

# Saanich Peninsula Stormwater Quality 2013 Annual Report

## DRAFT

Parks &amp; Environmental Services

Environmental Protection

Including the jurisdictions of

District of Central Saanich

District of North Saanich

Town of Sidney

Pauquachin First Nation

Tsartlip First Nation

Tsawout First Nation

Tseycum First Nation

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# STORMWATER QUALITY ANNUAL REPORT 2013 SAANICH PENINSULA

## EXECUTIVE SUMMARY

### INTRODUCTION

The Capital Regional District (CRD) Integrated Watershed Management Program (IWMP) works to promote and coordinate stormwater management, and monitor and evaluate water quality of the creeks and shorelines of the Saanich Peninsula that receive stormwater discharges. This program is a component of the Saanich Peninsula Liquid Waste Management Plan (LWMP) and is undertaken in cooperation and consultation with the participants: District of Central Saanich, District of North Saanich, Town of Sidney, Tsawout First Nation, Pauquachin First Nation, Tsartlip First Nation and Tseycum First Nation.

The 2013 annual report covers four main areas of activity:

1. Stormwater Discharge Assessments
2. Source Investigations
3. Stream Monitoring
4. Special Projects

CRD staff assess stormwater discharges along the Saanich Peninsula coastline. This assessment prioritizes stormwater discharges based on public health and environmental concern and strives to protect freshwater and nearshore marine ecosystems and resources. When contamination is found in stormwater, staff undertake investigations to identify the causes. IWMP staff are also involved in a number of special projects to improve stormwater quality on the Peninsula.

### RESULTS AND DISCUSSION

#### 1. Stormwater Discharge Assessments

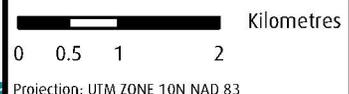
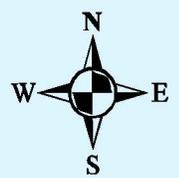
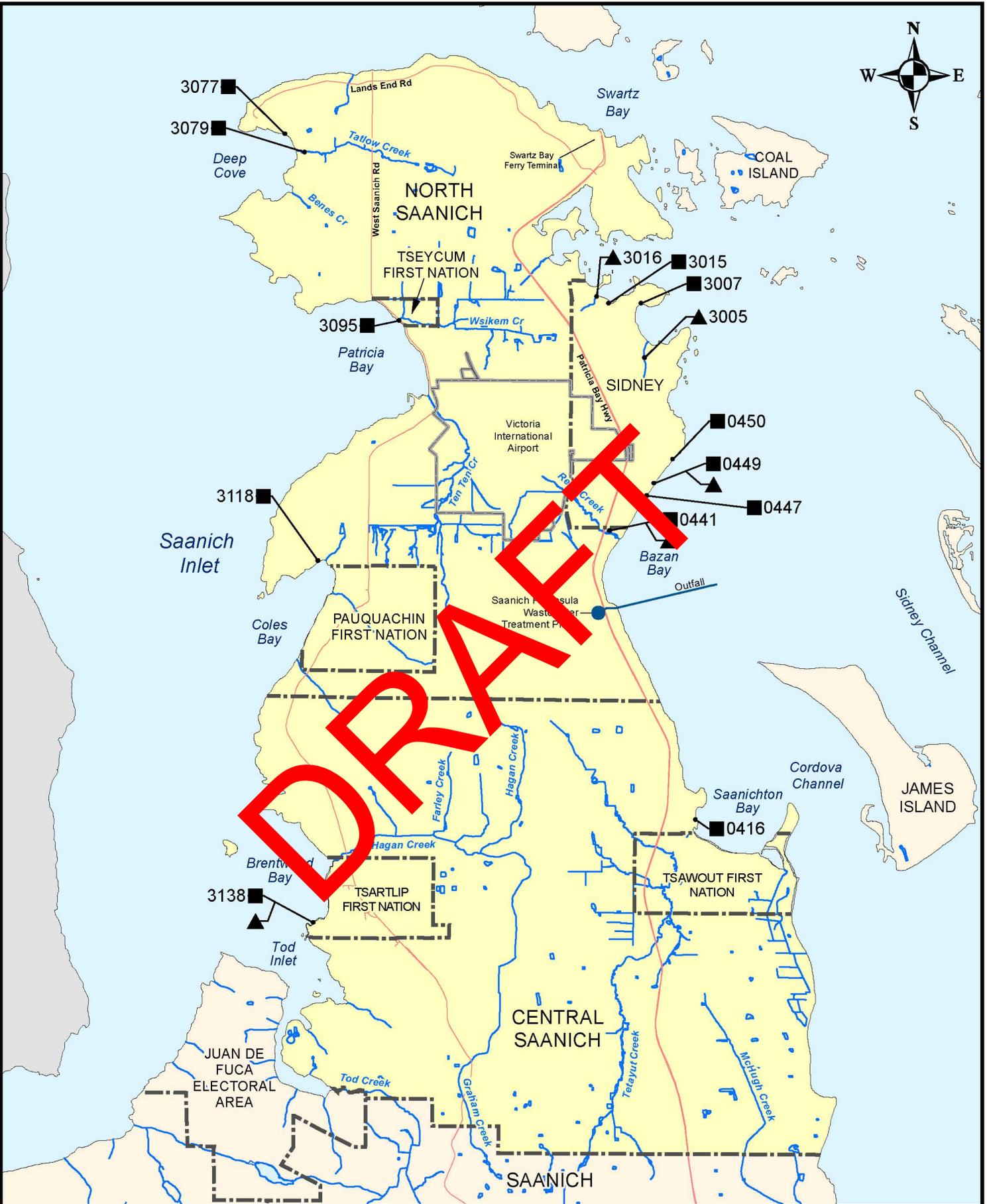
The study area covers the marine coastline from the Saanich-Central Saanich border on the east coast to the Central Saanich-Juan de Fuca electoral area border on the west coast of the Peninsula (Figure A).

##### **Public Health: Fecal Coliforms**

The program evaluated 77 stormwater discharges for public health concerns. Each discharge was sampled for fecal coliform bacteria during the winter and summer, and then rated based on the level of contamination in the stormwater and potential for human contact.

Discharge ratings allow jurisdictions to prioritize remedial measures where they will have the greatest benefit.

The program identified 12 high ratings for public health concern among the 77 discharges assessed in 2013. Table A provides the jurisdictional distribution of high-rated discharges in from 2000 to 2013. In 2013, North Saanich and Sidney had the most high-rated discharges (four and five, respectively), while remaining jurisdictions had one or none.



**Figure A - Saanich Peninsula - 2013 Stormwater Discharges Requiring Action for Public Health or Environmental Concerns**

- Discharges Requiring Action**
- High Public Health Rating
  - ▲ High Environmental Rating and Recommended for Action
  - Sewage Treatment and Outfall
  - ~ Streams
- Municipal and First Nations Boundary  
 Major Roads  
 Stormwater Monitoring Area

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The number of high-rated discharges went down considerably between 1999 (21) and 2002 (7), and has fluctuated between 11 and 13 high-rated discharges for the past eight years. Many of the high-rated discharges have been of concern for a number of years; six of them have been assigned a high-rating at least four times in the last five years (see Table B). Contamination remains in these discharges because the source is difficult to find, more than one source exists or mitigation is costly. As a result, the IWMP redirected some resources in 2013 (as directed by the Saanich Peninsula Wastewater Commission) to increase investigative efforts in discharges of most concern to determine the sources of fecal coliform contamination.

**Table A. Number of Discharges Rated High for Public Health Concern over Time**

Jurisdiction	Number of Discharges Rated High													
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Central Saanich	1	0	2	1	3	2	0	1	1	1	1	2	2	1
North Saanich	6	5	4	4	10	10	7	2	5	5	6	4	4	4
Sidney	7	3	1	4	1	3	4	6	5	5	4	5	4	5
Pauquachin First Nation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tsartlip First Nation	0	0	0	1	0	0	0	0	0	0	0	0	1	1
Tsawout First Nation	0	0	0	1	0	0	1	1	0	1	0	0	1	0
Tseycum First Nation	0	0	0	0	0	0	0	1	1	1	1	1	1	1
Total	14	8	7	11	16	16	12	11	12	13	12	12	13	12

**Table B. Historical High Public Health Concern Ratings for Discharges Rated High in 2013**

Discharge	Jurisdiction	Number of high ratings 2009-2013
416	Central Saanich	5
3077	North Saanich	4
3079	North Saanich	3
3118	North Saanich	4
441	North Saanich	1
447	Sidney	2
449	Sidney	4
450	Sidney	4
3007	Sidney	1
3015	Sidney	1
3095	Tseycum First Nation	5
3138	Tsartlip First Nation	2

## Environment: Discharge Sampling for Chemical Contaminants

In 2013, the program evaluated 12 stormwater discharges along the Saanich Peninsula coastline for environmental concern according to the level of chemical contaminants identified in discharge sediment. In addition, six samples were collected upstream to narrow down sources of elevated contaminant concentrations. Contaminant ratings are determined by comparing the concentration of each contaminant [eight metals and polycyclic aromatic hydrocarbons (PAH)] with the CRD marine sediment quality guidelines (MSQG). The MSQG are concentrations above which adverse effects may occur to marine life. Ratios of concentration to MSQG for each contaminant are summed to account for potential effects caused by combining the contaminants.

In 2013, three discharges received a high contaminant rating [441 (Reay Creek, North Saanich), 3005 (Mermaid Canal, Sidney) and 3138, Brentwood Bay, Central Saanich)]. These three high-rated discharges, plus two others rated high in previous years (3016 and 449) are recommended for corrective action based on consecutive high ratings. Locations of these discharges are shown in Figure A.

**Table C. Historical High Chemical Contaminant Ratings for Discharges Rated High in 2013**

Discharge	Location/Jurisdiction	Number of high ratings 2009-2013
441	Reay Creek – North Saanich	5
3005	Mermaid Canal – Sidney	5
3138	Brentwood Bay -- Central Saanich	2 (and in 2004)

IWMP staff conduct investigations of the source of the contamination in discharges recommended for corrective action. IWMP and municipal staff have been working towards finding and eliminating the source(s) of contamination in those five discharges recommended for action for a number of years.

CRD and VAA staff narrowed down the source(s) of contamination in two of these discharges (441: Reay Creek) and restoration activities are being completed. CRD staff have narrowed down the contaminant sources to within a few blocks for three of the discharges (449, 3016 and 3138), while investigations are inconclusive for one discharge (3005) partially due to the difficulty in collecting sediment.

Investigations in discharges 449 and 3138 have been suspended due to the challenges of finding a single point source of zinc, which enters storm drains from roadways due to particulate from vehicle brake pads, or from eroding storm drain pipes themselves.

In 2007, IWMP proposed creation of a CRD-led stormwater source control program. This is a method of reducing contaminant inputs to the stormwater system by working with businesses to reduce or eliminate their contaminant discharge to stormwater. It requires staff to work cooperatively with businesses through a balanced approach of education and enforcement.

In 2010, CRD staff began work on updating the model Stormwater Source Control Bylaw (including harmonizing with the newly adopted Central Saanich Surface Water Bylaw). In 2012, the Province of British Columbia granted the CRD the powers necessary to create a stormwater source control service. CRD staff prepared a service establishing bylaw for adoption in late 2013 and will be working throughout 2014 with municipalities and stakeholders to finalize the regulatory bylaw.

## **2. Contaminant Source Investigations**

### **Fecal Coliform**

In 2013, IWMP and municipal staff put more effort into identifying fecal coliform sources in discharges that have been high-rated for a number of years. Staff received direction at the Saanich Peninsula Wastewater Commission (SPWWC) February 21, 2013 meeting to redirect program resources: reduce ambient shoreline monitoring efforts in 2013 and increase investigation of potential contaminant sources associated with current high-rated discharges. In 2013, IWMP staff investigated the catchment areas of eight stormwater discharges during 17 sampling events to gather information about the sources of fecal coliform contamination.

Source investigations included assessments of the catchment area land use, upstream sampling and bacterial source tracking (BST; analysis of bacterial DNA to determine if humans or specific animals are the source). Once the origin of a source is narrowed down, staff contact the appropriate jurisdiction to further isolate it or undertake corrective actions.

The results of the BST analyses are as follows:

- bacteria of human origin were identified in samples from two stormwater discharges in North Saanich (3077 and 3118); and
- results from a sample from a third discharge in Central Saanich (3142) was inconclusive (the bacteria could not be identified).

The status of investigations is as follows:

- the source was found in one discharge (more detail follows);
- staff narrowed down the potential source of contamination in three catchments (discharges 449A, 3142, 3077), but more sampling is needed to identify the source or confirm results;
- Investigations are ongoing for the remaining four discharges (3118, 3142, 449, 450); Investigations have been inconclusive due to lower levels of fecal coliforms, multiple sources of contamination or dry conditions.

IWMP and Central Saanich staff worked together to identify the source of contamination in discharge 416; however, more investigation is needed by IWMP staff to confirm what part of the property the contamination is emerging from and if substances other than fecal coliforms are a concern. Central Saanich and CRD staff expect to work with the property owner to mitigate the stormwater contamination.

### **Chemical Contaminants**

In 2013, IWMP staff collected six sediment samples from the catchment area of four discharges (441, 449, 3016 and 3138) to investigate sources of metal or PAH contamination. Staff have identified the source of contamination in one discharge (441; Reay Creek), but continue to investigate the source of elevated mercury identified in 2012 (mercury was low in 2013). Staff have narrowed down a source of contamination to within a few blocks in discharges 449, 3016 and 3138. However, investigations have been suspended in discharges 449 and 3138 due to the challenges of finding a single point source of zinc. Investigations have been inconclusive for discharge 3005 due to the difficulty of collecting sediment in this catchment. In 2014, IWMP staff will continue to monitor Reay Creek for changes due to corrective actions and creek restoration and will continue to investigate the source of arsenic in discharge 3016.

### **3. Major Watercourse Monitoring**

IWMP staff continued to monitor water quality in eight creeks on the Saanich Peninsula (Hagan, Reay, Tetayut, Tatlow, Tén Tén, Tod, Tsawout and Tseycum) in 2013. These creeks are monitored to provide information about creek and watershed health. CRD data shows that water quality in the streams has been consistent over the past five years, and is good in one creek (Tod Creek), fair in two creeks (Tetayut and Reay), and poor in five creeks (Hagan, Tatlow, Tén Tén, Tsawout and Tseycum). The parameters of most concern were fecal coliform bacteria, turbidity and phosphorus. Elevated levels of these parameters are likely the result of failing onsite sewage systems and agricultural practices.

