Adaptation Fund program under a federal grant has commenced. The program's goal is to upgrade select sewer, storm drain and water main infrastructure over nine years to address challenges due to natural hazards (e.g., earthquakes, climate change as well as increased demand). The design and construction work started in late 2020 and will continue until 2028. As part of the grant, six sanitary sewer manholes and 403 meters of sanitary sewer mains were replaced by open trench excavation by contractors in 2022.

Highlights of the I&I-related work carried out in in the first half of 2023 include:

- 11,900 meters of sanitary sewer mains were CCTV inspected by City of Victoria crews.
- 4,970 meters of sanitary sewer mains were inspected by contractors along with 157 sanitary sewer laterals.
- 77.3 kilometers of sanitary sewer mains were cleaned by City crews.
- Three sanitary sewer manholes were replaced by City crews as part of ongoing system maintenance.
- 130 meters of sanitary sewer mains were repaired by City crews following an assessment of the main condition.
- 12 sanitary sewer laterals were repaired, and 24 sanitary sewer laterals have been replaced by City crews.
- 118 linear meters of sanitary sewer mains was replaced by open trench excavation by City crews along with 11 sanitary laterals.
- One catch basin was upgraded.

2.7 View Royal

View Royal continues its sewer maintenance and repair program, which includes camera inspections, sewer flushing and flow monitoring. In 2022 to mid-2023, View Royal completed the following sewer work related to I&I:

- Continued its program of camera-inspecting and flushing sewer mains and manhole inspections.
- Upgraded the Helmcken Bay pump station, including the addition of a flow meter.

2.8 Esquimalt First Nation

In 2018, the Esquimalt Nation hired a consultant to inspect its sewer system and prepare a report containing recommendations for maintenance, repairs and I&I reduction. In 2019 and 2020, the First Nation removed/capped four unused sewer laterals, completed a point repair, grouted a manhole and renewed its pump station. In late 2023 / early 2024, the CRD plans to install a meter to measure the Nation's sewer entering the regional sewer system. The data will be used for core area sewer cost sharing and to monitor the Nation's I&I trends long-term.

2.9 Songhees First Nation

Songhees Nation does routine sewer maintenance and repairs, as needed. In 2015, the Nation hired a consultant to investigate its sewer system for I&I sources and to provide detailed designs for remediation.

For years, the work was ready for tender and awaiting funding from Indigenous Services Canada. It's been indicated that construction on the I&I reduction project will start in 2024.

2.9 CRD

The CRD carried out a number of I&I related actions in 2022 to mid-2023:

- Flow data vetting and I&I analyses for a large network of sewer flow meters.
- Preparing monthly reports for the core area municipalities and First Nations.
- Supporting the CRD update of Section 5 of the CALWMP, which deals I&I and overflows. (The Province required this update as part of its conditional approval of Amendment 12 of the LWMP.)
- The I&I Program delivered a 1.5-hour webinar to the Canadian Association of Home and Property Inspectors on February 28, 2023. The presentation focused on the CRD's educational materials to encourage homeowners to have their sewer laterals inspected to prevent basement flooding. Home inspectors are key stakeholders and were encouraged to use these materials to educate their clients.
- The CRD is in the process of installing six new permanent flow meters. Five of these meters will be used for cost sharing and assessing compliance with the municipal sewer flow allocations in Bylaw 4304. The remaining meter is needed for operational purposes. Construction (kiosks, conduit, meters, etc.) is anticipated for late 2023 and 2024.
- Through separate budgets, the I&I Program worked with the Saanich Peninsula municipalities to prepare initial I&I management plans (draft) using tools and techniques from the Core Area I&I Program. This included significant work to generate sewer flow data from municipal pump stations.

2.4 Future Initiatives

Table 2.1: Anticipated Next Steps for Supporting I&I Reduction

Action	Description / Timeline
Assessing the Accuracy of Municipal Pump Station Flow Data – Phase 2	<ul style="list-style-type: none"> • In 2021, a project was carried out to check the accuracy of municipal pump station flow data generated by the I&I program (Phase 1). For a small number of pump stations, it was found that the methods used to create the flow data were not suitable. The purpose of Phase 2 is to assess options for getting reliable flow data for these pump stations.
Rain Gauge Network Review / Calibration Checks	<ul style="list-style-type: none"> • Rainfall data is critical to I&I calculations. The purpose of this work is to do calibration checks of each of the core area owned rain gauges and to confirm that data is being stored accurately in SCADA.
Pump Station Flow Data for Colwood and Saanich	<ul style="list-style-type: none"> • Colwood and Saanich currently cannot derive sewer flow data from their sewer pump stations. The CRD and its consultants will work with both to assess options and may provide resources for implementation.
Municipal Pump Station Real Time Flows / I&I Monitoring	<ul style="list-style-type: none"> • Sewer flow data for a number of municipal pump stations is currently generated every few years by downloading data from SCADA (i.e., wetwell levels and pump starts/stops) and sending it to FlowWorks.com. The calculations are already setup online. The purpose of this task is to automate the process so that data can be viewed in FlowWorks.com in real time.

3. OVERFLOWS

3.1 Overview

Sanitary sewer overflows are releases of raw sewage into storm drains and/or local waterways. The majority of sewer overflows occur during heavy rainfall events as a result of I&I overwhelming the capacity of the sewer system. Overflows may also occur as a result of sewer blockage, pipe failure and pump station failures. Sewer overflows can expose people, pets and the environment to sewage, harmful chemicals, infectious bacteria, viruses, parasites, etc. The risks associated with sewage releases are influenced by the following characteristics of the receiving environments:

- public use (e.g., shoreline access, kayaking, swimming, shellfish harvesting)
- habitat sensitivity (e.g., productive or endangered habitats such as shellfish areas, kelp beds and herring spawning sites)
- flushing characteristics (e.g., exposed coastline or in-land waters)

CRD staff monitor regional overflow points through the CRD SCADA system, which alerts operators when overflows occur. The core area municipalities have similar systems for monitoring their pump stations for overflows. When overflows occur, they are investigated, documented and reported to Emergency Management BC.

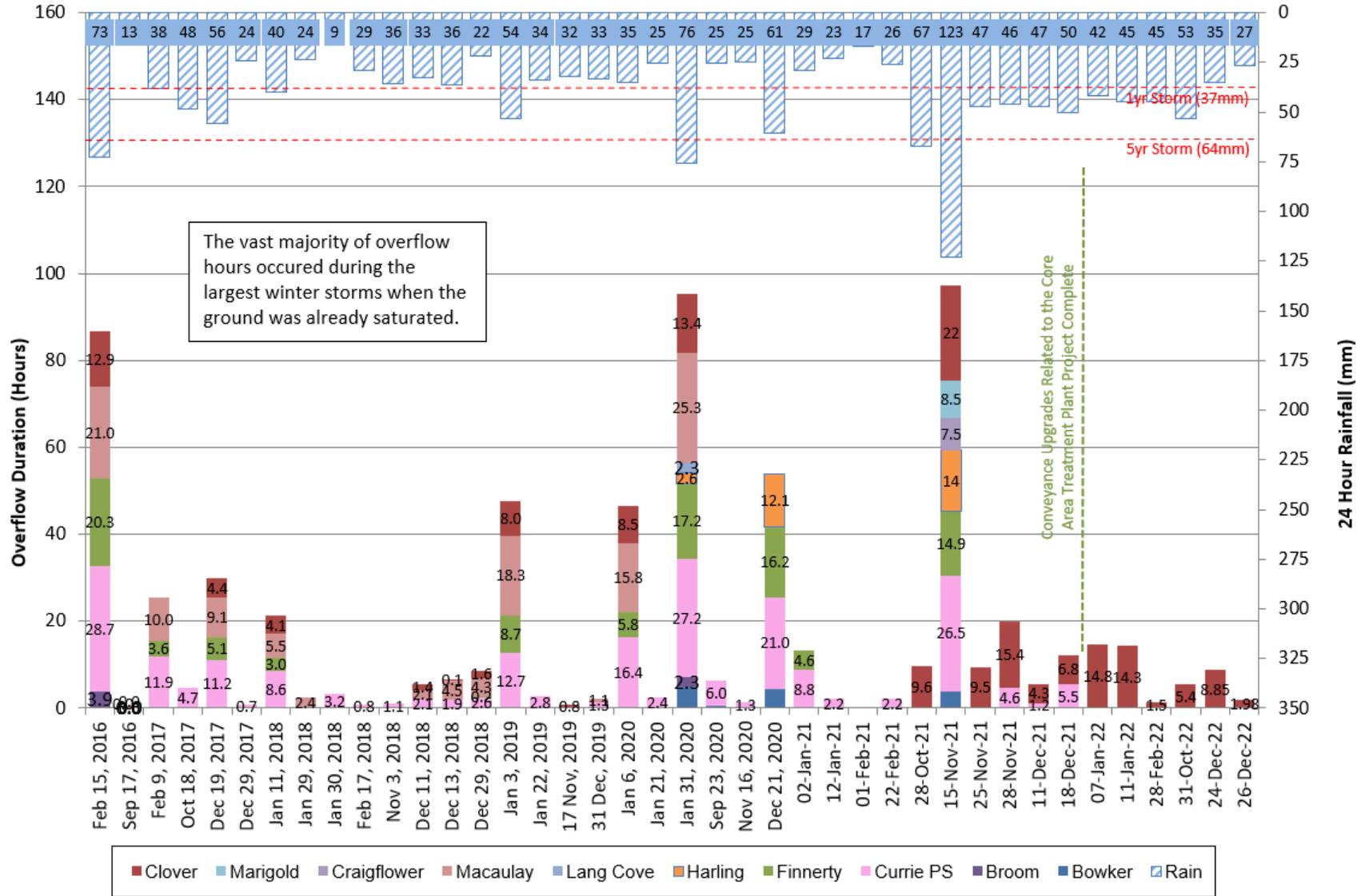
3.2 Reported Overflows

Figure 3.1 summarizes the specific overflow events by year for 2016 to mid-2023. Note that:

- The vast majority of overflow hours occur during very large storm events when conditions are saturated.
- Since the treatment plant project conveyance upgrades were complete (early 2022), the Clover long outfall is the only location in the core area to overflow for sub-5-year rainfall events.
- Overflows from the Humber and Rutland pump stations are excluded from Figure 3.1 because their catchments have combined sewers which overflow during most storms. Oak Bay already has an approved plan with the Province for separating these combined sewer catchments.