In 2013, IWMP staff will work with municipal staff to locate sources of fecal coliform contamination. As part of the overall stormwater education initiative on the Peninsula, IWMP will also educate property owners about methods to reduce the amount of sediment and phosphorus leaving their properties and ultimately ending up in the creeks.

### **4. Special Projects**

The CRD IWMP has undertaken a number of special projects related to reducing and eliminating contaminants in watercourses and improving stormwater quality in the region. These are as follows:

#### **Increase Communication between CRD and Municipal Staff**

IWMP staff worked cooperatively with municipal staff to plan and implement a Peninsula-wide stormwater source control program. Municipal staff have been attending an Inter-municipal Integrated Watershed Management Working Group chaired by the CRD.

#### **Review Chemical Contaminant Sampling**

IWMP staff are evaluating the effectiveness of the current chemical sampling program and are investigating new methods of obtaining samples and interpreting the results. Upstream investigations for zinc are being suspended due to the difficulty of finding a single point source of this chemical. This will allow efforts to be focused on finding the source of other chemicals, such as mercury and lead. Other methods of evaluating the environmental impact of stormwater discharges, such as toxicology testing, are also being investigated.

#### **Review Watercourse Sampling**

IWMP staff evaluated the watercourse sampling program with the goal of revising sample design to complete more intensive sampling of creeks so that water quality parameters can more reliably be compared to provincial water quality guidelines. Streams will be sampled more intensively, but less frequently, beginning in 2014.

## **RECOMMENDATIONS**

### **STORMWATER DISCHARGE SURVEYS**

1. That sampling is continued by Integrated Watershed Management Program staff at all discharges with a high or moderate level of public health concern, and at selected low rated discharges, to confirm contaminant levels and monitor for change. In 2014, IWMP will continue to decrease the number of discharges sampled in order to redirect funds to increased upstream investigations for those discharges that have been rated high for a number of years.
2. That sediment sampling and analysis be continued at high-rated discharges to confirm chemical contaminant levels and sources of contamination, as required.
3. That sediment sampling and analysis be discontinued at discharges where low chemical contaminant levels have been confirmed, but that they are sampled at least once every five years as part of a long-term strategy to monitor for changes.

4. That Integrated Watershed Management Program staff continue to evaluate the effectiveness of the current sediment sampling program and make changes as required to protect watercourses and the nearshore marine environment.

#### **WATERCOURSE SAMPLING**

1. That the watercourse sampling program be revised to produce data that can be reliably compared with provincial water quality guidelines, which are based on average concentrations from five samples collected within a 30-day period.
2. That one creek per year on the Saanich Peninsula is selected for intensive sampling.

#### **UPSTREAM INVESTIGATIONS**

1. That Integrated Watershed Management Program staff increase efforts in 2014 to find and eliminate the sources of high fecal coliform concentrations in those discharges rated high for public health concern. This can be accomplished by decreasing efforts used for routine stormwater discharge surveys and redirecting these funds to investigations.
2. That Integrated Watershed Management Program staff work with the jurisdictions involved to determine the sources of contamination for the discharges with a confirmed rating of high environmental concern.

#### **SPECIAL PROJECTS**

1. That the Integrated Watershed Management Program continues to undertake special projects, as necessary, to improve stormwater quality on the Peninsula.

#### **GENERAL**

The following are also recommended:

1. That Integrated Watershed Management Program staff develop and promote education and best management practices for water shed and stormwater protection for the public through the Saanich Peninsula Stormwater Quality Program and for businesses through the Saanich Peninsula Stormwater Source Control service.
2. That, where appropriate, Integrated Watershed Management Program staff will support municipalities and First Nations to investigate spills and other incidents that may lead to the contamination of storm drains, watercourses and the marine environment.

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**STORMWATER QUALITY ANNUAL REPORT 2013  
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# STORMWATER QUALITY 2013 ANNUAL REPORT SAANICH PENINSULA

## 1.0 INTRODUCTION

Under the Saanich Peninsula Liquid Waste Management plan (SPLWMP), the Capital Regional District (CRD) Integrated Watershed Management Program (IWMP) is committed to planning, promoting and coordinating the management of stormwater quality in cooperation with the participating municipalities, First Nations and other jurisdictions. Initiatives have been undertaken to improve stormwater quality on the Saanich Peninsula, with the goal of reducing or eliminating contaminants, improving aquatic habitat, protecting fish stocks and opening shellfish beds.

### 1.1 Study Area

IWMP assesses quality of stormwater for discharges along the entire Saanich Peninsula coastline (see Figure 1). The Saanich Peninsula is 10,413 hectares and has a population of 38,203 (Census Canada, 2011). The area is comprised of three municipalities (Central Saanich, North Saanich and Sidney), four First Nations (Pauquachin, Tsartlip, Tsawout and Tseycum) and various smaller industrial, provincial and federal land parcels (Swartz Bay ferry terminal, Victoria International Airport and Institute of Ocean Sciences).

Land use includes residential, agricultural, industrial, commercial and institutional activities. Roughly 3,490\* properties use onsite sewage disposal and approximately 12,400\* properties are connected to the Saanich Peninsula Wastewater Treatment Plant. Stormwater has the potential to carry contaminants from these land use activities to streams, ditches and the ocean.

The Saanich Inlet shellfishery is an important food source to First Nations people and the community on the Saanich Peninsula. Many shellfish beds on the Saanich Peninsula coast are closed for harvesting, primarily due to elevated fecal coliform levels.

### 1.2 Integrated Watershed Management Program Activities

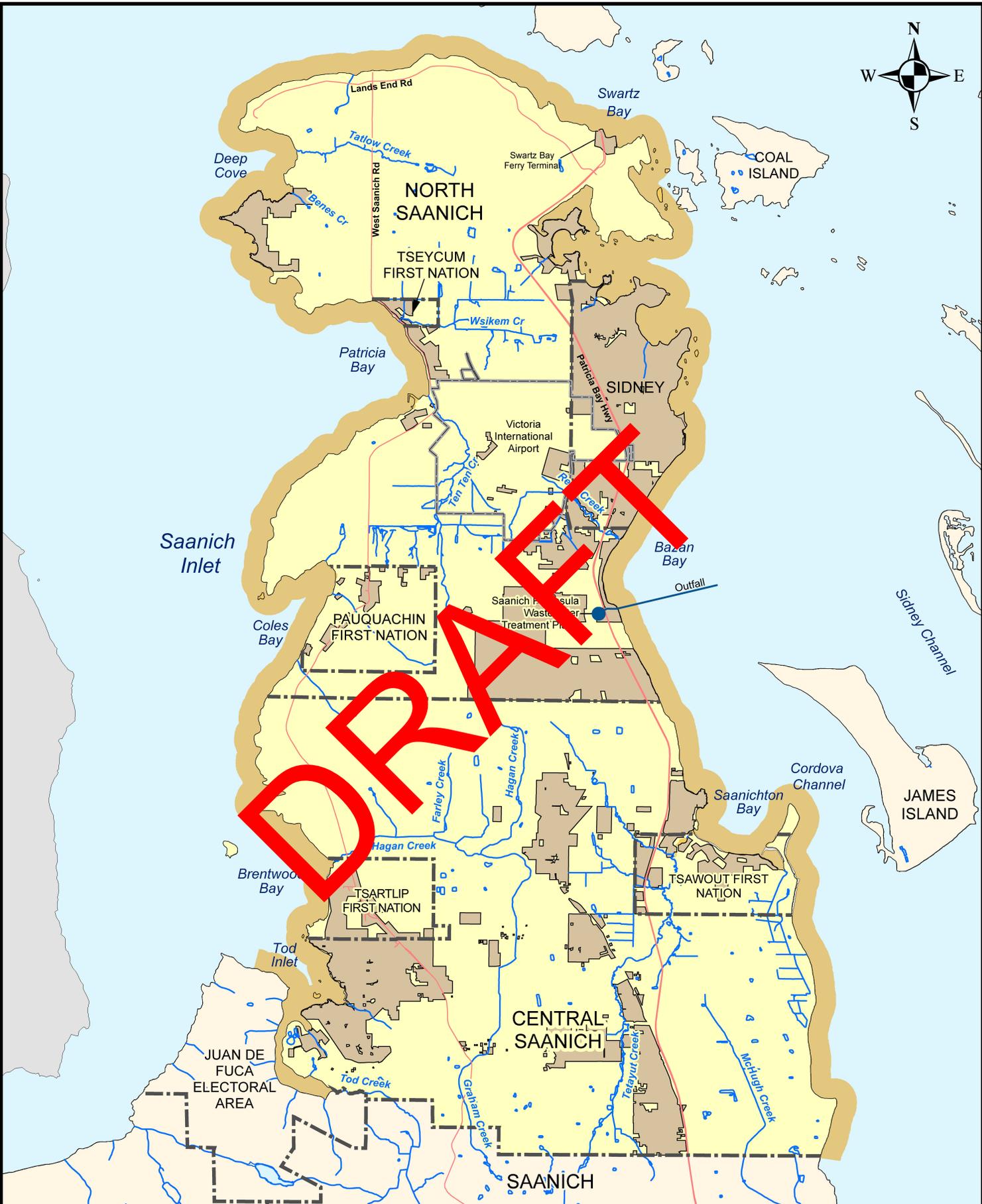
Rainwater travelling over pavement, roofs and other impervious surfaces has potential to pick up contaminants and convey them as stormwater. In addition, heavy precipitation can overwhelm poorly maintained in-ground sewage disposal systems allowing sewage to enter the environment. These contaminants can be conveyed to streams, ditches and the ocean where they can cause adverse effects to public health and the environment.

IWMP has been monitoring stormwater on Saanich Peninsula since 1997 as a component of the SPLWMP. The program works to limit impacts of stormwater runoff on the environment and public health through the following activities:

- **Stormwater Discharge Assessment** — Stormwater discharges are evaluated along the Saanich Peninsula coastline to investigate public health and environmental concern. Water and sediment is collected and analyzed for fecal coliform bacteria and chemical contaminants, respectively.
- **Source Investigations** — Investigations are completed to determine sources of contamination and direct corrective actions when a discharge is rated high for public health or environmental concern.

\*

These figures include all properties that are taxable based on BC Assessment Authority. Therefore, individual units in condo buildings, townhouses, row housing, etc., are counted if they have individual owners (an apartment building with a single owner would only be counted as one property).



**Figure 1 - Saanich Peninsula - 2013 Overview of Survey Area**



- Sewage Treatment and Outfall
- Streams
- Municipal and First Nations Boundary
- Major Roads
- Victoria International Airport
- Survey Area
- Stormwater Monitoring Area
- Sewered Areas

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- **Major Watercourse Monitoring** — Water quality parameters are monitored in a number of creeks in the Saanich Peninsula at the point of discharge into the marine environment. This monitoring is completed to assess health of the watercourses and monitor for change over time.
- **Technical Assistance** — The CRD provides technical assistance to municipal staff, community groups and the public. The CRD does not have authority to directly implement any mitigative programs; this continues to be the responsibility of municipalities, First Nations and other government agencies.
- **Special Projects** — IWMP undertakes special projects within the CRD to assist in protection of stormwater quality. Some of these projects are applicable to the Saanich Peninsula and were forwarded to the various jurisdictions for their consideration. Special projects include the following:
  - CRD-led stormwater source control
  - public outreach and education

### 1.3 Regulatory Background

In 1994, the CRD Board passed a resolution to prepare a Liquid Waste Management Plan for the Saanich Peninsula after obtaining agreement from Central Saanich, North Saanich and Sidney councils. In general, the plan was developed to address sewage treatment requirements, in-ground sewage disposal systems in unsewered areas, source control of contaminants, inflow and infiltration reduction, as well as stormwater and sewage management.

In the *Saanich Peninsula Liquid Waste Management Plan* (SPLWMP, CRD, 1996), a number of commitments were made by the CRD and the participating municipalities regarding stormwater quality.

The CRD makes the following commitments:

1. *to plan, promote and co-ordinate a program for management of stormwater quality and surface water resources in cooperation and consultation with the participating municipalities of Central Saanich, North Saanich and Sidney, and other Saanich Peninsula communities and local governments to:*
  - a) *limit the impacts of stormwater runoff on the environment and public health and well being*
  - b) *protect freshwater and near-shore marine ecosystems and resources*
2. *to promote education about water quality issues and to develop educational material*

Although the CRD is committed to coordinating the management of stormwater quality, the municipalities have authority over stormwater under the *Community Charter* and are responsible for mitigative programs. In the SPLWMP, the participating municipalities make the following commitments:

3. *to act on priorities within their jurisdiction to protect stormwater quality, the physical environment and aquatic habitat, and to reduce the levels of contaminants in stormwater discharges to accepted government standards in watercourses and near-shore marine areas*
4. *to use resources available to municipal governments to achieve these reductions*
5. *to amend bylaws, as necessary, to ensure that new development takes place in accordance with appropriate best management practices*

Specific commitments made in the SPLWMP by each of the three Saanich Peninsula municipalities are provided in Appendix A.

The stormwater monitoring program on the Saanich Peninsula was initiated to meet the commitments made by the CRD in the SPLWMP. The objectives of the program (taken from the SPLWMP), which will be phased in as resources allow, are as follows:

1. *to develop a program based on the best available information and technology*
2. *to investigate stormwater discharges with an emphasis on priority listing for remedial action and to identify possible remedial measures*
3. *to research, adopt and enforce, where applicable, best management practices for both existing and proposed urban developments*
4. *to research and promote agricultural best management practices*
5. *to develop policy statements on stormwater quality for inclusion in the official community plans of the participating municipalities*
6. *to research the sources of contaminants in municipal stormwater systems*
7. *to participate in and promote the principles of watershed management including public involvement and education programs*
8. *to prioritize watersheds for consideration of an integrated watershed management approach*

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## 2.0 SAMPLING PROGRAM

### 2.1 Study Area

The study area included the marine coastline and upstream locations between the Saanich-Central Saanich border on the east side of the peninsula to the Central Saanich-Juan de Fuca Electoral Area border (see Figure 1) within the following jurisdictions:

- District of Central Saanich
- District of North Saanich
- Pauquachin First Nation
- Town of Sidney
- Tsartlip First Nation
- Tsawout First Nation
- Tseycum First Nation

Land use in these areas includes residential, agricultural, industrial, commercial, institutional and parkland activities. The area includes: Victoria International Airport, Institute of Ocean Sciences and the Swartz Bay ferry terminal.

#### 2.1.1 Stormwater Drainage

Stormwater drainage in the developed areas of the Saanich Peninsula consists mainly of pipes in the urban areas. In more rural areas, stormwater drainage consists of open ditches and natural watercourses.

#### 2.1.2 Sewage Disposal

Sewage disposal consists of sewage collection systems or onsite sewage treatment facilities. Areas of Central and North Saanich not connected to the Saanich Peninsula Wastewater Treatment Plant are serviced by onsite sewage treatment facilities. The Tsawout wastewater treatment facility is owned by the Tsawout First Nation and treats sewage from their properties. Outfalls connected to two decommissioned sewage plants (in North Saanich and Sidney) are used as emergency sewage overflows. Private sewage treatment plants are also at the Swartz Bay ferry terminal and the North Saanich marina in Tsehum Harbour. Figure 1 in Appendix A shows areas serviced by a sewage collection system.

## 2.2 Public Health Concern — Fecal Coliform Sampling

### 2.2.1 Discharge Water Sampling

Designated stormwater discharges are assessed each year for public health concern. Each discharge is visited once during January–April (wet season) and once during June–September (dry season) to provide information about seasonal differences. Each visit includes an estimate of flow rate and collection of a water sample for laboratory analysis of fecal coliform bacteria, if the discharge is flowing. The level of contamination (i.e., fecal coliform counts and flow rate) and the potential that public may contact the discharge flow is used to rate each discharge for public health concern (details in Section 3.1).

Stormwater flows were sampled by land or boat at the point of discharge to the ocean, avoiding flows not associated with the discharge (e.g., salt water).

Fecal coliform levels are variable and can be influenced by many factors (e.g., rainfall levels and time of sampling). This program attempts to capture some of the seasonal variability by sampling during the wet and the dry seasons, but also attempts to reduce the chance of obtaining unusual results by avoiding first flush conditions. Measurements that are unusual compared to historical results are confirmed by resampling.

Sampling is continued for discharges rated high and moderate for public health concern until problems are resolved and the discharge is rated low. Approximately 20% of previously low-rated discharges are revisited each year. This ensures all discharges rated low are revisited within approximately five years to determine if new sources of fecal coliform bacteria have developed.

In 2013, a total of 77 stormwater discharges along the Saanich Peninsula coastline were assessed for public health concern. Locations of discharges are in Appendix B.

Eight of the stormwater discharges sampled are creeks. These creeks (Hagan, Reay, Tetayut, Tatlow, Tén Tén, Tod, Tsawout and Tseycum) are also monitored for additional water quality parameters to provide information on health of the creeks (Section 4.5).

### **2.2.2 Source Investigations**

Stormwater discharges of high public health concern or that have high fecal coliform counts (usually greater than 2,000 FC/100 mL) were investigated to determine the source of contamination. Source investigations included assessment of the catchment area land use, upstream sampling and bacterial source tracking (BST; analysis of bacterial DNA to determine if human or other animals are the source). Previous source investigations by CRD staff have identified four primary pathways of fecal coliform bacteria to land-based stormwater flows and the marine environment, namely:

1. failing septic tanks and fields
2. problems with municipal sewage collection systems
3. poor agricultural practices
4. non-point source pollution (recreational vehicle discharges, animals and birds)

Once the origin of a source is narrowed down, the jurisdiction is notified to further isolate it or undertake corrective actions. Vancouver Island Health Authority is contacted if a septic tank and field is suspected to be the source. If a sanitary-stormwater sewer cross-connection or malfunctioning sanitary sewer line is suspected, the municipality is contacted. Often, farm animals and wildlife are sources of high fecal coliform counts. In 2013, source investigations were carried out for eight discharges.

### **2.2.3 Quality Assurance — Fecal Coliform Analyses**

The quality assurance program includes replicate samples (field splits) for 10% of the discharge and marine surface water samples collected. Field splits are not collected during upstream sampling for source investigations as they are carried out more than once to find a source of high fecal coliform bacteria. A detailed discussion on the quality assurance program is provided in Appendix E.

## **2.3 Environmental Concerns — Chemical Contaminant Sampling**

### **2.3.1 Discharge Sediment Sampling**

Each year, sediment is sampled from designated stormwater discharges and assigned a chemical contaminant rating based on the concentration of eight metals and PAH relative to marine sediment quality guidelines. Sample locations were chosen based on proximity to environmentally-sensitive, heavily-populated and high recreational use areas where there is a greater risk of pollution. An attempt was made to equally distribute sampling locations throughout the study area.

Sediment samples are collected from the top 2 to 5 cm of sediment by hand or with specially-designed sediment traps above tidal influence. Samples are collected in the following order of preference, to ensure samples are not influenced by other contaminant sources:

- from within a storm drain
- from the centre of an open ditch or watercourse or from just outside the discharge point of a storm drain above tidal influence
- from within a stormwater collection system manhole, nearest the point of discharge

In 2013, sediment samples were collected from 18 locations to determine the level of contamination. Twelve of these samples were collected at the point of discharge and six were collected upstream within the catchment area of four stormwater discharges to narrow down source(s) of elevated contaminant concentrations.

Chemical contaminant data collected from 1998 to 2013 were used to assess environmental concerns in 2013. Data from previous years were included in the assessment to allow continued reporting of discharges recommended for corrective action, but not yet mitigated. Sampling locations are shown in Appendix B.

Sampling is continued yearly until a rating is confirmed (the same for two sequential years) or to monitor for change in areas of concern (i.e., those with changes in land-use, spills or clean-up efforts). Sampling is discontinued after contaminant concentrations have been confirmed to allow limited funds to be re-allocated for sampling other discharges. IWMP staff attempt to sample sediments from each discharge every five years. However, number and location of sediment samples collected are limited by accessibility, presence of sediment and budget.

### **2.3.2 Metals**

Sediment samples were analyzed for eight metals: arsenic, cadmium, chromium, copper, lead, mercury, silver and zinc. Detailed information on the methods used for laboratory analysis is reported in a separate document (Maxxam, 2011).

### **2.3.3 Polycyclic Aromatic Hydrocarbons**

Fifteen PAH are analyzed and grouped into high molecular weight PAH (HPAH) and low molecular weight PAH (LPAH). Detailed information on the methods used for laboratory analysis is reported in a separate technical document (Maxxam, 2011).

### **2.3.4 Quality Assurance — Chemical Contaminant Analysis**

Quality assurance for sediment analysis included field duplicates, laboratory triplicates and Standard Reference Materials (SRM). Precision and accuracy of the laboratory analysis were estimated from the results of these replicate and SRM samples. A full description of the measures is presented in Gormican (2010).

## **2.4 Marine Surface Water Sampling**

Environment Canada (EC) analyzed fecal coliform bacteria in marine water from selected areas offshore of the Saanich Peninsula for classification of shellfish harvesting areas. Sampling was conducted in Sectors 01 (Patricia Bay/Coles Bay), 03 (Bazan Bay/Saanichton Bay) and 10 (Saanich North).

### **2.4.1 Background**

The Saanich Inlet shellfishery is an important food source to First Nations people and the community on the Saanich Peninsula. Many shellfish beds on the Saanich Peninsula coast are closed for harvesting, primarily due to elevated fecal coliform levels.

In 1999, EC and the CRD worked cooperatively to open shellfish beds along the west coast of the Saanich Peninsula by reducing non-point sources of bacterial contamination. The *Open Saanich Inlet Shellfish Beds* project ended in 2007 due to the closure of the Environment Canada Georgia Basin Ecosystem Initiative program. This work was successful in reducing bacterial contamination responsible for shellfish bed closures.

### **2.4.2 Regulation of Shellfish Harvesting**

The jurisdictions involved with regulating and monitoring shellfish harvesting include the Department of Fisheries and Oceans Canada (DFO), EC and the Canadian Food Inspection Agency.

EC is the lead agency responsible for the survey and classification of shellfish growing areas, including:

- carrying out comprehensive sanitary and bacteriological water quality surveys of the molluscan shellfish growing areas in Canada
- determining the sources of pollution, the degree and extent of contamination and recommending the location of closure lines

A summary of EC data collected for classification of shellfish growing areas up to 2013 is in Section 4.4.

## 2.5 Monitoring of Major Watercourses

Eight watercourses are assessed each year by IWMP staff (Hagan, Reay, Tseycum (Wsikem), Tsawout, Tod, Tetayut, Tatlow and Tén Tén). In 2013, as in previous years, creeks were monitored for fecal coliform, temperature, pH, dissolved oxygen, specific conductance, turbidity, nitrate-nitrogen and phosphorus. Each creek was sampled at the point of discharge twice (wet and dry seasons) to assess watercourse health and provide information about changes in water quality over time.

Water quality measurements were compared to provincial guidelines for protection of aquatic life. Exceedences of these guidelines indicate potential for adverse effects to aquatic life. Fecal coliform measurements were compared to guidelines intended for protection of human health as aquatic life guidelines are not available for this parameter. BC guidelines were established by Ministry of Environment (MOE). Water quality parameters and guidelines adopted by IWMP are summarized in Table 1.

**Table 1 Water Quality Guidelines Used to Assess Watercourse Health**

Parameter	BC Approved Water Quality Guidelines	IWMP Guideline
Fecal Coliform	14 FC/100 mL <sup>1</sup>	200 FC/100 mL <sup>3</sup>
Temperature	19°C <sup>4</sup>	na
pH	6.5-9.0 pH units	na
Dissolved Oxygen	5 mg/L <sup>5</sup>	na
Specific Conductance	na <sup>6</sup>	na
Turbidity	9 NTU <sup>7</sup>	na
Nitrate	32.8 mg/L NO <sub>3</sub> -N <sup>8</sup>	na
Phosphorus	0.01 mg/L P <sup>9</sup>	na

**Notes:**

- <sup>1</sup> BC MOE shellfish harvesting guideline. Based on a minimum of five samples collected over 30 days, the median fecal coliform concentration should not exceed 14 FC/100 mL. IWMP compares single rather than median values to this guideline.
- <sup>2</sup> na = not applicable.
- <sup>3</sup> Guideline for Canadian Recreational Water Quality for human health protection from primary contact (e.g., swimming, kayaking). The 30-d log mean must not exceed 200 FC/100 mL. IWMP compares single rather than mean values to this guideline.
- <sup>4</sup> Maximum daily water temperature for streams with unknown fish distribution.
- <sup>5</sup> Minimum dissolved oxygen levels for the protection of freshwater aquatic life.
- <sup>6</sup> Due to high variability in specific conductance, MOE has not developed a guideline for aquatic life protection. However, natural levels range from 50 to 1500 µS/cm.
- <sup>7</sup> Assuming background levels are 1 nephelometric turbidity units (NTU), turbidity should not exceed background levels by more than 8 NTU. IWMP compares single samples to this value.
- <sup>8</sup> Maximum; expressed as nitrate-nitrogen (NO<sub>3</sub>-N).
- <sup>9</sup> Maximum; draft phosphorus objective for Vancouver Island streams (during growing season: May to September).

### 3.0 STORMWATER DISCHARGE RATING SYSTEM

The CRD evaluates stormwater discharges for public health and environmental concerns using rating systems developed by the CRD (Drinnan, 1997a). Coastline sensitivity associated with Saanich Peninsula stormwater discharges (Drinnan, 1997b) was evaluated to determine levels of public use, coastline habitat sensitivity and flushing characteristics of the receiving marine waters. Rating of discharges allows jurisdictions involved to better manage limited funds and undertake remedial measures where most necessary. Brief methodology of the stormwater discharge rating system follows:

#### 3.1 Public Health Concern

Each discharge is assigned a high, moderate, or low level of concern for public health based on the level of contamination in the stormwater and the potential for human contact using the following parameters:

- fecal coliform bacteria concentrations in stormwater discharges
- stormwater flow rate
- location of the flow (relative to the high waterline)
- public use of the shoreline (activities such as swimming, fishing, kayaking or beach use)

Fecal coliform are found in the gut and feces of warm-blooded animals and are indicators of contamination due to failing onsite treatment systems, deteriorating sanitary sewer infrastructure, improper manure storage and human or animal presence in and around the watercourses.

To determine the public health concern rating, a fecal coliform rating and public shoreline use rating are calculated (Table 2). The sum of these ratings determines the public health concern rating (Table 3).

**Table 2 Criteria for Fecal Coliform and Public Use Ratings**

Ratings	Fecal Coliform Rating <sup>1</sup> Criteria	Public Use Rating Criteria
1	FC <sup>2</sup> is < 200 FC/100 mL consistently and no flows	low public use (e.g., beach walking)
2	FC is > 200 and < 5,000 FC/100 mL	secondary contact (e.g., fishing)
3	FC is > 5,000 FC/100 mL	primary contact (e.g., swimming, scuba diving)

**Notes**

<sup>1</sup> Factors such as flow rates and location of flow with respect to the high waterline are also considered.

<sup>2</sup> FC = Fecal coliform count.

<sup>3</sup> The IWMP guideline is adopted from Vancouver Island Health Authority and Guidelines for Canadian Recreational Water Quality (30-d log mean of 200 FC/ 100 mL) for protection of public health from primary contact. IWMP compares single measurements to this value.

**Table 3 Categories for Public Health Concern Ratings**

Sum of Public Use and Fecal Coliform Ratings	Level of Concern	Recommendations
2 or 3	Low	No action
4	Moderate	Continue monitoring
5 or 6	High	Continue monitoring and corrective action

### 3.2 Environmental Concern

#### 3.2.1 Contaminant Rating

Contaminant ratings are based on the level of contaminants in sediments from stormwater discharges. Contaminants included were eight metals and a group of organic contaminants known as PAH. Ratings are determined by comparing the concentration of each contaminant (Cn) with the marine sediment quality guideline (MSQG)<sup>†</sup>. The MSQG are concentrations above which adverse effects may occur to marine life. Ratios of Cn/MSQG for each contaminant are then summed to account for potential effects caused by combining contaminants. The sum of ratios for each sample is the toxic equivalent unit (TEU). Table 4 provides criteria for determining the contaminant rating.