Since 2008, overflows to moderate and high sensitivity receiving environments (i.e. Bowker Creek, Gorge Waterway) have essentially been eliminated thanks to a number of high profile projects (see Table 1.2). The only exceptions to this were overflows to Bowker Creek: 1) during a summer storm when the Trent pump station was down for maintenance in 2013, related to the construction of the Trent Forcemain Connector in 2020, and an overflow during a 100-year storm in 2021.

Figure 3.1: CRD Overflows from 2016 to March 2023 (excluding the Uplands)



4. I&I RATES FOR THE CORE AREA

Regional I&I flow rates for the core area are generally analyzed every three years because there are not enough significant storm events to justify I&I analyses on an annual basis. In general, there are between zero to three significant storm events per year. The most recent I&I results analysis was completed using data up to March 2022. The results are documented in this report.

The results of the I&I analyses are summarized as follows:

- A map of the entire core area displaying the most recent 5-year peak I&I rates for individual catchments is in Figure 4.1.
- The individual I&I rates within each municipality have been converted into an overall weighted average for each municipality and compared with previous years' estimated I&I rates (see Table 4.1). This table is useful in providing a performance measure benchmark for each municipality to track overall I&I trends, but it must be interpreted with caution because it summarizes a vast amount of data into single municipal averages. For instance, a single very high I&I sub-area could skew the overall municipal average, or a single year of erratic weather and/or flow data could lead to misleading results. Therefore, it is prudent to allow sufficient time to measure the full effect of any I&I reduction work in addition to gathering, compiling and analyzing weather patterns and I&I rates to track overall trends.
- I&I tends to predictably increase as sewers age due to the deterioration of sewer material, types of sewer material, the environment and the installation practices of the day.
- In general, the rate of I&I tends to increase in proportion to the age of the system due to deterioration of sewer material, types of sewer material, the environment and the installation practices of the day. Older systems usually need more work than newer systems. The primary goal of the I&I program is to reduce I&I to an optimum cost-benefit level. It is expensive to size wastewater facilities to accommodate vast amounts of I&I, but it can be equally expensive to rehabilitate or replace sewers to reduce I&I. Therefore, the optimal I&I level is the most cost-effective combination of I&I reduction and I&I accommodation.

Figure 4.1: I&I Rates Map for the CRD Core Area

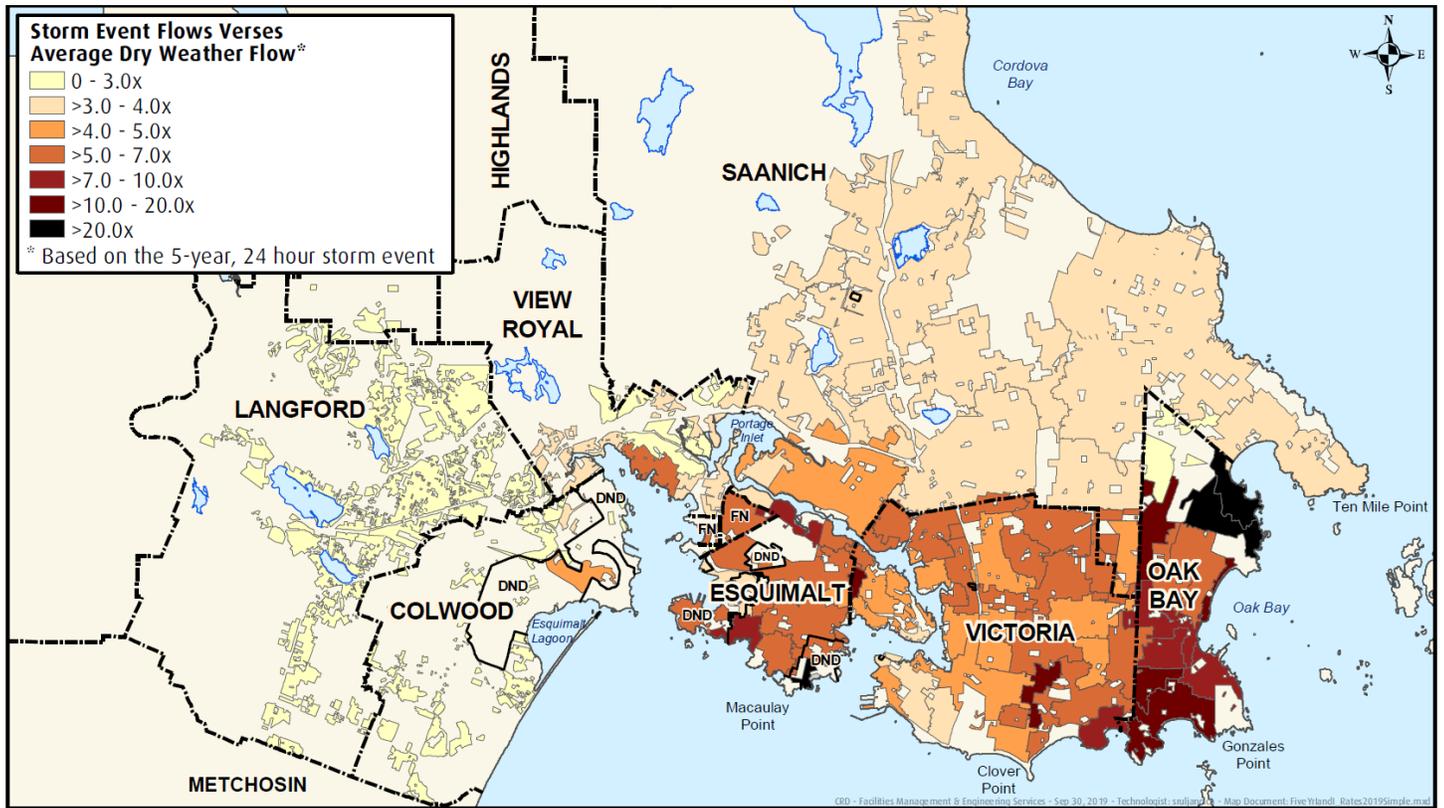


Table 4.1: Summary of CRD Core Area Municipal Peak 5-Year I&I Rates

Municipality	Ave. Age of Sewers	Estimated 5-Year I&I Rate ¹ (L/ha/day)						5-Year Peak Flows ¹ Compared to Average Dry Weather Flow (ADWF)
		2010	2012	2014	2016	2019	2022	
Colwood	20	10,309	8,540	7,965	8,777	8,777	8,777	2.3 x ADWF
Esquimalt	87	52,412	52,599	48,727	51,471	48,786	56,015	6.9 x ADWF
Langford	17	11,023	9,364	9,222	10,606	8,587	10,291	2.0 x ADWF
Oak Bay ²	76	51,873	48,133	46,600	55,686	56,123	56,123 ₃	9.0 x ADWF
Saanich	48	15,514	13,613	15,427	15,223	14,369	15,932	3.4 x ADWF
Victoria	95	96,734	94,281	84,650	76,026	73,490	75,162	5.4 x ADWF
View Royal	35	12,322	12,294	13,216	14,525	11,541	16,037 ₄	3.5 x ADWF
First Nations	43	35,160	35,160	48,052	48,052	38,573	44,457	5.1 x ADWF

¹ Based on peak 24-hour flows. The rates are generally based on data from multiple flow meters, which are interpolated into a weighted average over each particular municipality. A 5-year storm event I&I flow rate is used, since the Municipal Sewage Regulation stipulates that a sewer system must be able to convey flow under this condition without an overflow.

² Excludes the combined sewer in the Uplands (which has I&I rates over 200,000 l/ha/day). Also excludes overflows from the rest of Oak Bay's sewer system because the overflow volumes aren't currently measured.

³ Oak Bay's rate was not updated due to routine sub-5-year overflows. It's expected that these overflows will be eliminated (except in the Uplands) due to the treatment plant project conveyance system upgrades (early 2022) and that future storms will be suitable for updating Oak Bay's overall I&I rate.

⁴ View Royal's increased rate is the result of changes in how the rate was calculated.

5. SEWER ALLOCATIONS

CRD Bylaw No. 4304 (2020) includes maximum allowable sewer flows for each input into the core area trunk sewer system. Each input has an allocated average dry weather flow and an allocated peak daily flow.

Table 5.1 compares measured peak 24-hour flows to the allocated flows from Bylaw No. 4304 and was prepared for information purposes only. Cells highlighted in grey note planned upgrades or known issues. Some of the known issues will be resolved now that the conveyance system upgrades related to the treatment plant project are complete (early 2022). Others are being addressed with current and planned future capital projects.