**Table 4 Criteria for Determining the Contaminant Rating**

Contaminant Rating	Criteria for Determining the Contaminant Rating
Low	Sum of the individual ratios of Cn/MSQG (TEU) is < 1.0.
Moderate	Sum of the individual ratios of Cn/MSQG (TEU) is > or = 1.0, but no individual parameter exceeds, or = 0.75.
High	The ratio Cn/MSQG is >, or = 0.75 for any single parameter (i.e., the parameter concentration is 75% of the MSQG).

#### 3.2.2 Habitat Rating to Prioritize Remediation

Corrective measures to eliminate the source of contaminants are recommended for discharges with a confirmed high contaminant rating. Order in which limited resources can be best used to address discharges with high levels of contaminants can be determined by the relative CRD habitat rating. The habitat rating considers habitat sensitivity, discharge flow and marine flushing characteristics. Criteria to determine scores for each of these factors are briefly described in Table 5. Habitat sensitivity, discharge flow and marine flushing scores are summed to determine a habitat rating (shown in Table 6).

### 3.3 Other Concerns

There are a number of other concerns that are reviewed and discussed by CRD staff and jurisdictions involved when setting priorities for remediation of discharges with a high level of concern for public health and the environment, including:

- cost of remediation
- likelihood that remediation will succeed
- compatibility with municipal priorities
- public interest

<sup>†</sup> The CRD Marine Sediment Quality Guidelines were adopted from Washington State Department of Ecology's Sediment Quality Standards: WAC 172-204-320.

**Table 5 Criteria for Habitat Sensitivity, Discharge Flow and Marine Flushing Scores**

Habitat Sensitivity Score	Habitat Sensitivity Score Criteria
1	areas of lower productivity and less diverse habitats
2	areas of moderate productivity and diverse habitats
3	areas with high productivity or endangered or protected habitats
Habitat Sensitivity Score	Discharge Flow Score Criteria
0.5	flows < 50 L/minute
1	flows between 50 to 500 L/minute
1.5	flows > 500 L/minute
Marine Flushing Score	Marine Flushing Score Criteria
0.5	areas of open shoreline with high flushing
1	partially enclosed areas with moderate flushing
1.5	enclosed areas with poor flushing

**Table 6 Criteria for Establishing the Habitat Rating**

Habitat Rating and Mitigative Priority	Sum of Habitat + Flow + Flushing Scores
Low	2.0 - 3.0
Moderate	3.5 - 4.5
High	5.0 - 6.0

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## 4.0 RESULTS

### 4.1 Public Health Concern

In 2013, 77 stormwater discharges along the Saanich Peninsula coastline were assessed for public health concern based on fecal coliform levels and potential for public contact. Public health concern ratings for the stormwater discharges were as follows:

- 38 were assigned a low public health concern rating
- 27 were assigned a moderate rating
- 12 were assigned a high rating

Distribution of public health concern ratings by jurisdiction is in Table 7. North Saanich and Sidney had the most high-rated discharges (four and five, respectively), while Central Saanich, Tsartlip First Nation and Tseycum First Nation had one each.

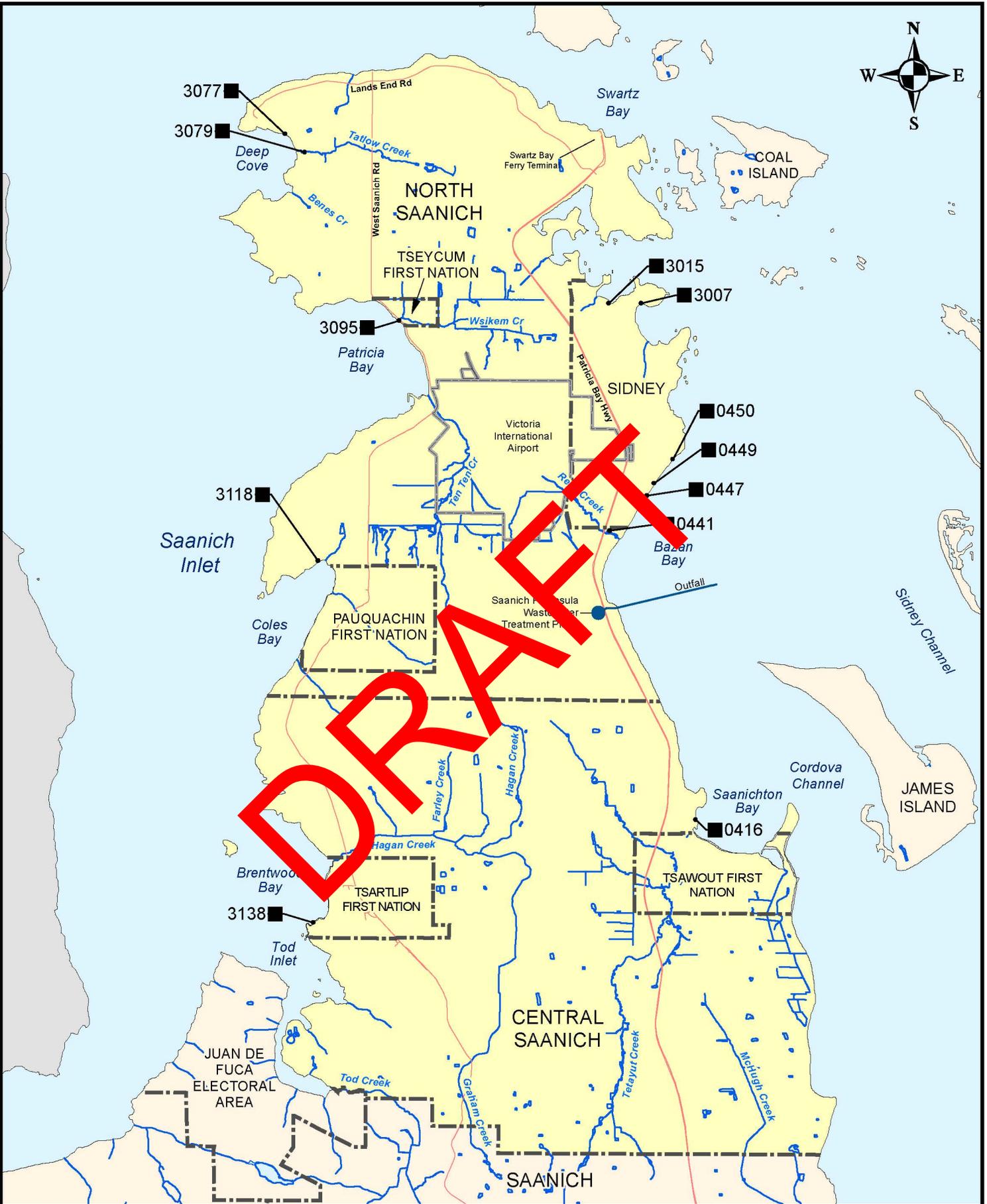
Discharges assigned a high rating will be investigated to determine the source of fecal coliform contamination. A possible source has been identified in one discharge (416 in Sidney) and narrowed down for two discharges (3142 in Central Saanich and 3077 in North Saanich). These investigations are summarized in Section 4.2.

**Table 7 Jurisdictional Distribution of Discharges Rated for Public Health Concern in 2013**

Jurisdiction	Number of Discharges Rated			
	Low	Moderate	High	Total
Central Saanich	4	6	1	11
North Saanich	19	6	4	29
Sidney	5	11	5	29
Pauquachin First Nation	0	1	0	1
Tsartlip First Nation	1	2	1	4
Tsawout First Nation	1	1	0	2
Tseycum First Nation	0	0	1	1
<b>Total</b>	<b>38</b>	<b>27</b>	<b>12</b>	<b>77</b>

**Notes:**

High-rated discharges are identified in Table 8 and locations are shown in Figure 2. Detailed figures of discharge locations and their public health concern ratings are in Appendix B. Fecal coliform and flow data and public health concern ratings are in Appendices C and D, respectively.



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0 0.5 1 2 Kilometres

Projection: UTM ZONE 10N NAD 83

**Figure 2 - Saanich Peninsula - 2013 Stormwater Discharges High-rated for Public Health Concern**

- High Public Health Concern Rating
- Sewage Treatment Facility & Outfall
- ~ Streams
- Municipal and First Nations Boundary
- Major Roads
- Victoria International Airport
- Stormwater Monitoring Area

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**Table 8 Discharges Assigned a High Public Health Concern Rating in 2013 by Jurisdiction**

Jurisdiction	High-rated Discharge Identification Numbers
Central Saanich	416
North Saanich	441, 3077, 3079, 3118
Sidney	447, 449, 450, 3007, 3015
Tsartlip First Nation	3138
Tseycum First Nation	3095

**4.1.1 High-rated Discharge Trends over Time**

Changes in the number of high-rated discharges over time on the Saanich Peninsula are shown in Table 9. The number of high-rated discharges has been steady since 2006, fluctuating between 11 and 13. Although the number of high-rated discharges has been similar for the past three years, this includes some discharges being repaired and removed from the list, and new high-rated discharges discovered.

**Table 9 Number of Discharges Rated High for Public Health Concern over Time**

Jurisdiction	Number of Discharges Rated High													
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Central Saanich	1	0	2	1	3	0	0	1	1	1	2	2	1	
North Saanich	6	5	4	4	10	1	7	5	5	6	4	4	4	
Sidney	7	3	1	4	1	3	4	6	5	5	4	5	4	5
Pauquachin First Nation	0	0	0	0	0	0	0	0	0	0	0	0	0	
Tsartlip First Nation	0	0	0	1	0	0	0	0	0	0	0	0	1	1
Tsawout First Nation	0	0	0	1	0	0	1	1	0	1	0	0	1	0
Tseycum First Nation	0	0	0	0	0	1	0	1	1	1	1	1	1	1
<b>Total</b>	<b>14</b>	<b>8</b>	<b>7</b>	<b>11</b>	<b>14</b>	<b>16</b>	<b>12</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>12</b>	<b>12</b>	<b>13</b>	<b>12</b>

Six of the 2013 high-rated discharges have been of concern for a number of years. Contamination remains in these discharges because sources have been difficult to find, more than one source exists or mitigation is costly. The six discharges that have been rated high at least four times since 2009 are listed below:

- 416, Ferguson Road beach access
- 449, SW of Tulista Park
- 450, foot of Ocean Avenue and Second Street
- 3077, W of Tatlow Road beach access
- 3095, Tseycum Creek
- 3118, foot of Hartfell

Three discharges received a lower rating in 2013 due to lower fecal coliform counts: discharges 407, 449A and 3153.

Three discharges that were not high-rated in 2012 were added to the list of high-rated discharges in 2013 due to increased fecal coliform counts: discharges 441, 3007 and 3015. Discharge 441 (Reay Creek) exhibited slightly elevated counts in 2013 and there is high potential for public contact in this discharge. Discharge 3007 (Sidney) was revisited for a first time in five years and discharge 3015 (Sidney) had an unusually elevated fecal coliform count in 2013. Staff will resample these discharges and confirm results in 2014.

#### 4.1.2 Quality Assurance Results — Fecal Coliform Analyses

Quality assurance results indicated that the laboratory analysis of fecal coliform was satisfactory. A detailed description of the results is provided in Appendix E.

#### 4.2 Fecal Coliform Source Investigations

In 2013, the IWMP put more effort into finding sources of the fecal coliform contamination identified through stormwater discharge sampling program. Staff received direction at the Saanich Peninsula Wastewater Commission (SPWWC) February 21, 2013 meeting to redirect program resources: reduce ambient shoreline monitoring efforts in 2013 and increase investigation of potential contaminant sources associated with current high-rated discharges. The catchment areas of eight stormwater discharges were investigated in 2013 during multiple sampling events to gather information about the sources of fecal coliform contamination.

Investigations involve upstream sampling in the catchment area, observation of land uses that may be contributing to contamination and BST. Once a source is identified or narrowed down to within approximately two manholes, the appropriate jurisdiction is notified to undertake corrective actions.

CRD IWMP conducted upstream sampling for fecal coliform or BST analysis in the following eight catchments:

- 3118 and 3077 in North Saanich
- 449, 449A and 450 in Sidney
- 416, 3142 and 3153 in Central Saanich

Staff conducted multiple sampling events in some catchments for a total of 17 upstream sampling events to collect stormwater samples for fecal coliform analysis. In addition, staff collected three stormwater samples for BST analysis.

The results of the BST analyses are as follows:

- bacteria of human origin were identified in samples from two stormwater discharges in North Saanich (3077 and 3118); and
- results from a sample from a third discharge in Central Saanich (3142) was inconclusive (the bacteria could not be identified).

The status of investigations is as follows:

- the source was found in one discharge (416; more detail follows);
- staff narrowed down the potential source of contamination in three catchments (discharges 449A, 3142, 3077), but more sampling is needed to identify the source or confirm results;
- Investigations are ongoing for the remaining four discharges (3118, 3142, 449, 450); Investigations have been inconclusive due to lower levels of fecal coliforms, multiple sources of contamination or dry conditions.

IWMP and Central Saanich staff worked together to identify the source of contamination in discharge 416; however, more investigation is needed by IWMP staff to confirm what part of the property the contamination is emerging from and if substances other than fecal coliforms are a concern. Central Saanich and CRD staff expect to work with the business to mitigate the stormwater contamination.

Further details of the Saanich Peninsula source investigations by area and discharge are in Table 10.

**Table 10 Summary of Saanich Peninsula Source Investigations in 2013**

Discharge ID	Location	# Upstream Sampling Events	BST Results <sup>1</sup>	Investigation Status	Follow-up
<b>Sidney</b>					
449	Ditch SW of Tulista Park	2	na; ruminants in 2010	Ongoing; Multiple sources of contamination	IWMP staff to continue sampling.
449A	Oakville and Eighth St.	4	na	Source narrowed; Ongoing	IWMP staff to continue sampling along James White Blvd.
450	Below Ocean Ave and Second St.	1	na	Ongoing; High fecal coliform counts upstream	IWMP staff to continue sampling above Bevan and 11th. Fecal coliform levels (2,800,000 CFU/100 mL) indicate direct sewage input.
<b>Central Saanich</b>					
416	Ferguson Rd. beach access	4	na; ruminants in 2010	Source found	IWMP staff to conducting further sampling to identify what part of the property contamination is emerging from and if other water quality parameters are elevated. Central Saanich staff are reviewing business.
3142	Foot of Verdier; N ferry wharf	1	general bacteroides	Source narrowed; High fecal coliforms and soapy discharge	IWMP narrowed down to a cul-de-sac. Central Saanich dye tested the houses and results were negative for cross connection.
3153	Butchart Gardens	1	na	Started in 2013; Ongoing	IWMP staff to continue sampling.
<b>North Saanich</b>					
3077	Tatlow beach access	2	human, ruminant animals	Source narrowed; Ongoing	IWMP staff to continue sampling near properties on Chalet Road.
3118	Foot of Hartfell	2	human	Ongoing; Multiple sources of contamination	IWMP staff to continue narrowing down human source.

**Notes:**

<sup>1</sup> BST= bacterial source tracking; genetic analysis to provide information about genetic source of fecal coliform bacteria (e.g., human, ruminant etc.)

In 2014, source investigations will continue to identify the source (human or other) and locations of identified sources of contamination in discharges with high fecal coliform counts. IWMP staff will continue to resample discharges with high fecal coliform counts to verify contaminant levels.

#### 4.2.1 Environmental Concern — Chemical Contaminant Sampling

In 2013, a total of 18 sediment samples were collected and analyzed for metals and PAH. The concentrations of metals and PAH were compared to guidelines for protection of aquatic life. Sediments can provide a record of substances deposited over time and chemical concentrations are used to determine contaminant ratings (methods in Section 2.2). Twelve stormwater discharges were sampled at the coastline and assigned a chemical contaminant rating. In addition, six upstream samples were collected in the catchment areas of discharges to assist in finding the sources of metals and PAH.

Locations and contaminant ratings for the discharges assessed in 2013 are shown in Figure 3. Detailed point of discharge sample locations and the most recent chemical contaminant ratings for all discharges are provided in Appendix B. Appendix F presents the contaminant data collected from 1998 to 2013; the following is a list of the tables provided in Appendix F:

- Table 1 provides the contaminant concentrations for each sample.
- Table 2 provides the sediment concentration relative to guideline ratios, the toxicity equivalent units (TEUs) and contaminant ratings.
- Table 3 summarizes rating results and provides recommendations.
- Table 4 provides the habitat rating for discharges of environmental concern.

#### 4.2.2 Chemical Contaminant Ratings

Discharge contaminant ratings are based on the contaminant concentrations in stormwater sediment at the point of discharge into the marine environment. In 2013, IWMP staff assessed 12 discharges along the Saanich Peninsula coastline and assigned the following contaminant ratings:

- Three were assigned a high rating [441 (Rey Creek), 3005 (Mermaid Canal) and 3138 (Brentwood Bay)]
- Two were assigned a moderate rating (3016 and 3021)
- Seven were assigned a low rating (600, 09C, 440, 3079, 3124, 3136B and 3146).

The three discharges assigned a high rating in 2013 have had elevated levels of contaminants in relation to marine sediment aquatic life guidelines for many years. More information on the high-rated discharges is provided below:

- **Discharge 441** (Rey Creek; North Saanich) carries flow from Victoria International Airport through Sidney and discharges to the North Saanich coastline. This creek has been monitored intensively since a fish kill occurred in 2004. IWMP staff collected sediment quarterly from 2004 to 2011 and annually since 2012 for metal and PAH measurement. This creek has received high ratings since 2004 due to elevated levels of zinc and cadmium in the sediment. Pollution prevention, restoration and creek enhancement activities undertaken by the Victoria Airport Authority and other groups have resulted in re-established runs of salmon and trout, but contamination remains in the sediment. IWMP staff will continue to monitor this creek.
- **Discharge 3005** (Mermaid Canal, Sidney) carries flows from residential and commercial areas. It was rated high due to zinc and PAH in 2013. These contaminants have been elevated since 2005 and the discharge was recommended for corrective action in 2007. Elevated arsenic concentrations have also been measured upstream. Source investigations in this discharge have been inconclusive to date partly due to the difficulty of collecting sediment. Investigations will continue in 2014.

- **Discharge 3138** (Brentwood Bay, Tsartlip First Nation) carries flows from Tsartlip land and was rated high in 2013 and intermittently since 2004 due to elevated zinc concentrations. Arsenic was also elevated in 2004 and 2005, but is low in recent samples. Investigations suggest that a source of zinc contamination is near Tsartlip Drive and Stelly's Cross Road; however, zinc concentrations are highest downstream at the discharge likely due to aged corrugated pipes. The source is narrowed down to within a couple blocks and IWMP will resample if corrective actions to replace the pipes is undertaken.

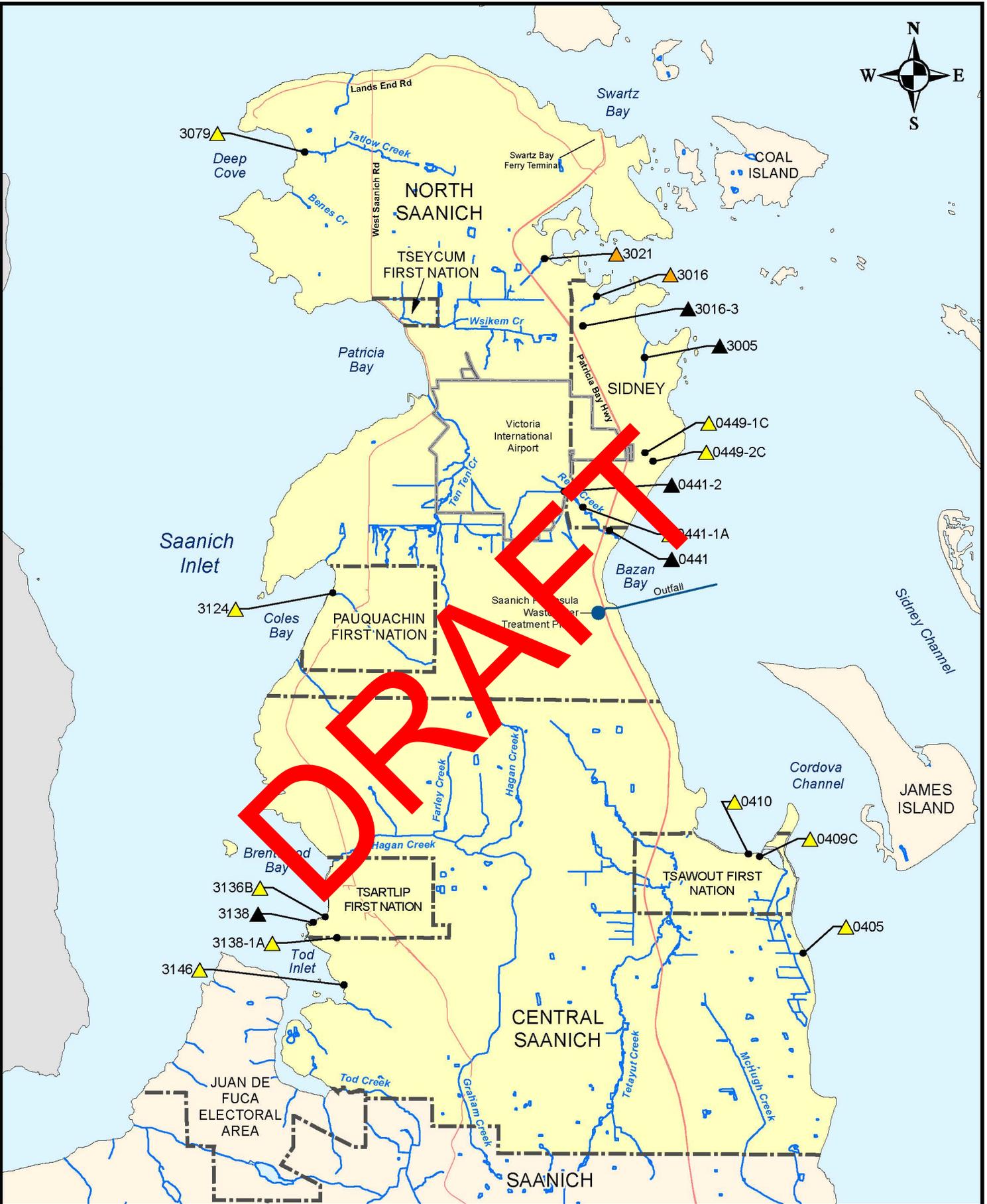
A discharge rated high in 2012 received a lower rating in 2013 (discharge 410). Discharge 410 is located on Tsawout First Nation land and drains into Saanichton Bay. It received high rating in 2012 due to elevated lead levels compared to the marine sediment quality guideline. Elevated concentrations of lead were also observed in this discharge in 2002. IWMP staff will resample in 2014 to confirm the lower results.

The two discharges rated moderate in 2013 were rated moderate or high in previous years and one of the discharges is recommended for corrective action based on previous high ratings (3016). More information on discharge 3016 is below:

- **Discharge 3016** (All Bay, Sidney) carries flows from Sidney land and was rated high at the point of discharge, and upstream for a number of years due to elevated zinc. IWMP staff recommended this discharge for corrective action in 2006 due to consecutive high ratings. Concentrations of zinc have fluctuated at the discharge in recent years resulting in moderate ratings in 2013 and 2011; however, zinc and more recently arsenic have remained elevated upstream in 2012 and 2013. This discharge is also rated high for public health concern and staff (IWMP and Sidney) have identified an area of damaged stormwater and sewer infrastructure. IWMP staff have partially narrowed down the source of contamination; investigations will continue in 2014.

Of the seven discharges assigned low contaminant ratings in 2013, one (410) will be resampled in 2013 to confirm the rating. Low ratings have been confirmed for the remaining discharges; therefore, they will not be resampled until 2018, unless there is a reason to suspect a new source of contamination before then.

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**Figure 3 - Saanich Peninsula - 2013 Discharge and Upstream Chemical Contaminant Ratings**

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0 0.5 1 2 Kilometres

Projection: UTM ZONE 10N NAD 83

**Chemical Contaminant Rating**

- ▲ High
- ▲ Moderate
- ▲ Low

- Sewage Treatment Facility & Outfall
- Streams
- Municipal and First Nations Boundary

- Major Roads
- Victoria International Airport
- Stormwater Monitoring Area

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### 4.3 Sediment Upstream Investigations

In 2013, six sediment samples were collected from the catchment area of four discharges (441, 449, 3016 and 3138) to determine sources of contamination observed in the discharges. The upstream sampling sites are referred to as stations (labelled as discharge number and a dashed number/letter). Details of these investigations are summarized below.

- **Discharge 441** (Reay Creek) flows from Victoria International Airport through Sidney and off the North Saanich coastline. Stream enhancement projects and restoration by a number of groups have resulted in re-established runs of salmon and trout. Cadmium and zinc continue to be the contaminants of concern; however, PAH are also elevated upstream in 2013. The source of contamination is above Canora Road (station 441-2) and Victoria Airport Authority (VAA) have identified sources of cadmium. VAA undertook steps to ensure tenants on their property have appropriate chemical storage, handling and disposal practices. In addition, VAA removed contaminated sediment and soil upstream of Canora Road from 2007 to 2009 and continues to monitor water quality. Elevated mercury was detected for the first time in 2012, but levels were low in samples collected in 2013. IWMP staff will continue to monitor sediment from Reay Creek annually for changes resulting from corrective and restorative actions.
- **Discharge 449** (Tulista Park, Sidney) carries flow from residential and commercial areas (including Sidney public works yard) and has been rated high due to zinc and HPAH. Sidney Public Works installed an oil/water separator to reduce contaminants leaving their yard. Staff have identified zinc originating from three areas. An automotive dump site under the Anacortes ferry terminal parking lot may be a source; aged corrugated metal pipes are another. The 2013 data shows lower levels of zinc (well below aquatic life guidelines) in the two upstream samples collected. It is uncertain how much of the zinc is coming from the land as the sampling point that connects the two upstream stormwater lines is tidally influenced. Due to the presence of multiple sources, recent lower zinc levels and the ubiquitous presence of zinc, IWMP staff will discontinue upstream investigations in this discharge until changes in the catchment that may influence zinc levels occur.
- **Discharge 3016** (All Bay, Sidney) carries flows from Sidney and was rated high at the point of discharge, and upstream (3016-3) for a number of years due to elevated zinc. In 2013, although zinc (and other metals) levels were low at the discharge, zinc and arsenic were elevated upstream at 3016-3 suggesting the source may be above Ardwell Avenue and Gabriola Place. Another upstream site (3016-2) had lower levels of metals indicating the area it drains is not a source. IWMP will continue source investigations in the area above Ardwell Avenue and Gabriola Place in 2014.
- **Discharge 3138** (Brenwood Bay, Tsartlip First Nation) carries flows from Tsartlip land and was rated high in 2013 and intermittently since 2004 due to elevated zinc concentrations. Arsenic was also elevated in 2004 and 2005, but recent samples had lower concentrations. Zinc was high in an upstream sample (3138-1) in 2004 and 2011, but concentrations were low in 2010. Samples collected further upstream (3138-1A and 3138-1B in 2005 to 2009 and 3138-1B in 2010) had low levels of contaminants, suggesting that the source of zinc contamination is near Tsartlip Drive and Stelly's Cross Road. The discharge will be resampled in 2014 to confirm the previous results. Zinc levels may be due to corroding pipes and, therefore, investigating the source of zinc will cease after 2014 until pipes are replaced.

### 4.4 Discharges Requiring Corrective Action

When chemical contaminant ratings remain high for two years and concentration of the parameter(s) of concern remain elevated, recommendations are made to determine and eliminate the source(s).

IWMP staff have recommended five discharges for corrective action in 2013 based on consecutive high ratings for the same contaminant(s). These discharges have been recommended for action for a number of years as IWMP and municipal staff have attempted to determine the source(s). One discharge (445) was removed from the action list as IWMP staff have been unable to collect sediment in this discharge since 2007 and Sidney has upgraded pipes in this discharge which may have removed the previous source of contamination.

The three discharges rated high in 2013 (441, 3005 and 3138) are recommended for corrective action based on consecutive high ratings. Discharge 3016 was rated moderate in 2013, but is still recommended for action until the moderate rating is confirmed and because contamination is still present upstream. One discharge not sampled at the discharge point in 2013, but rated high due to consecutive high-ratings, is also recommended for action (449).

CRD and VAA staff narrowed down the source(s) of contamination in one of these discharges (441: Reay Creek) and restoration activities are being completed. CRD staff have narrowed down the contaminant sources to within a few blocks for three of the discharges (449, 3016 and 3138), while investigations are inconclusive for one discharge (3005) partially due to the difficulty in collecting sediment.