Table 5.1: Measured Flows (2022) versus Allocated Flows from Bylaw No. 4304

Allocation Point	Allocated Peak Daily Flow (ML/day)	Peak 24 Hr. Flow			
		Past Year (Mar 2022 to Mar 2023)		5-yr Rainfall Event (Statistical; based on multiple storms from recent years)	
		ML/day	% of Allocated Capacity	ML/day	% of Allocated Capacity
COLWOOD					
Total <i>(Calculated as Parson's minus Meaford. During large storm events, the Parson's meter is not reliable, and the storm flows are calculated. The Parson's meter is being replaced in late 2023 / early 2024).</i>	18.8	5.6	29%	7.7	41%
ESQUIMALT					
Esquimalt Panhandle	0.48	0.35	72%	0.44	91%
Lang Cove PS (DND)	0.50	0.27	53%	2.00	0.85
Lang Cove PS (Esquimalt)	0.78	0.36	46%	3.10	2.10
Dockyard	4.04	3.16	78%	3.52	87%
Kinver	1.76	1.72	98%	2.20	125%
Pooley Place <i>(Flows are based on a correlation with an adjacent catchment. Catchment is not suitable for metering due to small size and multiple connections to the CRD system.)</i>	0.24	0.17	69%	0.21	87%
Devonshire	7.40	7.36	99%	10.91	147%
Wilson	1.48	1.13	76%	1.48	100%
Head	6.72	5.34	79%	7.82	116%
Anson	0.97	0.48	49%	0.63	65%
Total	28.36	21.77	77%	30.16	106%
LANGFORD					
Total <i>(Meaford)</i>	56.48	15.40	27%	17.01	30%
OAK BAY					
Windsor	11.68	13.78	118%	16.24	139%

Allocation Point	Allocated Peak Daily Flow (ML/day)	Peak 24 Hr. Flow			
		Past Year (Mar 2022 to Mar 2023)		5-yr Rainfall Event (Statistical; based on multiple storms from recent years)	
		ML/day	% of Allocated Capacity	ML/day	% of Allocated Capacity
Humber <i>(This is catchment has combined sewers. It frequently overflows during moderate to large storm events but the overflow volumes aren't measured. The peak flow values noted to the right are less than actual as they do not include overflow volumes.)</i>	2.40	4.14	172%	4.29 ¹	177% ¹
Rutland <i>(This is catchment has combined sewers. It frequently overflows during moderate to large storm events but the overflow volumes aren't measured. The peak flow values noted to the right are less than actual as they do not include overflow volumes.)</i>	1.48	5.07	342%	5.92 ¹	400% ¹
Currie Net <i>(The data is based on storm events since February 2022 when the treatment plant conveyance system upgrades were completed; eliminating upstream overflows for sub 5-year rainfall events.)</i>	3.88	6.91	178%	>6.91 ¹	>178% ¹
Currie Lift Station	6.48	8.64	133%	12.29	190%
Harling Point PS	0.79	1.35	171%	1.86	236%
Total <i>(The peak flows noted to the right are lower than actual due to unmeasured upstream overflows at Humber and Rutland. Also, the data is only based on storms since the treatment plant conveyance system upgrades were completed in early 2022.)</i>	26.48	37.957	143%	>37.957 ¹	>143% ¹
SAANICH					
Marigold PS	52.76	52.76	43%	35.32	67%
City Boundary	23.52	23.52	31%	10.97	47%
Harriet	13.08	13.08	55%	9.37	72%
Townley	2.44	2.44	49%	1.97	81%
Haultain	2.27	2.27	29%	1.14	50%
Arbutus	28.31	28.31	33%	20.95	74%
Haro - UVic	3.17	3.17	26%	0.81	26%
Penrhyn LS	3.73	3.73	52%	2.99	80%
Total	131.56	131.56	38%	83.52	63%
VICTORIA					
Cecelia	12.57	9.65	77%	14.76	117%
Chapman & Gorge <i>(Flows are based on a correlation with an adjacent catchment. Plans are in place to install a meter in 2024)</i>	1.43	4.11	294%	4.98	356%
Selkirk <i>(Flows are based on a correlation with an adjacent catchment. Plans are in place to install a meter in late 2023 / 2024)</i>	1.11	0.22	20%	0.39	35%
Langford - Vic West	0.77	0.77	100%	1.32	171%
Hereward	7.65	4.04	53%	6.52	85%
Sea Terrace <i>(The flume appears to surcharge during large storms. Options are being explored to address this issue.)</i>	1.32	2.96	224%	2.96	224%
Trent Net	29.25	24.75	84%	43.06	147%
Hollywood	2.16	5.07	235%	7.43	344%

Allocation Point	Allocated Peak Daily Flow (ML/day)	Peak 24 Hr. Flow			
		Past Year (Mar 2022 to Mar 2023)		5-yr Rainfall Event (Statistical; based on multiple storms from recent years)	
		ML/day	% of Allocated Capacity	ML/day	% of Allocated Capacity
Olive	92.24	34.48	37%	63.00	68%
Clover Net <i>(Flows are calculated using data from other cost sharing meters.)</i>	100.71	49.15	49%		
Total	153.19	99.07	65%	150.64	98%
VIEW ROYAL					
Craigflower Pump Station <i>(Flows for this catchment are substantially impacted by the Parson's mag meter, which is being replaced in late 2023 / 2024 to improve accuracy during storm events.)</i>	14.16	3.5	25%	7.1	50%
Shoreline Trunk	0.55	0.4	71%	0.50	91%
Total	14.17	3.9	27%	7.1	50%
ESQUIMALT NATION					
Esquimalt Nation <i>(Flows are calculated. Plans are in place to install a meter in late 2023 / early 2024)</i>	0.28	0.21	74%	0.35	126%
SONGHEES NATION					
Songhees Nation	2.36	1.82	77%	2.49	106%
Maplebank	0.04	0.010	24%	0.005	13%
Total	2.52	1.82	72%	3.09	106%

¹ Value is lower than actual because there are unmeasured upstream overflows.

6. CLOSING

The purpose of this report is to provide an update on work related to I&I in the core area from 2022 to mid-2023. The work supports commitments located in Section 5 of the CALWMP, which addresses the *Management of Infiltration and Inflow and Control of Wastewater Overflows*. The report included:

- summary of special projects carried out by the core area I&I program
- I&I related updates from each of the core area municipalities
- overflow statistics
- current I&I rates
- comparisons of wet weather flows to the sewer flow allocations in Bylaw No. 4304

**Appendix A:
Core Area LWMP Commitments Related to I&I**

**CAPITAL REGIONAL DISTRICT
CORE AREA LIQUID WASTE MANAGEMENT PLAN**
(Consolidated Version incorporating all applicable amendments, February 2019)

**SECTION 5
MANAGEMENT OF INFILTRATION AND INFLOW AND
CONTROL OF WASTEWATER OVERFLOWS**

GOAL

Condition 17(1)(a) of Schedule 1 of the Municipal Sewage Regulation (MSR) requires that if infiltration and inflow (I&I) causes daily flows to be greater than 2 times the average dry weather flow (ADWF), the discharger must address “how I&I can be reduced as part of a Liquid Waste Management Plan” and condition 17(2) outlines the treatment and discharge requirements for such flows.

The goal of the I&I program is therefore to comply with this requirement of the MSR by developing and implementing a strategy aimed at reducing the amount of rainwater and groundwater entering the core area’s sanitary sewer system from both the publicly owned and privately owned parts of the system in order to reduce and eventually eliminate overflows from the system.

How the Capital Regional District (CRD) proposes to substantially meet the requirements of Condition 17(2) is addressed in Sections 4 and 6 and in the draft operational certificate in Section 12.

COMMITMENTS

The CRD and the participating municipalities commit to the following actions to reduce I&I sufficiently to reduce maximum daily wet weather flows to less than four times the average dry weather flow by 2030:

1. Continue flow monitoring in each municipality to further refine priority areas for remediation.
2. Develop, by the end of 2011, and submit to the Ministry of Environment, comprehensive inflow and infiltration management plans for the core area that will:
 - a) Identify and evaluate options and opportunities that promote the minimization of groundwater and rainwater I&I into municipal sanitary sewer systems, including I&I originating from service laterals (private and public sections of sewer connections).
 - b) Identify needed changes to legislation and legal authority to enable options and strategies.
 - c) Identify opportunities for the inspection of private sewers connected to municipal sewers:
 - (i) as part of the municipal process in evaluating and issuing renovation and building permits for serviced properties; and/or
 - (ii) at the time of property transfer; and/or
 - (iii) targeted inspections.
 - d) Require the repair or replacement of private sewers that have cross-connections between storm sewers and sanitary sewer or are identified as being in poor condition.
3. Update, by the end of 2011, and enforce sewer use bylaws to prohibit the construction of rainwater and groundwater connections to sanitary sewers.
4. Implement the overflow reduction plans contained in the sanitary sewer overflow management plan, which was submitted to the Ministry of Environment in June 2008. These plans are summarized as follows:

Table 5.1
 Prioritized Order of CRD Overflow Reduction Plan
 (Updated based on current information)

Priority No.	O/F Name	Action Plan	Estimated Year of Completion	Estimated Cost (\$2008) to Complete
1.	Monterey Avenue MH0130	Complete and commission Trent pump station	2008 (Complete)	\$500,000
2.	Macaulay Point Pump Station	Complete installation of standby power	2008 (Complete)	\$800,000
3.	Harling Pump Station	Install a screen on the overflow pipe	2008 (Complete)	\$10,000
4.	Shoreline Drive MH0340	Commence with capacity deficiency study and identify upgrade options	2010	\$50,000
5.	Penrhyn Lift Station	Investigate pump and genset capacity	2010	\$600,000
6.	Humber Combined Sewers	Oak Bay plans to separate the sewers in the Uplands area	2015	To be determined (Oak Bay cost)
7.	Rutland Combined Sewers	Oak Bay plans to separate the sewers in the Uplands area	2015	To be determined (Oak Bay cost)
8.	Head Street MH0040	Twin the NWT from Macaulay Point to MH0055	2015	\$20,000,000
9.	Sea Terrace MH0055	Twin the NWT from Macaulay Point to MH0055	2015	as above
10.	Broom Road	Extend Trent forcemain down to Clover Point	2017	as above

Table 5.2
 Prioritized Order of Colwood Overflow Reduction Plan

Item No.	Work Name	Description	Estimated Year of Completion	Estimated Cost (\$2008) to Complete
1.	SCADA Upgrade	Upgrade the SCADA system to collect flow data from all pump stations.	2008 (Complete)	\$10,000
2.	CCTV Inspection	Continue to inspect all new sewers that are installed to ensure they are well constructed	Annually	\$15,000
3.	Sewer System Maintenance	Continue to clean all mains and manholes, and repair as necessary.	Annually	\$50,000
4.	Lift Station Maintenance	Continue to maintain all lift station components to ensure that they run efficiently.	Annually	\$72,500