Investigations in discharges 449 and 3138 have been suspended due to the challenges of finding a single point source of zinc, which enters storm drains from roadways due to particulate from vehicle brake pads, or from eroding storm drain pipes themselves.

The status of corrective actions for these discharges is shown in Table 11.

**Table 11 Status of Corrective Actions for Discharges of Concern**

Discharges Requiring Corrective Action	Status of Corrective Actions
441	Remedial efforts are being completed by Victoria Airport Authority and other groups for zinc and cadmium sources, but results are not expected to be evident in sediment for several years. Investigations to determine the source of elevated mercury measured in 2012 were carried out; however, mercury levels were low in 2013. IWMP staff will continue to monitor sediment from Reay Creek annually for changes resulting from corrective and restorative actions.
449	Three sources, one area of contamination narrowed down. IWMP staff will cease investigation in 2014 due to multiple sources and lower levels of zinc in 2013. The discharge will be sampled again in 2018 to monitor for change.
3005	Source investigations have been inconclusive partly due to the difficulty of collecting sediment. Town of Sidney and IWMP staff will continue source investigations in 2014.
3016	IWMP staff will continue to investigate the source of zinc and arsenic in the area above Ardwell Avenue and Gabriola Place in 2014.
3138	The source of zinc contamination has been narrowed down to the area at and downstream of Tsartlip Drive and Stelly's Cross Road. The majority of zinc is likely due to corroding metal pipes and, therefore, investigating the source of zinc will cease until pipes are replaced.

#### 4.4.1 Quality Assurance Results — Chemical Contaminant Analyses

Based on the quality assurance and quality control data analysis, the chemical contaminant data were considered acceptable for the purpose of assigning chemical contaminant ratings.

## 4.5 Marine Surface Water Monitoring

### 4.5.1 Shellfish Closures on the Saanich Peninsula

With the exception of two small areas south of Patricia Bay and Coles Bay, the coast of Saanich Peninsula is classified as closed for shellfish harvesting by EC (Figure 4). Shellfish can be harvested from closed areas under a special federal licence. They must be treated through depuration or other cleaning processes before being sent to market.

Shellfish growing waters can be closed for a variety of reasons, including:

- The presence of fecal material, poisonous and deleterious substances or marine biotoxins (e.g., red tide) to the extent that shellfish consumption may be hazardous.
- Reduced shellfish population levels (for conservation).
- The proximity to structures used for boat moorage or any permanently anchored floating structure (e.g., float homes).
- The proximity to other point and non-point pollution sources (e.g. sewage outfalls and agricultural runoff).

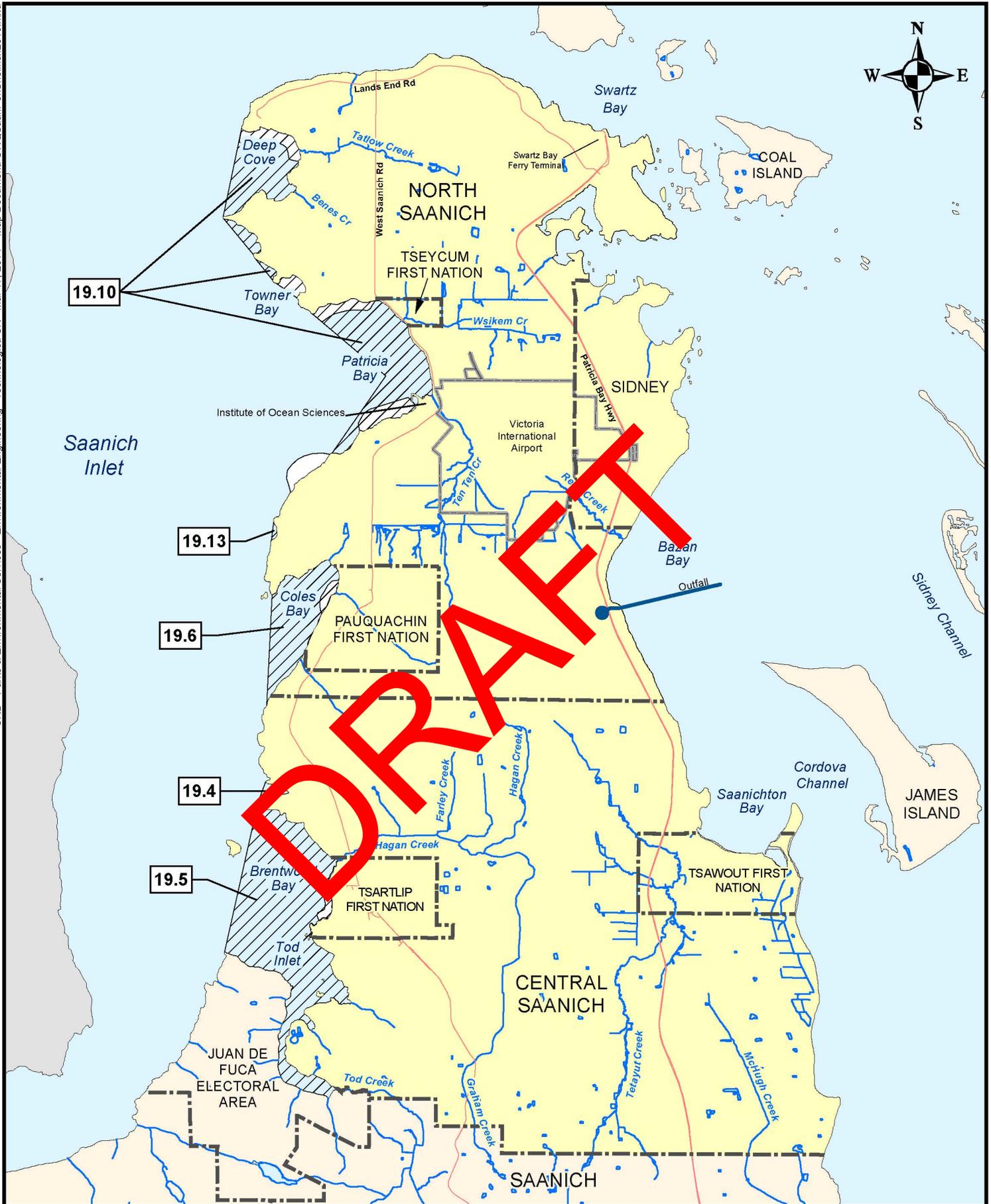
Shellfish harvesting closures as a result of fecal coliform levels occur if the following criteria are not met:

- The median fecal coliform concentration from a minimum of 15 samples is below 14 FC/100 mL and/or less than 10% of the samples exceed a fecal coliform concentration of 43 FC/100 mL.

### 4.5.2 Environment Canada Marine Surface Water Monitoring Results

In 2013, EC continued analyzing fecal coliform bacteria in marine water samples from selected areas offshore of the Saanich Peninsula to be used for reclassifying shellfish harvesting areas. The most recent 15 data points for fecal coliform concentrations along the Saanich Peninsula are summarized in Table 12. The results for Sectors 01 (Patricia Bay/Coles Bay) and 03 (Bazan Bay/Saanichton Bay) show exceedences of the shellfish harvesting standard, while Sector 10 (Saanich North) does not have any exceedences.

The EC Shellfish Growing Water Quality protection program is designed to identify and evaluate all actual and potential sources of pollution to growing and harvesting areas. In addition to routine classification sampling, there was an emergency, rainfall shellfish closure invoked in December 2012. During this event, high fecal coliform counts were recorded in Patricia Bay and Towner Bay (which are permanently closed for shellfish harvesting, regardless). These high fecal coliform levels corresponded with conditions across the Georgia Basin, and were due to fecal contamination from storm drain inputs throughout southern Vancouver Island and the southern mainland. This closure was considered a one-time event by EC. CRD staff will continue to work with the jurisdictions and EC to detect sources of fecal coliforms, if there is local interest in opening shellfish beds for a depuration harvest.



**Figure 4 - Saanich Peninsula - 2013 Environment Canada Shellfish Harvest Closure Areas West Coast of Saanich Peninsula**

**CRD**  
Making a difference...together

0 0.5 1 2 Kilometres

Projection: UTM ZONE 10N NAD 83

**Important:** This map is for general information purposes only. The Capital Regional District (CRD) makes no representations or warranties regarding the accuracy or completeness of this map or the suitability of the map for any purpose. **This map is not for navigation.** The CRD will not be liable for any damage, loss or injury resulting from the use of the map or information on the map and the map may be changed by the CRD at any time.

- Sewage Treatment Facility & Outfall
- Streams
- Municipal and First Nations Boundary
- Major Roads
- Victoria International Airport
- Shellfish Beds
- Shellfish Closure Areas
- Stormwater Monitoring Area

**Table 12 Environment Canada Marine Fecal Coliform Data for Saanich Inlet 2013**

Sector	Description	Station	Median	No. Samples >43 FC/100 mL	Frequency (%) >43 FC/100 mL
SA01	Patricia Bay/Coles Bay	SA017	<2	0	0%
		SA018	<2	1	7%
		SA019	<2	1	7%
		SA020	<2	1	7%
		SA021	2	1	7%
		SA031	2	2	<b>13%</b>
		SA033	2	1	7%
		SA116	<2	0	0%
		SA153	2	0	0%
		SA168	<2	0	0%
		SA173	5	3	<b>20%</b>
		SA174	2	1	7%
SA03	Bazan Bay/Saanichton Bay	SA125	12	0	<b>27%</b>
		SA158	<2	0	0%
		SA167	7	1	8%
SA10	Saanich North	SA014	<2	1	7%
		SA115	<2	1	7%
		SA119	<2	0	0%
		SA170	<2	0	0%

**Notes:**

Data is a summary of the previous 15 samples collected at each station and spans from 2007 to 2013. Bolded underlined values exceed one of the shellfish harvesting (1) median > 14 FC/100 mL or 2) >10% of the samples have >43 FC/100 mL.

**4.6 Monitoring of Major Watersheds**

Eight of the stormwater discharges monitored along the Saanich Peninsula coastline are creeks. IWMP staff collect water quality data to provide some information about watershed health and how it is changing over time. Staff sample the creeks at the point of discharge, twice each year (winter and summer) for a number of parameters (fecal coliforms, nutrients and physical parameters). The creeks are shown on Figure 5 and the data is in Appendix G.

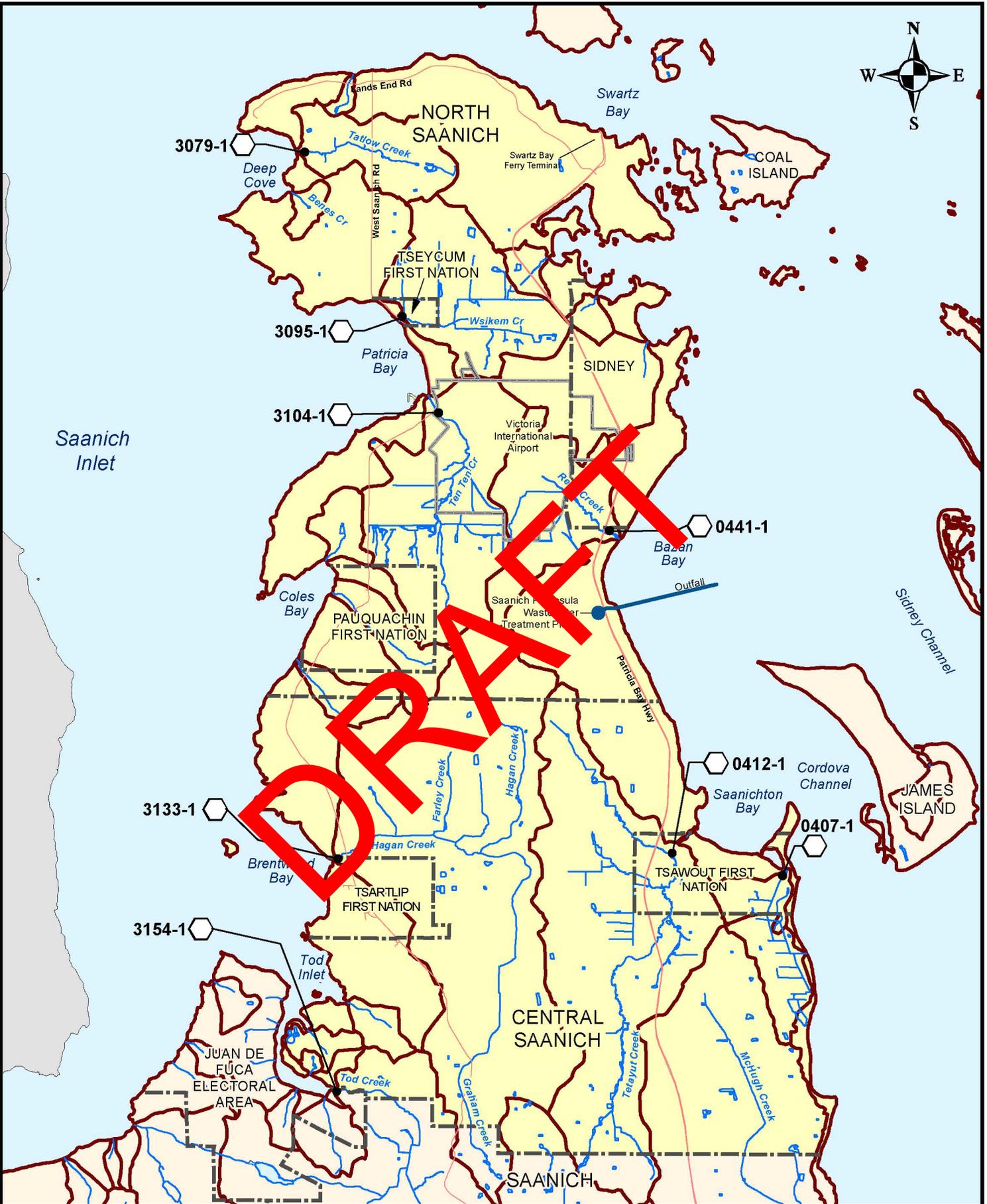
IWMP staff compared water quality measurements to provincial guidelines for the protection of aquatic life (See Table 1). Exceedences of these guidelines indicate a potential for adverse effects to aquatic life. The exceptions are the BC MOE fecal coliform guideline intended to protect humans consuming shellfish, and the less stringent IWMP guideline, intended for protection of humans through direct contact. IWMP uses the fecal coliform guidelines to evaluate the level of sewage contamination.

The BC MOE has recently drafted a phosphorus objective for Vancouver Island streams. The objective is specific to summer conditions when the streams are most sensitive to increases in phosphorus due to low stream flow and elevated temperatures. The objective is intended to protect streams from excess algal growth and associated impacts to stream health. The objective is that during the growing season (May to September), the maximum total phosphorous value should not exceed 0.01 mg/L in any one sample (a monthly average objective is also available, but CRD data is not collected monthly).

Phosphorus measurements in all Saanich Peninsula creeks in 2013 (and previous years), are elevated above this objective due to human activity in the watersheds such as land development, onsite sewage disposal and agriculture. Summer phosphorus levels are generally higher than winter levels in Saanich Peninsula creeks, but all measurements were above the summer guideline.

The following summarizes the IWMP monitoring program data by watercourse. Also provided is characterization information regarding known land use and fish populations for each creek.

**DRAFT**



**Figure 5 - Saanich Peninsula - 2013 Sampling Locations of Creeks Monitored in the Survey Area**

**CRD**  
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0 0.5 1 2 Kilometres

Projection: UTM ZONE 10N NAD 83

**Important:** This map is for general information purposes only. The Capital Regional District (CRD) makes no representations or warranties regarding the accuracy or completeness of this map or the suitability of the map for any purpose. **This map is not for navigation.** The CRD will not be liable for any damage, loss or injury resulting from the use of the map or information on the map and the map may be changed by the CRD at any time.

- Major Watercourse Sampling Stations
- Streams
- Sewage Treatment and Outfall
- Major Roads
- Municipal and First Nations Boundary
- Victoria International Airport
- Major Watersheds
- Stormwater Monitoring Area

### **Hagan Creek — CRD Discharge 3133** (Jurisdictions: Tsartlip First Nation, Central Saanich)

Hagan Creek carries flows from agricultural, industrial, institutional, recreational and residential land within the District of Central Saanich, through Tsartlip First Nation property and discharges to Hagan Bight. The watershed area is 1,676 hectares. Cutthroat trout are the only known fish population in this creek.

CRD data indicates that Hagan Creek has occasional exceedences of fecal coliforms, pH, dissolved oxygen, turbidity and phosphorus. These exceedences are not consistent through the years with the exception of turbidity which has been elevated three times in the last six years. There were no exceedences of water quality parameters in Hagan Creek in winter 2013 and results were similar to previous winter results. However, the summer 2013 sample had elevated fecal coliforms (290 FC/100 mL) and low dissolved oxygen (4.33 mg/L) for the first time since 2008 and 2009, respectively. More monitoring is required to determine if these exceedences indicate a change in overall water quality or are due to a random occurrences.

All other parameters met guidelines, except phosphorus (0.036 and 0.046 mg/L) which exceeds the draft Vancouver Island stream objective (0.01 mg/L) and is elevated in all CRD streams.

### **Reay Creek — CRD Discharge 441** (Jurisdictions: North Saanich, Sidney, Victoria Airport Authority)

Reay Creek carries flows from Victoria Airport Authority property through recreational and residential land, discharges to Bazan Bay and its catchment area is 371 hectares. Fish populations in this creek include coho salmon, chum and sea-run cutthroat trout.

CRD data indicates that Reay Creek occasionally has exceedences of fecal coliforms and turbidity. In 2013, there were no exceedences of water quality parameters with the exception of fecal coliforms. Elevated levels of fecal coliforms were measured in summer of 2013 (480 FC/100mL) and winter of 2011 (1,800 FC/100 mL). In 2012, fecal coliform concentrations were below the IWMP guideline for recreational contact (200 FC/100 mL) but exceeded the BC shellfish harvesting standard (14 FC/100 mL).

Winter turbidity was marginally below the guideline (8.53 compared to 9 NTU) in 2013, but was elevated in 2011 and 2012.

All other parameters met guidelines, except phosphorus (0.059 and 0.065 mg/L) which exceeds the draft Vancouver Island stream objective (0.01 mg/L) and is elevated in all CRD streams.

### **Tetayut Creek — CRD Discharge 442** (Jurisdictions: Tsawout First Nation, Central Saanich)

Tetayut Creek carries flows from agricultural, industrial, recreational and residential land, discharges to Saanichton Bay and its catchment area is 1,251 hectares. Sea-run cutthroat trout are the only known fish population in this creek.

CRD data indicates that fecal coliforms and turbidity are the parameters of concern in Tetayut Creek. Water quality in Tetayut Creek in 2013 was similar to previous years; however, only turbidity was elevated. The winter turbidity measurement was nearly two times above the guideline (17.5 NTU). Fecal coliform concentrations were lower than usual (110 and 20 FC/100 mL). As in previous years, all other parameters met guidelines, except phosphorus which exceeds the draft Vancouver Island stream objective (0.01 mg/L) and is elevated in all CRD streams.

### **Tatlow Creek — CRD Discharge 3079** (Jurisdiction: North Saanich)

Tatlow Creek carries flows from agricultural and residential land, discharges to Deep Cove and has a catchment area of 224 hectares. Sea-run cutthroat trout are the only known fish population in this creek.

CRD data indicates that fecal coliforms and turbidity are the parameters of concern in Tatlow Creek. Water quality in 2013 was similar to previous years, with exceedences of guidelines for both fecal coliforms and turbidity. The winter turbidity measurement was above the guideline (11.7 NTU) while the summer measurement was below (7.2 NTU). Fecal coliform concentrations were similar to previous years (70 and 570 FC/100 mL). As in previous years, all other parameters met guidelines, except phosphorus (0.036 and 0.072 mg/L) which exceeds the draft Vancouver Island stream objective (0.01 mg/L) and is elevated in all CRD streams.

#### **Tén Tén Creek — CRD Discharge 3104** (Jurisdictions: Victoria Airport Authority, North Saanich)

Tén Tén Creek carries flows from agricultural and residential property, through Victoria Airport Authority land and discharges to Patricia Bay. The catchment area for this watercourse is 602 hectares in size. No known fish populations exist in this creek; however, recent restoration activities by Peninsula Streams Society, as part of the Tén Tén Channel Renewal Project, have attracted a population of red-legged frogs (an endangered species).

CRD data indicates that fecal coliforms, turbidity, nitrate and phosphorus are the parameters of concern in Tén Tén Creek. In 2013, water quality results were similar to previous years – fecal coliforms, turbidity, and phosphorus concentrations were elevated compared to aquatic guidelines.

In 2013, fecal coliform concentrations (150 and 420 FC/100 mL) exceeded the IWMP guidelines in the summer and the BC shellfish harvesting standard in the summer and winter. Turbidity levels are elevated (9.04 and 7.4 NTU) and exceeded the guideline in winter. As in other CRD streams, phosphorus is greater than the Vancouver Island stream summer guideline; however, measurements in Tén Tén Creek are generally 10 times higher (i.e., 7 out of 10 measurements were above 0.1 mg/L). In 2013, the winter phosphorus measurement was lower than usual (0.026 mg/L) while the summer measurement was similar to previous results (0.163 mg/L). Nitrate levels range from 0.7 to 7.1 mg/L in this stream and were 1.5 and 1 mg/L in 2013 which is elevated compared to other Saanich Peninsula streams which usually exhibit levels below 1 mg/L.

#### **Tod Creek — CRD Discharge 3154** (Jurisdictions: Central Saanich, Saanich)

Tod Creek carries flows from agricultural, commercial and residential land within the District of Central Saanich and Saanich, discharges to Inlet and has a catchment area of 2,300 hectares. Coho and chum salmon, resident anadromous cutthroat trout, rainbow trout, three spine stickleback, prickly sculpin, smallmouth bass, brown bullhead and pumpkinseed sunfish are all known fish populations in the watershed.

As in previous years, water quality in Tod Creek is good. In 2013, all parameters met water quality guidelines with the exception of phosphorus (0.016 and 0.052 mg/L) which exceeds the draft Vancouver Island stream objective (0.01 mg/L) and is elevated in all CRD streams.

#### **Tsawout Creek — CRD Discharge 407** (Jurisdictions: Tsawout First Nation, Central Saanich)

Tsawout Creek carries flows from agricultural land within District of Central Saanich through Tsawout First Nation land and discharges to Saanichton Bay. This creek has a catchment area of 108 hectares. Land use in the watershed consists of mainly agricultural, residential and Tsawout First Nation property. No known fish populations exist in this creek.

CRD data shows that dissolved oxygen and turbidity have been the parameters of concern in Tsawout Creek. Fecal coliform concentrations are generally low (usually below the IWMP guidelines of 200 FC/100 mL and many of them have been below the BC shellfish harvesting standard of 14 FC/100 mL). In 2013, water quality was similar to previous years except dissolved oxygen was within acceptable guidelines and pH (6.34) was below the aquatic life guideline for the first time. Winter turbidity was elevated above the maximum guidelines for aquatic life as it has been for the past five years. When sampled in March 2013 the discharge had a dark amber colour. It is important to note that although there is a significant flow from the land, conductivity measurements taken by CRD staff confirm that there is

marine influence in at this sampling location, therefore, water quality results may be influenced by ocean conditions. Phosphorus, as previously stated, is elevated in all CRD creeks; however, the levels in Tsawout in summer are usually more than 10 times greater than the draft Vancouver Island stream summer objective (0.01 mg/L). The 2013 phosphorus measurements were 0.059 and 0.098.

All other parameters met guidelines.

### **Tseycum (Wsikem) Creek — CRD Discharge 3095** (Jurisdictions: Tseycum First Nation, North Saanich)

Tseycum Creek carries flows from agricultural, commercial and residential land, discharges to Saanichton Bay and has a catchment area of 321 hectares. Sea-run cutthroat trout are the only known fish population in this creek.

CRD data shows that fecal coliforms, dissolved oxygen, turbidity and phosphorus are the parameters of concern in this creek. In 2013, water quality was similar to previous years. Fecal coliform concentrations exceeded the IWMP guidelines of 200 FC/100 mL in the summer and winter (280 and 360 FC/100 mL). Bacterial source tracking results from 2009 and 2010 show that fecal coliform bacteria from ruminant animals, pigs and dogs are present. Dissolved oxygen (3.62 mg/L) fell below the minimum of 5 mg/L in the summer. Turbidity (40.5 NTU) exceeded the guideline of 9 NTU in the winter. Phosphorus was above the applicable guideline in all creeks; however, phosphorus concentrations in Tseycum (0.13 to 0.36 mg/L) exceeded the BC water quality objective by more than 13 times.

As in previous years, all other parameters met guidelines.

### **GENERAL**

Water quality in Saanich Peninsula creeks appeared to have remained consistent over the past five years and is measured as:

- good in one creek (Tod Creek; no exceedences of guidelines with the exception of phosphorus which is elevated in all CRD streams),
- fair in two creeks (Reay and Tsayut; one parameter exceeded a guideline with the exception of phosphorus which is elevated in all CRD streams), and,
- poor in five creeks (Hagan, Tatlow, Té Tén, Tsawout and Tseycum; two or more parameters were in exceedence of guidelines).

The parameters of most concern were fecal coliforms, turbidity and phosphorus. Temperature, pH and nitrate were generally within water quality guidelines, with just one exceedence of pH. Elevated levels of turbidity, fecal coliforms and phosphorus (the parameters of concern) are likely the result of higher levels of human settlement or agricultural practices. These three parameters and their possible sources are discussed below.

In 2013, fecal coliforms were elevated above the IWMP guideline for recreation (e.g., swimming) in five streams (Hagan, Reay, Té Tén, Tatlow and Tseycum). The highest count of 570 FC/100 mL was measured in Tatlow Creek. The major sources of fecal coliforms on the Peninsula are due to agricultural practices and failing onsite sewage systems.

Fecal coliform concentrations in Saanich Peninsula creeks have consistently exceeded 14 FC/100 mL (the BC fecal coliform guideline for shellfish harvesting is based on a median value of 14 FC/100 mL from five samples collected within 30 days). In 2013, only Tod Creek met this guideline. Since no shellfish harvesting is occurring in these creeks, the guideline is used as a conservative benchmark of fecal contamination.

Fecal coliform data vary slightly from year to year due to changes in precipitation levels. In many cases when precipitation levels increase, septic fields become saturated and can overflow, causing an increase in fecal coliform concentrations. As well, precipitation causes domestic animal or wildlife feces to enter

stormwater flows along the surface and through groundwater. However, higher precipitation levels may also decrease fecal coliform levels through dilution.

Turbidity is a measure of water clarity based on the amount of suspended material in the water. The suspended material can clog fish gills, smother developing eggs and increase water temperature. Turbidity levels in 2013 exceeded the guideline of 9 NTU in six of the eight Saanich Peninsula creeks monitored by IWMP staff in winter (i.e., Hagan, Tatlow, Tén Tén, Tetayut, Tsawout and Tseycum). There were no exceedences in the summer. Elevated turbidity is common in these creeks and is likely due to development in the watershed, vegetation removal, and stream alteration which increases the rate of runoff and leads to erosion. Excessive algal growth, as a result of nutrient inputs and lack of tree cover, also contributes to elevated turbidity.

Phosphorus exceeded the draft Vancouver Island objective by more than 10 times in Tén Tén, Tsawout and Tseycum creeks in 2013. Phosphorus levels are often elevated in these creeks and exceedences were observed in the same three creeks in 2012. Phosphorus sources include: sewage, fertilizers, toothpaste, detergents, pesticides and naturally occurring processes. Septic tank and fields, land clearing and agricultural practices can contribute to phosphorus exceedences if not managed properly.

In general, areas with higher human settlement and lower levels of overhead vegetation had a greater number of exceedences.

#### **REVISIONS TO WATERCOURSE MONITORING SAMPLE DESIGN**

The limited number of samples collected at each creek annually makes it difficult to obtain statistically robust data that can be compared to water quality guidelines and between seasons and years. Provincial and federal water quality guidelines are generally developed to be compared against a suite of five samples collected within a 30-day period, rather than single samples. This provides a more thorough picture of stream health now and for comparison in the future.

In 2014, IWMP will begin selecting one creek per year for intensive sampling. Intensive sampling will consist of five samples collected in a 30-day period in the fall flush period (and maybe summer, if funds allow) in the selected creek. In addition, a survey of benthic invertebrate health will be completed as an index of stream health if the budget permits. Over an eight-year period, each creek will be assessed once.