Table 5.3
Prioritized Order of Esquimalt Overflow Reduction Plan

Item No.	Work Name	Description	Estimated Year of Completion	Estimated Cost (\$2008) to Complete
1.	Sewer Relining	Relining and repairs to sewer mains rated poor and poorest	Completed	n/a
2.	Combination Manhole Separation	<ul style="list-style-type: none"> 148 manholes remain to be separated 29 manholes to be separated in 2008 Five manholes separated per year from 2009 to 2025 	2025	\$950,000
3.	Grafton Pump Station Upgrade	New electrical power supply, kiosk and controls	2008 (Complete)	\$38,000
4.	Grafton Pump Station Upgrade	Pump replacement	2012	\$40,000
5.	Sewer Main Replacement	Replacement of undersize sewer main on Craigflower Road between Tillicum Road and Lampson Street	2009 (Complete)	\$250,000
6.	Municipal Wide Smoke and Dye Testing	Smoke and dye testing underway to identify cross connections in attempts to reduce I&I in the future. The full scope of the project has not yet been determined.	2010	unknown

Table 5.4
Prioritized Order of Langford Overflow Reduction Plan

Item No.	Work Name	Description	Estimated Year of Completion	Estimated Cost (\$2008) to Complete
1.	Sewer Master Plan Upgrades	Continue with infrastructure upgrades as identified in the Sewer Master Plan.	Ongoing	\$0.2-0.5 Million
2.	CCTV Inspection	Continue to video inspect all new sewers that are installed to ensure that they are well constructed.	Annually	\$15,000
3.	Manhole Inspection	Continue to visually inspect manholes to ensure that they do not leak.	Annually	\$15,000
4.	Pump Station Maintenance	Continue to maintain all pump station components to ensure that they run efficiently.	Annually	\$200,000
5.	Sewer System Maintenance	Continue to keep the sewers clean and free from defects.	Annually	\$25,000

Table 5.5
Prioritized Order of Oak Bay Overflow Reduction Plan

Item No.	Work Name	Description	Estimated Year of Completion	Estimated Cost (\$2008) to Complete
1a.	Uplands Sewer Separation Humber Catchment	Construction of new storm sewer	To be confirmed by December 31/2019	\$5,285,000
1b.	Uplands Sewer Separation Rutland Catchment	Construction of new storm sewer	To be confirmed by December 31/2019	\$9,815,000
1c.	Uplands sanitary sewer pipeline rehabilitation	Rehabilitation of the former combined sewer pipeline to address infiltration	To be confirmed by December 31/2019	\$3,000,000
2.	Oak Bay Inflow and Infiltration Rehabilitation Project	Continue with phased rehabilitation projects in various catchments	Annually	\$500,000
3.	CCTV Inspection	Video inspection of sewer mains	Annually	\$25,000
4.	Sewer System Maintenance Program	Maintenance to keep sewers clean and free from defects.	Annually	\$240,000

Table 5.6
Prioritized Order of Saanich Overflow Reduction Plan

Item No.	Work Name	Description	Estimated Year of Completion	Estimated Cost (\$2008) to Complete
1.	Dysart Pump Station	Complete construction of the new Dysart pump station.	2008 (Complete)	\$2,500,000 (est.)
2.	The following pump stations will be upgraded: Vantreight Lift Station Murray #1 Pump Station Murray #2 Pump Station Arundel Pump Station Glenwood Pump Station Ashley Pump Station Dunkirk Pump Station Colquitz Pump Station Gorge Pump Station	Rebuild pump station and add a new standby generator.	2009-2015	\$500,000 Annually

Table 5.7
Prioritized Order of Victoria Overflow Reduction Plan

Item No.	Work Name	Description	Estimated Year of Completion	Estimated Cost (\$2008) to Complete
1.	James Bay I&I Pilot Project	Commence with the rehabilitation of sewer mains, laterals and manholes in James Bay.	2010	\$3,000,000
2.	Hydraulic Model	Continue to complete a hydraulic model of the City's entire sanitary sewer collection system.	2009	\$100,000
3.	Overflow Elimination	Investigate, monitor and abandon, if possible, existing known overflow locations.	2010	\$100,000
4.	Combined Manhole Separation	Investigate, monitor and initiate a program to separate combined manholes.	2015	\$400,000

Table 5.8
Prioritized Order of View Royal Overflow Reduction Plan

Item No.	Work Name	Description	Estimated Year of Completion	Estimated Cost (\$2008) to Complete
1.	Upgrade Pump Stations	Upgrade pump stations where required to improve pump performance, provide standby power and collect better data.	2017	\$140,000
2.	CCTV Inspection	Continue to video inspect all new sewers that are installed to ensure that they are well constructed.	Annually	\$20,000
3.	Manhole Inspection	Continue to visually inspect manholes to ensure that they do not leak.	Annually	\$5,000
4.	Pump Station Maintenance	Continue to maintain all pump station components to ensure that they run efficiently.	Annually	\$120,000
5.	Sewer System Maintenance	Continue to keep the sewers clean and free from defects.	Annually	\$40,000

APPENDIX C

Excerpt from the Capital Regional District Core Area Liquid Waste Management Plan – Sanitary Sewer Overflow Management Plan, June 2008.

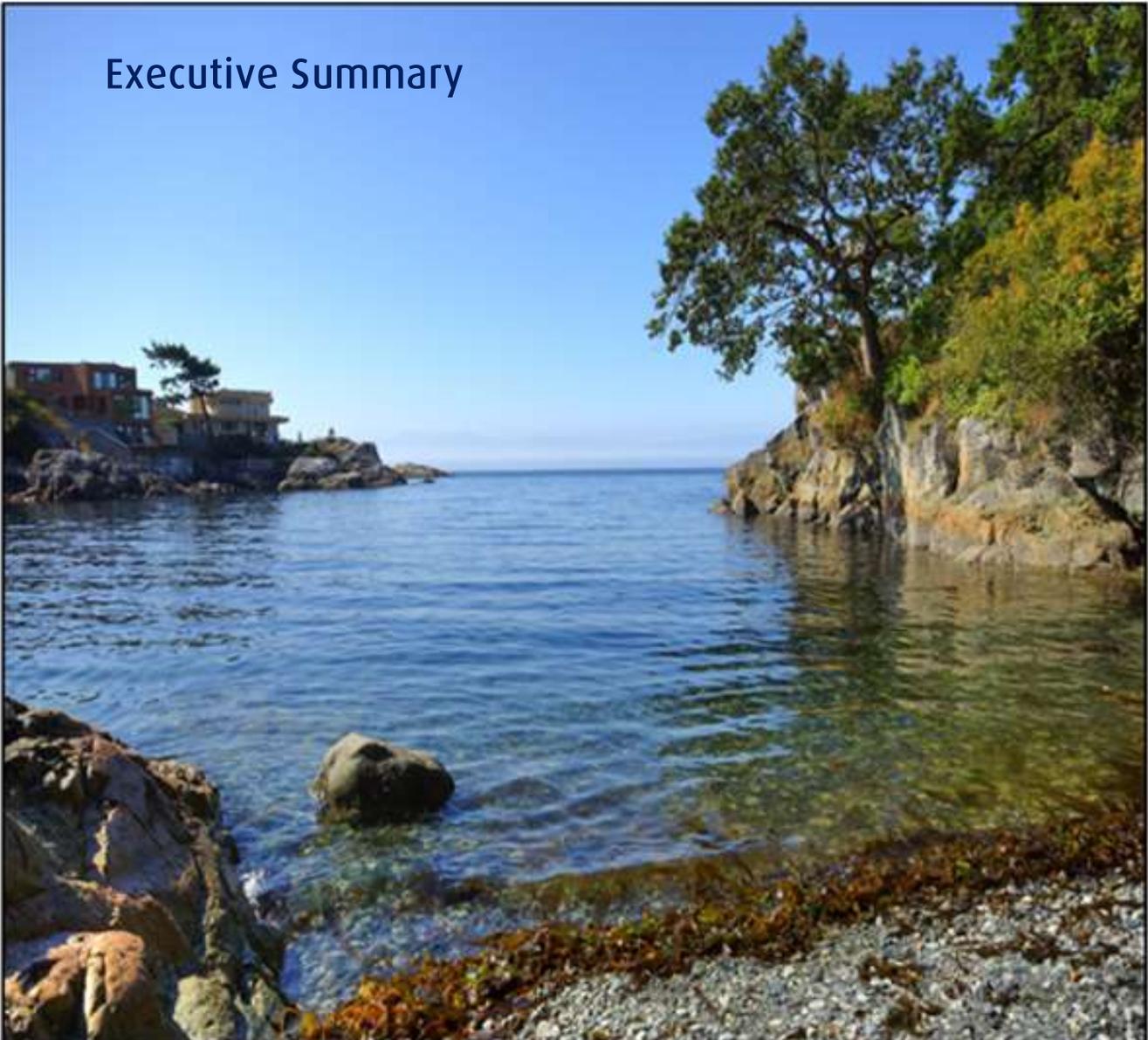
Appendix B:

**EXCEUTIVE SUMMARY: CORE AREA I&I MANAGEMENT PLAN:
2017 UPDATE**

Capital Regional District

Core Area Inflow & Infiltration Management Plan 2017 Update

Executive Summary



CORE AREA INFLOW & INFILTRATION MANAGEMENT PLAN

EXECUTIVE SUMMARY

Purpose

The purpose of the plan is to guide the Capital Regional District (CRD) and its municipal partners towards Inflow and Infiltration (I&I) reduction in a responsible, cost effective, integrated and well-planned manner. The primary objective of the plan is to reduce overflows and I&I to less than four times average dry weather flow (4xADWF), based on a five year return period, at Clover Point and the Core Area Wastewater Treatment Plant at McLoughlin Point by 2031.

Background

The core area municipalities are actively managing inflow and infiltration (I&I), a term that describes rainwater and groundwater that mistakenly gets into the sanitary sewer system. Inflow refers to rainwater that enters the sewer through plumbing cross connections and infiltration refers to groundwater that seeps into the sewer through cracks, faulty joints, etc. A certain amount of I&I is unavoidable and is accounted for in routine sewer design. However, too much I&I results in excessive sewer flows which can lead to:

- leaking sewers and overflows that can contaminate the environment and create public health concerns;
- backing up of sewage into buildings and homes that can destroy belongings and require expensive restoration;
- increasing operation and maintenance costs to convey and treat the increased flows; and
- consuming sewer capacity which could require expensive premature upgrades to the system.

The content of the Core Area I&I Management Plan is organized in the following sections: 1) Overview; 2) Overflows; 3) Asset Management; 4) Climate Change; 5) Public Property I&I; 6) Private Property I&I; 7 to 17) Municipal Plans; and 18) Monitoring & Verification.

Regulatory Context

The core area wastewater system is governed by the Core Area Liquid Waste Management Plan (LWMP). This plan was first approved by the Ministry of Environment in 2003. Since that time, there have been a number of amendments to the plan, the most recent being Amendment No. 11 (approved in 2016).

Section 5 of the plan relates to I&I and overflows and includes the following commitments:

The CRD and the participating municipalities commit to the following actions to reduce I&I sufficiently to reduce maximum daily wet weather flows to less than four times the average dry weather flow by 2030:

1. *Continue flow monitoring in each municipality to further refine priority areas for remediation.*
2. *Develop, by the end of 2011, and submit to the Ministry of Environment, comprehensive inflow and infiltration management plans for the core area that will:*
 - *Identify and evaluate options and opportunities that promote the minimization of groundwater and rainwater I&I into municipal sanitary sewers, including I&I originating from service laterals (private and public sections of sewer connections)*
 - *Identify needed changes to legislation and legal authority to enable options and strategies*
 - *Identify opportunities for the inspection of private sewers connected to municipal sewers:*
 - i. *as part of the municipal process in evaluating and issuing renovation and building permits for serviced properties; and/or*

- ii. *at the time of property transfer, and/or*
 - iii. *targeted inspections*
 - *Require the repair or replacement of private sewers that have cross-connections between storm sewers and sanitary sewers or are identified as being in poor condition.*
3. *Update by the end of 2011, and enforce sewer use bylaws to prohibit the construction of rainwater and groundwater connections to sanitary sewers.*
 4. *Implement the overflow reduction plans contained in the sanitary sewer overflow management plan, which was submitted to the Ministry of Environment in June 2008.*

Overflows

In 2014, the CRD submitted an updated core area overflow management plan to the Province. The plan documents the CRD's overflow related commitments and summarizes the significant work carried out related to overflows.

Asset Management

Asset management programs for sewer collection systems generally focus on the planned replacement of infrastructure based on remaining service life. Municipalities need to demonstrate that they are following the Asset Management BC Framework to qualify for federal gas tax funding.

Climate Change

Over the next five years, the CRD will carry out actions supporting a vulnerability assessment of CRD sewer infrastructure due to climate change. The actions include updating the core area sewer model, running the sewer model using climate change scenarios, and providing recommendations based on the results.

Public Property Inflow and Infiltration

I&I and overflow quantification helps municipalities to understand the condition and/or performance of their sewer systems. Quantified measurements can be compared to benchmarking standards and allow municipalities to track I&I performance. The most useful quantification methods are repeatable and follow a standardized approach. Examples of I&I quantification methods proposed in this plan include: statistical analysis of sewer flow data to calculate I&I rates, quantifying overflows based on given storm events, ranking structural integrity of sewer pipes based on closed circuit television (CCTV) inspections, counting cross-connections through smoke testing, documenting manhole condition and calibrating system performance using hydraulic models.

The public property I&I reduction plans are consistent with the systematic approach noted in the Infraguide for "Infiltration/Inflow Control/Reduction for Wastewater Collection Systems". Infraguide was a partnership between the Federation of Canadian Municipalities, the National Resource Council and Infrastructure Canada. It created best practice reports for municipal infrastructure. The guide proposes that I&I reduction programs be divided into the following three phases:

- Phase 1 - involves flow monitoring and data collection. The data is used to identify catchments that should be targeted for sewer investigation work.
- Phase 2 - involves sewer investigation work to identify specific sources of I&I. The data is used to create rehabilitation plans and to prioritize I&I rehabilitation work.
- Phase 3 - involves sewer rehabilitation work. The rehabilitation work is based on investigation data from Phase 2. If investigation data is not yet available, then archetype I&I rehabilitation programs should be used.

Archetype I&I rehabilitation programs were developed to provide a framework under which any given sewer catchment can be evaluated and related to an actionable plan to move forward with I&I assessments and

sewer rehabilitation. These programs are to be used as planning tools. They should be interpreted from a strategic planning level and are suitable for establishing long-range budgets and for steering the development of targeted I&I reduction programs.

Private Property Inflow and Infiltration

The I&I Management Plan (2012) contained a five-year plan for implementing a common private property I&I approach for the core area. The plan was to consult with stakeholders and the public from 2012 to 2014, recommend an approach in 2015 and implement that approach in 2016. Significant effort was made to come up with a common approach. By 2014, it was clear that a common approach wasn't appropriate as the core area municipalities have different I&I rates, different issues and require different solutions. Three of the core area municipalities have older sewers and elevated I&I and they would benefit from strong programs to reduce I&I. The other four municipalities have newer sewers and have low I&I. These municipalities would prefer to focus on I&I prevention activities. The I&I Subcommittee agreed that each municipality should implement their own custom approach to suit their needs and should draw on the significant research and support that the CRD has provided.

In late 2014, the CRD Board directed that a sample model bylaw related to the inspection of private sewer laterals connected to municipal sewers be prepared. The sample bylaw was built using past I&I Subcommittee feedback and content from the Pinna Report (2014) which documented the best I&I related language from existing Canadian and American bylaws. It underwent legal review and I&I Subcommittee review for general acceptability. The sample model bylaw was presented to the Core Area Liquid Waste Management Committee on May 13, 2015. The Core Area Liquid Waste Management Committee recommended that the sample bylaw be discussed with the I&I Subcommittee to determine how best to move it forward. The I&I Subcommittee decided that it would be best to incorporate the powers from the sample model bylaw into the existing municipal sewer use bylaws. Subsequently, a gap analysis was carried out comparing the powers from existing municipal sewer bylaws to the draft sample model bylaw and presented to the member municipalities through the I&I Subcommittee.

The next steps for addressing private property I&I include:

- assisting municipalities with the further development of private property I&I reduction plans;
- supporting the implementation of the powers from the sample model bylaw for private property I&I into existing or new municipal sewer bylaws;
- developing common public education materials for use by key industry stakeholders (i.e. plumbers, realtors and home owners);
- updating the general education approach to focus on homeowner protection (i.e. basement flooding) and environmental protection and how I&I plays an integral role; and
- continued collaboration with Metro Vancouver and the National Water and Wastewater Benchmarking Initiative's I&I Task Force.

Municipal Inflow and Infiltration Plans

Each of the core area municipalities has participated in the development of their own individual municipal I&I plans. The municipal plans are organized into eight sections:

1. *Overview*
2. *Catchments* - A list and map of the long-term flow monitoring catchments that will form the basis for evaluation of I&I rates and I&I management planning
3. *Inflow & Infiltration Data* – Summary of historical data collected, current data collected, summary of I&I analyses results, and flow data analyses
4. *Sewer Infrastructure Maintenance & Capital Work* – summary of routine sewer work, notable work completed between 2012 and 2015, and notable work planned for 2016 to 2020
5. *Asset Management* – high level municipal tools, approaches, etc.
6. *Bylaws* – Contains a comparison of the key powers suggested by the CRD Private Property I&I Model Bylaw to those found in each of the municipality's existing sewer bylaws

7. *Budget* – Summary I&I budget related information
8. *Summary* - A high level summary and a graph showing projected peak wet-weather flow (PWWF) relative to 4xADWF for the entire municipality from 2011 to 2031

Monitoring and Verification

Monitoring and verification of I&I Management Plan objectives will be achieved by using the following metrics:

1. Comparison of peak wet weather flow (PWWF) with 4xADWF at Clover Point and the proposed wastewater treatment plant. This will include graphs comparing projected PWWF and ADWF verses actual rates recorded over time.
2. Flow monitoring of all catchments to track I&I rates paying extra attention to measuring flows before and after targeted I&I reduction work to verify results.
3. Tracking overflows by location, frequency, duration and receiving environment sensitivity rating to monitor trends and verify results.
4. Completion of detailed and specific I&I management strategies for each catchment to replace the archetype plans.
5. Reporting of efforts and costs applied towards I&I management on a regular basis.

The CRD will continue to provide annual reports on the I&I program to the Core Area Liquid Waste Management Committee. Every second year the I&I analyses results will be updated, as is the current practice, and an I&I benchmarking template will be filled out for each of the core municipalities. The benchmarking template is currently in development and will include a number of performance measure criteria to help gauge the level of effort each municipality is applying to I&I management.

Forecasted Inflow and Infiltration Reduction

Additional work will be needed to meet the LWMP commitment of reducing wet weather flows below 4xADWF at Clover Point and the McLoughlin Point Treatment Plant by 2031. However, the gap between 4xADWF and peak wet-weather flow (PWWF) is decreasing, which is significant as it takes a substantial investment of time and resources to reverse the natural trend of I&I increasing with sewer age.

Colwood, Langford, Saanich and View Royal already meet the 4xADWF performance target. This is largely due to having young sewers built with modern materials and good installation practices. These municipalities will need to focus on I&I prevention in order to continue to meet the performance target.