## 5.0 DISCUSSION AND CONCLUSIONS

### 5.1 Public Health Concerns

In 2013, IWMP staff sampled 77 stormwater discharges along the Saanich Peninsula coastline and rated them for public health concern based on fecal coliform levels and potential for public contact. Twelve of these discharges were assigned a high public health concern rating. Sidney and North Saanich had five and four high-rated discharges, respectively, Central Saanich, Tseycum First Nation and Tsartlip First Nation each had one, while Pauquachin First Nation and Tsawout First Nation had none. The number of high-rated discharges overall decreased considerably between 1991 (21) and 2002 (7), and has fluctuated between 11 and 13 for the past seven years.

Six of the 2013 high-rated discharges have been of concern for a number of years. Contamination remains in these discharges either because the source is difficult to find, more than one source exists, or mitigation is costly. Locations of high-rated discharges are provided in Figure 2. In 2013, IWMP staff put more effort into finding the source of contamination in discharges that have been high-rated for a number of years. This is discussed further in Section 5.1.1. In 2014, discharges that have been assigned a high rating for a number of years, and where the source of contamination is suspected, will be further investigated to determine the precise source of fecal coliforms and recommend mitigation methods.

#### 5.1.1 Fecal Coliform Source Investigations

In 2013, regular discharge sampling efforts were reduced by approximately 20% in order to put more effort into investigating the source of contamination in discharges that have been high-rated for a number of years. IWMP staff conducted 17 sampling events in the catchment areas of eight stormwater discharges to gather information about the sources of fecal coliform contamination. Each sampling event includes collection of at least two samples within the catchment. Staff conducted source investigations on two discharges in North Saanich (3118 and 3077), three in Sidney (449, 449A and 450) and three in Central Saanich (416, 3142 and 3153). Staff conducted BST analysis to determine if the origin of the bacteria was human or a specific animal source of the discharges.

The results of the BST analyses are as follows:

- bacteria of human origin were identified in samples from two stormwater discharges in North Saanich (3077 and 3118); and
- results from a sample from a third discharge in Central Saanich (3142) was inconclusive (i.e. the bacteria could not be identified).

The status of investigations are as follows:

- the source was found in one discharge (416; more detail follows);
- staff have narrowed down the potential source of contamination in three catchments (discharges 449A, 3142, 3077), but more sampling is needed to identify the source or confirm results;
- Investigations are ongoing for the remaining four discharges (3118, 3142, 449, 450); Investigations have been inconclusive due to lower levels of fecal coliforms, multiple sources of contamination or dry conditions.

IWMP and Central Saanich staff worked together to identify the source of contamination in discharge 416; however, more investigation is needed by IWMP staff to confirm what part of the property the contamination is emerging from and if substances other than fecal coliforms are a concern. Central Saanich and CRD staff expect to work with the business to mitigate the stormwater contamination.

Results of the Saanich Peninsula source investigations by area and discharge are in Table 10.

### 5.1.2 Future Fecal Coliform Sampling Efforts

Discharges rated high or moderate for public health concern in 2013 will be re-sampled in 2014 to confirm ratings and monitor for changes. Some of the 2013 low-rated discharges will also be resampled if they meet the following criteria:

- they are high-flowing creeks
- they had elevated fecal coliform counts
- the 2013 ratings need to be confirmed

Sampling will be discontinued for up to five years for the remaining low-rated 2013 discharges to allow funds to be allocated for other sampling. In addition, attempts will be made to sample discharges previously rated low that have not been visited in five years to determine if any changes have occurred.

### 5.2 Environmental Concerns

Discharge contaminant ratings are based on the sediment concentrations of metals and PAH at the point of discharge into the marine environment. In 2013, 12 discharges along the Saanich Peninsula coastline were assigned the following contaminant ratings:

- three were assigned a high rating [441 (Reay Creek), 3005 (Mermaid Canal) and 3138 (Brentwood Bay)]
- two were assigned a moderate rating (3016 and 3021)
- seven were assigned a low rating (450, 409C, 410, 3079, 3144, 3136B and 3146)

The three discharges rated high in 2013 (441, 3005 and 3138) as well as two others rated high in previous years (3016 and 449) are recommended for corrective action based on consecutive high ratings as a result of elevated contaminants. IWMP, Victoria Port Authority and municipal staff have been working towards finding and eliminating the source(s) of contamination for a number of years. The location of source of zinc and cadmium contamination has been identified in one discharge (Reay Creek), and investigations to determine the source of mercury measured in 2012 were inconclusive due to low levels of mercury in 2013. IWMP staff have narrowed down the location of the source of contamination to within a few blocks for three of the discharges (3005, 3016 and 3138) recommended for action.

In 2014, IWMP staff will:

- collect and assess sediment from all the moderate and one of the low-rated discharges to confirm the ratings,
- sample locations have not been visited for approximately five years,
- continue investigations in three discharges (3005, 3016 and 3138) to further narrow down the contaminant sources,
- cease investigations in 449 due to multiple sources and lower levels of zinc in 2013, and,
- continue monitoring Reay Creek (441) to measure changes over time in relation to restoration activities

Low ratings have been confirmed for the remaining discharges assessed in 2013; therefore, they will not be resampled until 2018, unless there is a reason to suspect a new source of contamination before then.

#### 5.2.1 Source Control Program

While IWMP source investigations help narrow down sources of contamination, it has become clear that this approach has had limited success in eliminating sources of contamination in stormwater sediment. In 2007, IWMP proposed creation of a CRD-led stormwater source control program. This is a method of reducing contaminant inputs to the stormwater system by working with businesses to reduce or eliminate their contaminant discharge to stormwater. It requires staff to work cooperatively with businesses through a balanced approach of education and enforcement.

In 2010, CRD staff began work on updating the model Stormwater Source Control bylaw (including harmonizing with the newly adopted Central Saanich Surface Water bylaw). In 2012, the Province of BC granted the CRD the powers necessary to create a stormwater source control service. CRD staff prepared a service establishing bylaw for adoption in late 2013 and will be working throughout 2014 with municipalities and stakeholders to finalize the regulatory bylaw.

### 5.3 Monitoring of Major Watercourses

IWMP staff monitored eight stormwater discharges that are creeks (Hagan, Reay, Tetayut, Tatlow, Tén Tén, Tsawout, Tseycum and Tod). Staff collected water quality data (physical parameters, nutrients and fecal coliforms) to assess the health of these watercourses (their ability to sustain fish and other aquatic life) and to track changes over time. In general, areas with higher human settlement, nearby agricultural practices and lower levels of overhead vegetation had a greater number of exceedences. Monitoring results were assessed using provincial aquatic life guidelines. The following is a summary of the findings:

- Water quality was good in one creek, Tod Creek, with no exceedences of guidelines for the protection of aquatic life with the exception of phosphorus which is elevated in all CRD streams.
- Water quality was fair in two creeks, Reay and Tetayut; one parameter exceeded the guideline in addition to phosphorus, and,
- Water quality was poor in five creeks, Hagan, Tatlow, Tén Tén, Tsawout and Tseycum; two or more parameters were in exceedence of guidelines.

The parameters of most concern were fecal coliforms, turbidity and phosphorus.

In 2013, fecal coliforms were elevated above the IWMP guideline for primary recreation (e.g., swimming) in five streams (Hagan, Reay, Tén Tén, Tatlow and Tseycum). The major sources of fecal coliforms on the Peninsula are due to agriculture and aging on-site sewage systems.

Turbidity is a measure of water clarity based on the amount of suspended material in the water. The suspended material can clog fish gills, smother developing eggs and increase water temperature. Turbidity levels in 2013 exceeded the guideline of 9 NTU in six of the eight Saanich Peninsula creeks in winter (i.e., Hagan, Tatlow, Tén Tén, Tetayut, Tsawout and Tseycum). Lack of vegetation from land-clearing practices and stream alteration is a major cause of soil erosion leading to the high turbidity measured in most creeks especially during high flows after rain events. Excessive algal growth as a result of nutrient inputs and lack of tree cover also contributes to elevated turbidity.

Phosphorus is elevated in all creeks on the Peninsula; however, guidelines were exceeded by more than 10 times in Tén Tén, Tsawout and Tseycum creeks in 2013. Phosphorus levels are often elevated in these creeks and exceedences were observed in the same three creeks in 2012. Phosphorus sources include: sewage, fertilizers, toothpaste, detergents, pesticides and naturally occurring processes. Septic tank and fields, land clearing and agricultural practices can contribute to phosphorus exceedences if not managed properly.

### 5.4 Special Projects

The CRD IWMP has undertaken a number of special projects related to reducing and eliminating contaminants in watercourses and improving stormwater quality in the region. This section discusses some of the main projects undertaken that could be used by the Saanich Peninsula municipalities and First Nations to protect stormwater quality within their jurisdiction.

#### **INCREASE COMMUNICATION BETWEEN CRD AND MUNICIPAL PLANNING STAFF**

IWMP staff worked cooperatively with municipal planning staff to discuss the options for a Peninsula-wide stormwater source control program.

## **REVIEW CHEMICAL CONTAMINANTS SAMPLING**

IWMP staff are evaluating the effectiveness of the current chemical sampling program and investigating new methods of obtaining samples and interpreting the results. A revised sampling protocol will help support stormwater source control activities by providing more useful contaminant information.

## **REVIEW WATERCOURSE SAMPLING**

IWMP staff are recommending a revised watercourse sampling design to complete more intensive sampling of creeks over the long term. The revised design will provide information on creek health that can more reliably be compared to provincial water quality guidelines and will provide baseline information for comparison with any future changes in creek water quality.

## **BEST MANAGEMENT PRACTICES**

Best Management Practices (BMP) are voluntary strategies for preventing stormwater pollution. Saanich Peninsula businesses are being encouraged to adopt BMP into their regular daily activities to protect local watercourses and the nearshore marine environment.

Two sector-specific BMP which have been completed and are ready for region-wide use are as follows:

1. *Painting without Pollution*
2. *Power Washing without Pollution*

More information regarding the BMP is available from the IWMP website at: [www.crd.bc.ca/service/sewers-wastewater-septic/residential-wastewater-stormwater/regulating-stormwater](http://www.crd.bc.ca/service/sewers-wastewater-septic/residential-wastewater-stormwater/regulating-stormwater) or from IWMP staff by e-mail at [stormwater@crd.bc.ca](mailto:stormwater@crd.bc.ca).

## **PUBLIC EDUCATION**

The CRD IWMP includes public education as an important component for reducing contaminants flowing into storm drains and managing rainwater. Part of this public education includes promoting the use of BMP by the community. Recently developed BMP brochures include *Power Washing without Pollution*, *Painting without Pollution*, *Building a Rain Garden* and *Rainwater Harvesting*.

In 2013, work continued on implementing an education and outreach strategy that incorporates stormwater quality and quantity issues, as well as restoration and protection of watersheds. In addition, work to develop educational material around proper agricultural practices to limit contamination of stormwater, creeks and the marine environment continued. In 2013, IWMP delivered environmental education information on these subjects and others, such as pesticide-free gardening, at seven public events on the Saanich Peninsula. Events included the Saanich Fall Fair and Shaw Ocean Discovery Days.

The program also emphasizes the importance of reporting spills that can cause harm to public health and/or the environment to the Provincial Emergency Program (PEP). PEP staff will then contact the appropriate jurisdiction for action (municipality, EC, MOE, fire department, etc.) or take action themselves. The level of effort given to education will continue.

### TSEYCUM CREEK SOURCE INVESTIGATIONS

Water quality guidelines have not been met in Tseycum Creek for several years. Parameters of concern include fecal coliform bacteria, phosphorus, dissolved oxygen and turbidity. In 2010, additional monitoring plus source investigations were undertaken along Tseycum Creek with the goal of determining the cause of water quality exceedences. Low dissolved oxygen is likely a secondary effect of phosphorus concentrations, as high phosphorus loading leads to eutrophication. Turbidity is due to heavy precipitation in the winter causing soil runoff and resuspension of creek sediments. BST identified ruminants and pigs as the sources of fecal coliform found in Tseycum Creek. BST results combined with high phosphorus levels, which often come from fertilizers, point to agricultural land use as the source of elevated fecal coliform and phosphorus levels in Tseycum Creek.

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## **6.0 RECOMMENDATIONS**

### **RECOMMENDATIONS**

#### **STORMWATER DISCHARGE SURVEYS**

1. That sampling is continued by Integrated Watershed Management Program staff at all discharges with a high or moderate level of public health concern, and at selected low rated discharges, to confirm contaminant levels and monitor for change. In 2014, IWMP will continue to decrease the number of discharges sampled in order to redirect funds to increased upstream investigations for those discharges that have been rated high for a number of years.
2. That sediment sampling and analysis be continued at high-rated discharges to confirm chemical contaminant levels and sources of contamination, as required.
3. That sediment sampling and analysis be discontinued at discharges where low chemical contaminant levels have been confirmed, but that they are sampled at least once every five years as part of a long-term strategy to monitor for changes.
4. That Integrated Watershed Management Program staff continue to evaluate the effectiveness of the current sediment sampling program and make changes as required to protect watercourses and the nearshore marine environment.

#### **WATERCOURSE SAMPLING**

1. That the watercourse sampling program be revised to produce data that can be reliably compared with provincial water quality guidelines, which are based on average concentrations from five samples collected within a 30-day period.
2. That one creek per year on the Saanich Peninsula be selected for intensive sampling.

#### **UPSTREAM INVESTIGATIONS**

1. That Integrated Watershed Management Program staff increase efforts in 2013 to find and eliminate the sources of high fecal coliform concentrations in those discharges rated high for public health concern. This can be accomplished by decreasing efforts used for routine stormwater discharge surveys and redirecting these funds to investigations.
2. That Integrated Watershed Management Program staff work with the jurisdictions involved to determine the sources of contamination for the discharges with a confirmed rating of high environmental concern.

#### **SPECIAL PROJECTS**

1. That the Integrated Watershed Management Program continues to undertake special projects, as necessary, to improve stormwater quality on the Peninsula.

#### **GENERAL**

The following are also recommended:

1. That Integrated Watershed Management Program staff, in cooperation with the Ministry of Environment, Environment Canada and community groups, develop and promote education and best management practices for the protection of stormwater quality.
2. That, where appropriate, municipalities and First Nations investigate spills and other incidents that may lead to the contamination of storm drains, watercourses and the marine environment, and that these incidents be reported to the Provincial Emergency Program.

## 7.0 REFERENCES

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