Esquimalt, Oak Bay, and Victoria have older sewers which tend to have elevated I&I rates. If we extrapolate out current I&I rates, it is evident that these municipalities will need to focus on I&I reduction to meet their commitments not to exceed the 4xADWF performance target. This will require increased focus and funding on I&I reduction to achieve their reduction targets. Financial support (i.e. grants) from senior government would help to accelerate the I&I reductions. It is worth noting that:

- Esquimalt rehabilitated all of its sewers and manholes that required structural repairs in the early 2000's. It has also separated almost all of its combined manholes. Esquimalt's next steps for addressing I&I will involve actions related to I&I from sewer laterals and stormwater sewer upgrades.
- Oak Bay's I&I reduction work focused on developing a plan for the separation of the combined sewers in the Uplands area. Oak Bay finalized the separation plan in 2017. This was Oak Bay's highest I&I related priority and was required as part of a LWMP commitment. Oak Bay also completed the significant task of collecting sewer flow data for each of its outstanding catchments using portable meters. Oak Bay's next steps for I&I reduction will be to implement the Uplands' separation project, to complete the collection of sewer camera inspection data for the municipality and to update its sewer master plan based on the results of the camera inspections.
- Victoria has collected sewer flow data for its outstanding catchments, and has also performed camera inspections and smoke testing throughout the entire municipality. The data will be analyzed and actions put into Victoria's sewer master plan. Updating a sewer master plan is a substantial project. Victoria

had to delay the update of its sewer master plan until the location of the core area treatment plant was finalized because some of the locations considered for the plant would have resulted in dramatic changes to the plan. Work on the sewer master plan commenced in late 2016 after the regional treatment plant location was finalized.

The CRD is committed to assisting individual municipalities in the development of suitable private property I&I initiatives. Such initiatives could accelerate a municipality towards meeting its performance targets as it is estimated that 50% of I&I enters the sewer system on private property. Currently, there are no significant private property I&I initiatives in the core area; however, the research needed to develop such commitments is complete.

In addition, it is anticipated that significant progress will be made through the continuation and further development of I&I related education, stakeholder engagement, regulatory mechanisms, permit requirements, time of home sale options and through targeted pilot programs.

Key Future Actions

The next steps for addressing private property I&I include:

- supporting the implementation of the powers from the sample model bylaw for private property I&I into existing sewer municipal bylaws or into a new bylaw;
- assisting municipalities with the development and implementation of municipality specific private property I&I reduction plans;
- developing common public education materials for use by key industry stakeholders (i.e. plumbers, realtors and home owners);
- updating the general education approach to focus on homeowner protection (i.e. basement flooding) and environmental protection and how I&I plays an integral role; and
- continued collaboration with Metro Vancouver and the National Water and Wastewater Benchmarking Initiative's I&I Task Force.

The next steps for addressing public property I&I include:

- identifying "semi-combined" sewers in the core area and developing plans to address them;
- taking leadership on I&I benchmarking and taking action to introduce nationally;
- updating the core area sewer model, running the sewer model using climate change scenarios, and providing recommendations based on the results; and
- ongoing I&I metering, analyses and program development.

Conclusion

The Ministry of Environment reviewed and approved Amendment No. 11 of the Core Area LWMP. The LWMP included four commitments related to I&I and overflow management which are fulfilled by the I&I Management Plan.

The plan is purposeful and guided by a number of federal, provincial, regional and municipal regulatory documents and best practices. It provides the framework for how I&I can be quantified and establishes priority programs and approaches for each municipality and the CRD to follow. A strategy has been developed for moving the issue of private property I&I forward and the whole program will be monitored, verified and reported out using standard metrics and templates.

All core area municipalities assisted in the preparation of the plan and the specific actions and programs were developed based on current CRD and municipal funding levels for I&I and sewer service budgets. Modelling the results of implementing this plan show that the goal of reducing I&I to 4xADWF at Clover Point and the wastewater treatment plant is achievable but will require additional effort.

Appendix C:

EXAMPLE OF A MONTHLY SEWER REPORT FOR CORE AREA MUNICIPALITIES AND FIRST NATIONS

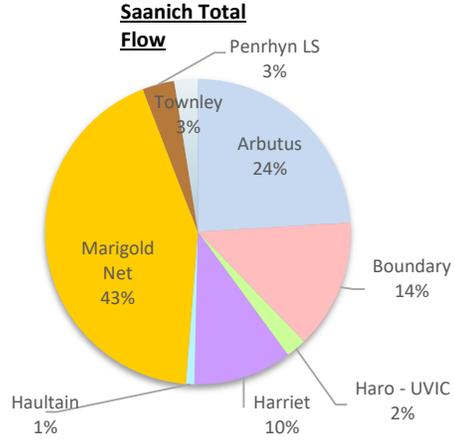
CRD IWS
Core Area Wastewater System
Monthly Wastewater Flow Report for Saanich - February 2023

Disclaimer: The data used in this report is considered preliminary. It may be further corrected in the annual cost requisition report.

1. Monthly Wastewater Flow Data: Feb 2023

This data summarizes the volume of flow measured from catchments contributing to Saanich's total flow (map on page 3).

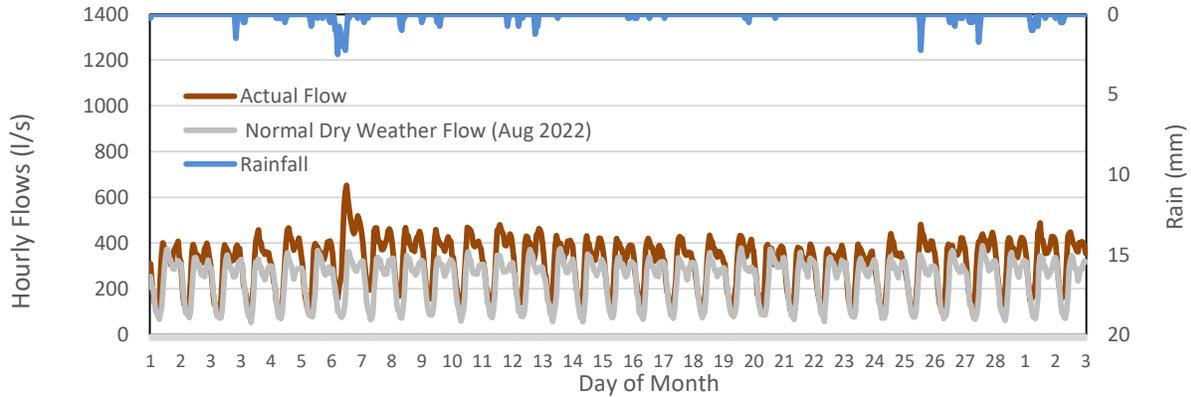
Flow Meter Name	Total Monthly Flow	
	m ³	%
Arbutus	180,593	24%
Boundary	103,437	14%
Haro - UVIC	16,285	2%
Harriet	78,052	10%
Haultain	6,763	1%
Marigold Net	322,223	43%
Marigold PS	415,348	
(Minus Hartland Leachate)	41,520	
(Minus Hartland Centrate)	51,605	
Penrhyn LS	25,193	3%
Townley	18,892	3%
Monthly Flow	751,440	100%



SAANICH FLOW = Marigold Net + Boundary + Harriet + Townley + Haultain + Arbutus + Haro + Penrhyn

2. Saanich Hourly Sewer Flows Feb 2023

This graph shows actual flow (brown) and rainfall (blue), per day, for the month and compares it to normal dry weather flow (grey).



3. Key Wastewater Flow Stats: Feb 2023

Metric	Flow (m ³) ¹
Total Monthly Flow	751,440
Average Daily Flow	26,837
Minimum Daily Flow	23,169
Peak 24hr Flow (PWWF) ²	37,318
Peak 1hr Flow ³	56,372
Average Dry Weather Flow (ADWF) ⁴	21,396
Estimated Daily Domestic Flow ⁵	17,163

Overflows (monitored by CRD): Feb 2023

Location	Date
Finnerty Outfall	None

¹ Excludes overflows that may have occurred (overflow volumes are not measured).

² Calculated as maximum rolling 24 hr flow for the month.

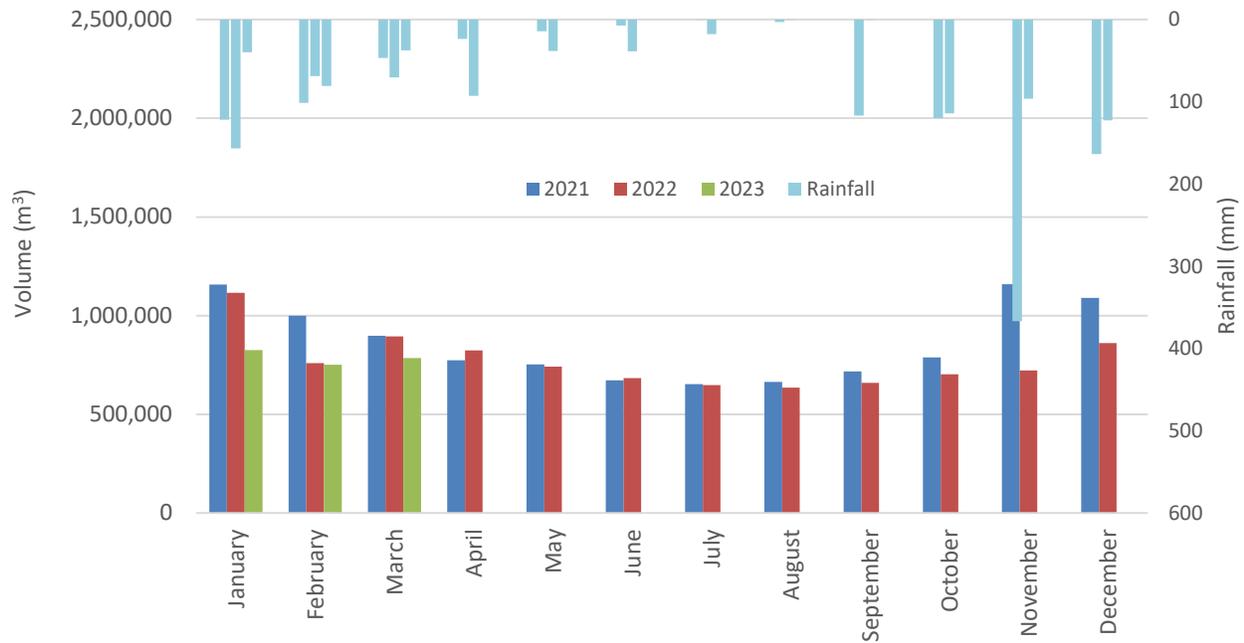
³ Expressed as 24 hour flow (peak 1 hr flow x 24).

⁴ Average daily flow from most recent Jun 1 to Aug 31 data. Includes groundwater infiltration over that period.

⁵ Calculated as ADWF minus summer groundwater (70% of minimum hourly flow x 24 hours).

4. Monthly Wastewater Flow: Historical vs. Current

This graph shows the total Saanich flow for each month and compares it with previous years.



5. Inflow & Infiltration Flow Summary: Feb 2023

Key I&I Metrics	Value ¹
Total Monthly Flow (m ³)	751,440
Estimated Domestic Flow for Month (m ³) ²	480,555
I&I Volume for Month (m ³) ³	270,885
I&I Volume for Month (% total flow)	36%
Peak 24hr Flow (PWWF) ⁴	1.7 x ADWF
Peak 1hr Flow ⁵	2.6 x ADWF

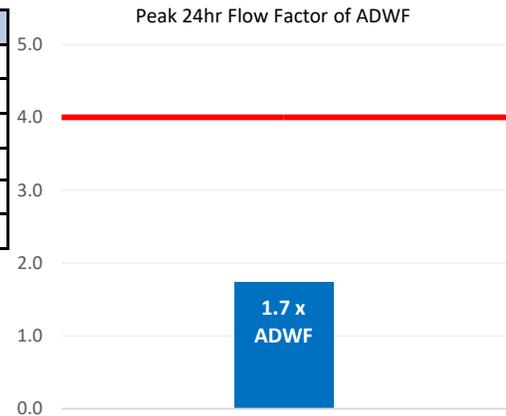
¹ Excludes overflow volume

² Determined by (Est. Daily Domestic flow from section 3.) x (number of days per month)

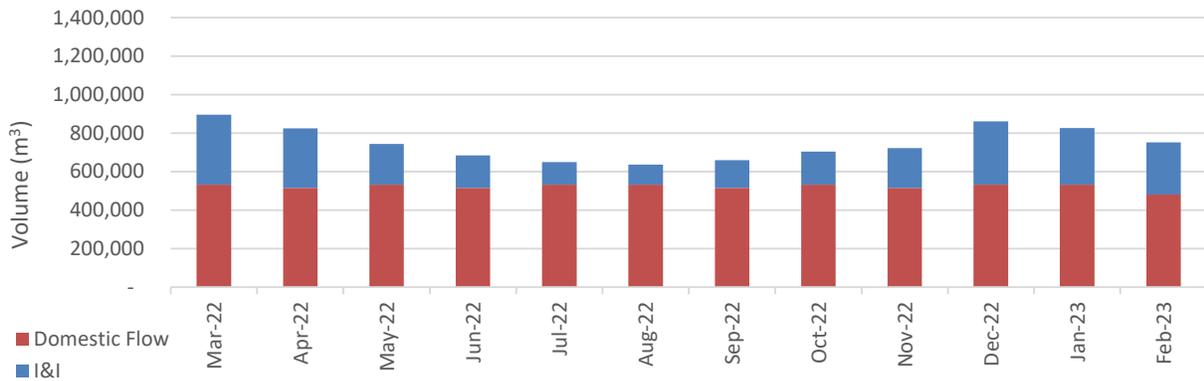
³ Determined by subtracting Estimated Domestic Flow from Total Monthly Flow

⁴ Determined by dividing Peak 24hr Flow from section 3. by ADWF

⁵ Determined by dividing Peak 1hr Flow from section 3. by ADWF

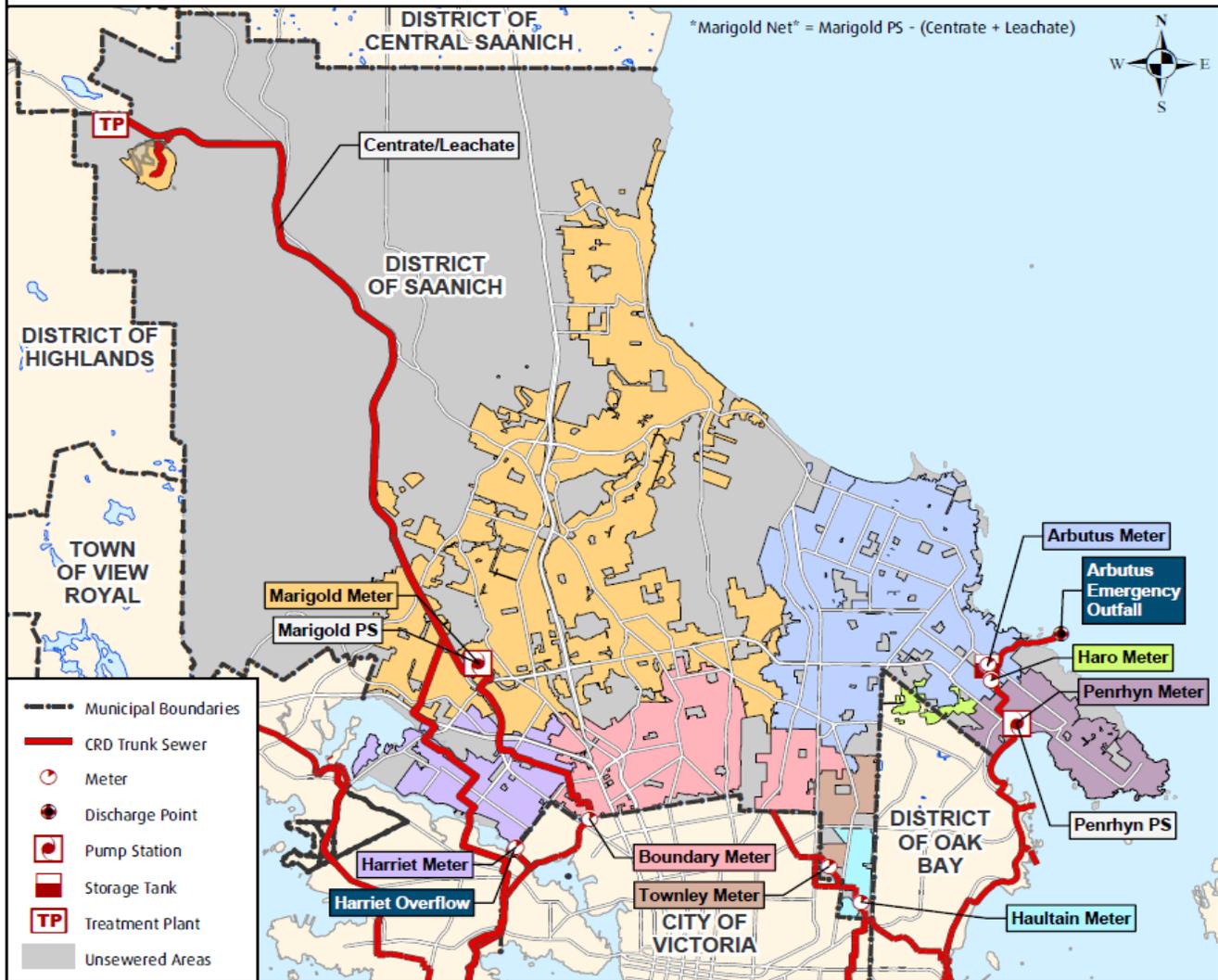


6. Monthly Flows: I&I and Domestic Flow



DISTRICT OF SAANICH SEWER CATCHMENTS

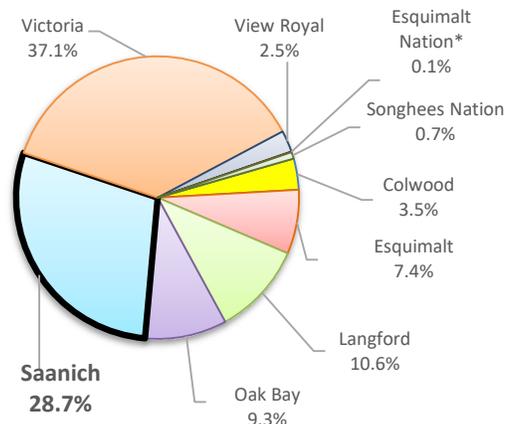
SAANICH FLOW = Marigold Net* + Boundary + Harriet + Townley + Haultain + Arbutus + Haro + Penrhyn



7. Regional Flow Data: Feb 2023

Participant Area	Total Monthly Flow	
	m ³	%
Colwood	92,787	3.5%
Esquimalt	192,347	7.4%
Langford	277,742	10.6%
Oak Bay	243,798	9.3%
Saanich	751,440	28.7%
Victoria	969,856	37.1%
View Royal	64,802	2.5%
Esquimalt Nation*	2,236	0.1%
Songhees Nation	19,527	0.7%
Total	2,614,535	100.0%

*Flows are calculated based on engineering estimates



Appendix D:

**SUMMARY OF CRD PRIVATE PROPERTY I&I
WORK AND EDUCATION WORK TO DATE**

Summary of CRD Private Property Inflow & Infiltration Actions to Date

Timeline	Action
Ongoing	<ul style="list-style-type: none"> • CRD: <ul style="list-style-type: none"> - review case studies of jurisdictions taking steps to deal with private property I&I - meet with various experts and share information - work with and share information with Metro Vancouver, which is also working to establish programs to address private property I&I - are members of the National Water and Wastewater Benchmarking Initiatives I&I Task Force - provide I&I education to the public • Two municipalities within the core area (Oak Bay and Esquimalt) require that laterals be inspected and fixed if required, when applications are made for major building permits. • Each of the core area municipalities have sewer bylaws or council policies that relate to private property I&I.
2022 to mid-2023	<ul style="list-style-type: none"> • Updated a CRD report that documented private property I&I programs from around North America to better understand programs options, costs, uptake, etc.
2020 to mid-2022	<ul style="list-style-type: none"> • Completing a study looking at downspout disconnection programs and best practices from across Canada.
2019 to 2020	<p>The CRD has developed the following items to support the updated I&I education approach:</p> <ul style="list-style-type: none"> • a brochure and banner that fully aligns with the Generally Accepted Principles document, • updated website content to align with the new approach, • attendance at a list of key regional events to interface with the public, including annual home show events, municipal events and key stakeholder events, and • a slideshow for presenting to realtors.
2018 to 2019	<p>The educational approach for addressing private property I&I was updated. The approach has the same desired outcomes as the existing approach: to promote the inspection and maintenance of sewer laterals. However, the approach focuses on preventing basement flooding which is more relevant to homeowners. The central document for the approach is the “Generally Accepted Principles” document, which:</p> <ul style="list-style-type: none"> • has full acceptance from the key stakeholder groups, • aligns the various stakeholder groups on the topic, • is designed to answer questions that the public may have on the issue in a clearly communicated fashion, • establishes relationships with the various I&I related stakeholders, • was developed in partnership with over 20 key stakeholder groups (local, provincial and national). Through consensus, the focus was extended to all private property underground pipes, including foundation drains and stormwater laterals, and • can be used by stakeholder to educate the public. <p>In late 2018, the CRD completed a report documenting how each of the key stakeholder groups preferred to be engaged on the I&I topic. The report also documented the level of outreach effort deemed appropriate for each of these groups.</p>

Timeline	Action
2017	<p>The following is a list of private property I&I work carried out in 2017 and the first half of 2018, details of which are located in Section 2:</p> <ul style="list-style-type: none"> • completed a background report to better understand I&I-related stakeholders, • a report showing how to identify semi-combined sewers using GIS, • collected additional private property I&I models bylaws from across Canada, and • Enforcement Approach for Addressing Cross Connections, as presented by the City of Burnaby to the Core Area I&I Subcommittee.
2016	<ul style="list-style-type: none"> • In general, the I&I Subcommittee agreed that the powers from the sample model bylaw should be incorporated into existing municipal sewer bylaws. To support this, the CRD retained consultants, Pinna Sustainability Inc., to compare the powers in the sample model bylaw to the powers in each municipality's existing sewer bylaws, and a gap analysis was completed. Based on the results, recommendations were made for updating each of the municipal sewer bylaws using language from the sample model bylaw. One municipality noted that they may include parts of the sample model bylaw as part of a new municipal bylaw. • On February 11, 2016 the CRD presented to the National Water and Wastewater Benchmarking Initiatives I&I Task Force on the topic of "Implementation of a Private Property I&I Management Program". The CRD is considered a frontrunner in Canadian municipalities regarding private property I&I efforts, and staff shared the CRD's experiences and plans for moving forward.
2015	<ul style="list-style-type: none"> • In late 2014, the Core Area Liquid Waste Management Committee (CALWMC) asked the CRD to prepare a sample model bylaw related to private property I&I. The sample bylaw was built using past I&I Subcommittee feedback and the best parts of existing bylaws from across Canada and the US, as documented in the report by Pinna Sustainability Inc. in 2014. The draft bylaw was reviewed by a lawyer and by the I&I Subcommittee for general acceptability. The sample model bylaw was prepared and presented to the CALWMC on May 13, 2015. The committee recommended the sample bylaw be discussed with the I&I Subcommittee to determine how best to move it forward. The I&I Subcommittee decided it would be best to incorporate the powers from the sample model bylaw into the existing municipal sewer use bylaws. One municipality (Esquimalt) may customize the sample model bylaw into a stand-alone bylaw suitable for Esquimalt.
2014	<ul style="list-style-type: none"> • On May 22, 2014, the I&I Subcommittee unanimously recommended that each municipality be able to customize their approach for meeting agreed-upon targets. This could involve a model bylaw that could be altered, as required, to meet the needs of individual municipalities. Overall, it was understood that municipalities with elevated I&I need a different approach than municipalities with low I&I. • In 2014, the CRD commissioned a study by Pinna Sustainability Inc. to prepare a memo entitled Update on Private Property I&I Programs. It contains supplementary research for the Stantec Report (2010). Notably it: <ul style="list-style-type: none"> - summarizes effective "drivers" for private property I&I programs, - details private property I&I programs from across Canada by province,

Timeline	Action
	<ul style="list-style-type: none"> - contains updates on private property I&I programs from the US, - documents potential problems related to implementing private property I&I programs and includes North American examples, and - summarizes “good practices” that should apply to all private property I&I programs. For each “good practice” there is example bylaw language taken from existing Canadian sewer bylaws. <ul style="list-style-type: none"> • In late 2014, the CALWMC asked the I&I program staff to make a presentation to it in early 2015 and to include a working “draft” model bylaw in the presentation.
2013	<ul style="list-style-type: none"> • Staff shortlisted private property I&I options and refined the options. • The I&I Subcommittee reviewed the shortlist and provided feedback on multiple occasions. • Options were discussed with representatives from stakeholder groups (i.e., real estate, building association, building inspection and insurance industry, etc.)
2012	<ul style="list-style-type: none"> • Staff prepared private property I&I specific education materials related to the program options noted in the Stantec report, including: <ul style="list-style-type: none"> - handouts summarizing each of the program option categories, - a detailed comparison table of the options, and - a reference guide covering frequently asked questions. • In June 2012, CRD staff hosted a workshop focused on private property I&I for elected representatives. The purpose of the meeting was to present background information, options for moving forward, and to open dialogue on the topic. New ideas were discussed and those who were present endorsed the implementation of the consultation portion of the private property I&I plan. • On November 30, 2012, CRD staff put on a workshop for members of the Victoria Real Estate Board. The workshop was a collaborative effort between the Core Area I&I Program, Onsite Program (i.e., septic systems) and Cross Connection Program. The purpose of the workshop was to provide education and to promote the use of infrastructure inspection in the real estate industry.
2011	<ul style="list-style-type: none"> • CRD staff provided an overview of the 2010 Stantec report to elected representatives and recommended a full workshop in 2012. • CRD staff initiated an I&I-related educational program that included new educational materials and education outreach events including: an I&I brochure for residents, a comprehensive website, a survey used in 2012 to 2014, and educational videos. Public education regarding I&I will now be ongoing.
2010	<ul style="list-style-type: none"> • CRD staff commissioned a report, completed by Stantec Inc., showing potential management options for addressing private property I&I. The report included a summary of private property I&I programs used throughout North America, costs/effectiveness of these programs, and legal options for implementing programs in the region. A copy of this report is on the CRD website. • A workshop was held with municipal and regional staff to initiate discussion about options for implementing private property I&I programs, objectives, and potential barriers. It was agreed that the key objectives for a private property I&I program would be to: protect the environment, create system capacity, minimize costs, increase ownership responsibility and awareness, and minimize liability issues. A summary of this workshop is located in the Stantec report.

Summary of CRD Private Property Inflow & Infiltration Education Work to Date

Action	Description
2020 to 2023	<p>Private Property I&I:</p> <ul style="list-style-type: none"> • As a result of the pandemic, a number of planned education actions had to be put on hold. • The PPI&I education brochures were available for display at municipal halls, etc. • Efforts to set up “lunch and learns” with realtor offices were postponed until in-person presentations could be made. • On February 28, 2023, the CRD presented a 1.5 hour webinar to the Canadian Association of Home and Property Inspectors regarding the CRD’s educational materials related to “inspecting and maintaining underground pipes to reduce the risk of basement flooding”. <p>Public Property I&I:</p> <ul style="list-style-type: none"> • Integrated Water Services and the Core Area I&I Program continue to produce monthly sewer use reports for each of the core area municipalities and First Nations (Section 2.2).
2019 and 2020	<p>Private Property Inflow & Infiltration</p> <p>On January 23, the CRD had a booth at the 2020 Vision Victoria Real Estate Board conference and debuted the new I&I education approach to key stakeholders. The reception to the approach was exceptional. Of key significance:</p> <ul style="list-style-type: none"> • Many realtors visited the booth and were interested in both the brochures and the detailed Generally Accepted Principals document. In general, they noted that the materials were both useful and relevant to them. • Five realtor offices invited the CRD to present at their “Lunch n Learns” or “Coffee Talks”, which realtor offices typically have each month. It is believed that the CRD could schedule similar talks for most real estate offices in the region as they are always looking for relevant content for these talks. • Tony Joe, a local radio personality, invited the CRD to have an extended interview related to the I&I education approach on “The Whole Home Show with Tony Joe”, a radio show on CFAX 1070 that focusses on real estate issues. It is a great sign that Tony Joe sees the value in the updated education approach because not only is he a realtor, he is a past president of the Victoria Real Estate Board and an Instructor for the British Columbia Real Estate Association. <p>As a result of COVID-19, a number of planned education actions had to be put on hold. To move things forward, efforts will be made to target the key stakeholder groups (i.e., plumbers, home inspectors, realtors) potentially through targeted video’s, webinars, etc.</p> <p>Public Property I&I</p> <p>Integrated Water Services and the Core Area I&I Program worked together to develop monthly wastewater flow reports for the core area municipalities and First Nations.</p>
2018 and 2019	<p>Developed an updated education approach making it more relevant to home owners and related stakeholders, as summarized in Section 2.2. The rollout of the updated approach was initiated in the fourth quarter of 2019.</p>

Action	Description
<p>2011 to Present</p>	<p>I&I was added to CRD outreach events where I&I materials were displayed along with those other CRD programs. In general, I&I was “featured” at 4 key events (e.g., home shows) per year and the materials made available upon request at an additional 10 events.</p> <p>From talking to CRD outreach staff, attending outreach events and talking to stakeholder groups, it is clear that I&I knowledge is low with the general public. Most people have little interest in the topic and say that they will deal with issues if they come up.</p>
<p>2010</p>	<p>The I&I program, in collaboration with the core area municipalities, created a brochure, two sets of videos to help explain I&I, and developed an I&I website. This information is valuable when staff are providing notification to neighborhoods of upcoming video inspection, smoke testing, sewer rehabilitation or other work related to I&I management. The overall approach was consistent with other municipalities around North America.</p>