

## Water Quality Objectives for Sooke Inlet, Harbour, Basin, and Tributary Streams

British Columbia Ministry of Environment & Climate Change  
Strategy



The **Water Quality Objective Series** is a collection of British Columbia (B.C.) Ministry of Environment and Climate Change Strategy water quality objectives reports. Water quality objectives are developed for waterbodies to promote the protection and stewardship of provincially significant water resources. Once approved, water quality objectives constitute formal Ministry policy and must be considered in any decision affecting water quality made within the Ministry of Environment and Climate Change Strategy. For additional information visit: <https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-objectives>.

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## **EXECUTIVE SUMMARY**

Water quality objectives were formally developed to promote the protection of water quality values associated with the marine waters of Sooke Inlet, Sooke Harbour, Sooke Basin, and the freshwater tributaries to these waterbodies. The marine waters are to be protected for recreational and cultural uses with an additional goal of improving water quality to allow for bivalve shellfish harvesting in the future. In the freshwater tributaries, water quality objectives are provided to ensure protection of source drinking water, aquatic life, and recreational and cultural uses. The water quality objectives are summarized in the following tables.

### **Water Quality Objectives for Sooke Inlet, Sooke Harbour, and Sooke Basin**

<b>Variable</b>	<b>Objective Value</b>	<b>Notes</b>
Enterococci – recreational and cultural uses	≤35 CFU <u>or</u> MPN/100 mL	Geometric mean of at least 5 weekly samples collected in a 30-day period.
	≤70 CFU <u>or</u> MPN/100 mL	Single sample maximum allowable concentration.
Fecal coliforms – bivalve shellfish harvesting	≤14 MPN/100 mL	Median or geometric mean of at least 5 weekly samples collected in a 30-day period.
	≤43 MPN/100 mL	Maximum allowable concentration for 90% of results within a sampling period. Sampling periods require a minimum of 10 results.

### **Water Quality Objectives for Freshwater Tributaries to Sooke Inlet, Sooke Harbour, and Sooke Basin**

<b>Variable</b>	<b>Objective Value</b>	<b>Notes</b>
Temperature – aquatic life	≤17 °C instantaneous maximum	Applies to the Sooke River.
Temperature – drinking water	≤15 °C instantaneous maximum	Applies to tributary streams with domestic water intakes.
Dissolved oxygen – aquatic life	≥8 mg/L average	Average of at least 5 weekly samples collected in a 30-day period.
	≥5 mg/L instantaneous minimum	Minimum concentration measured at any given time.
Turbidity – drinking water	<5 NTU	Maximum, October 1 – December 31.
	<2 NTU	Maximum, January 1 – September 30.
	≤1 NTU	95 <sup>th</sup> percentile for any 12-month period
Total phosphorus – aquatic life	≤5 µg/L	Average of 5 monthly measurements, May – September. No more than 20% of results to exceed this value.
	≤10 µg/L	Maximum allowable concentration.
<i>E. coli</i> – drinking water	≤10 CFU <u>or</u> MPN/100 mL	90 <sup>th</sup> percentile of at least 5 weekly samples collected in a 30-day period, January 1 – September 30.
	≤40 CFU <u>or</u> MPN/100 mL	90 <sup>th</sup> percentile of at least 5 weekly samples collected in a 30-day period, October 1 – December 31.
<i>E. coli</i> – recreational and cultural uses	≤200 CFU <u>or</u> MPN/100 mL	Geometric mean of at least 5 weekly samples collected in a 30-day period.
	≤400 CFU <u>or</u> MPN/100 mL	Single sample maximum allowable concentration.

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## **1. INTRODUCTION**

Water quality objectives (WQO) are developed by the Ministry of Environment and Climate Change Strategy (ENV) for specific waterbodies to promote the protection and stewardship of B.C.'s water resources. WQOs define conditions that represent levels of low risk to water values. They formalize expectations with respect to water quality for a given waterbody and are used to inform resource management decisions in the natural resource sector.

WQOs are established on a priority basis for waterbodies (fresh, estuarine, marine) of regional, provincial, inter-provincial, and international significance as part of ENV's mandate to protect, manage, and conserve B.C.'s water resources. WQOs are set with the goal of protecting water values by maintaining existing water quality, improving existing water quality, or protecting water quality for a specific use.

WQOs are based on water quality guidelines, or similar information, and water quality assessments which consider the characteristics of the waterbody. These characteristics include: the ambient water quality and its assimilative capacity; the aquatic life and wildlife, and its habitat; the hydrology; the sediments; the potential contaminant loadings from point and non-point source waste discharges; and the cultural and social values associated with a waterbody.

Once approved, WQOs constitute formal ENV policy and must be considered in any decision affecting water quality made within ENV.

This document presents WQOs for the marine waters near Sooke including Sooke Inlet, Sooke Harbour, and Sooke Basin, and their freshwater tributary streams. These WQOs are based on the document *Water Quality Assessment and Proposed Objectives for Sooke Watersheds, Inlet, Harbour and Basin* (Barlak, 2019); readers should refer to this report for detailed water quality information on this area.

## **2. SITE DESCRIPTION**

The Community of Sooke is located 30 km west of Victoria on southern Vancouver Island. With a population of about 13,000, Sooke is a popular destination for eco-tourists, fishermen, and visitors. The marine waters around Sooke include Sooke Inlet, Sooke Harbour, and Sooke Basin (Figure 1). The area consists of 12 major watersheds (Table 1) (Figure 2) and within these are 9 designated community watersheds under the *Forest and Range Practices Act* (Table 2).

The watershed area is within the traditional territory of the T'Sou-ke Nation. Non-reserve lands are governed by the District of Sooke, the District of Metchosin, and the Juan de Fuca Electoral Area and include Crown, private residential, and industrial lands. Urban development is greatest closer to the marine waters but is increasing further up the tributary watersheds.

The primary concerns associated with impacts on water quality are storm water runoff from developed areas and failing septic systems. In the marine environment, activities associated with boating (marinas, vessel maintenance etc.) are also a concern, as are potential legacy impacts from past industrial activities, including fish processing, aquaculture, and forestry (sawmill, log storage, and wood treatment).

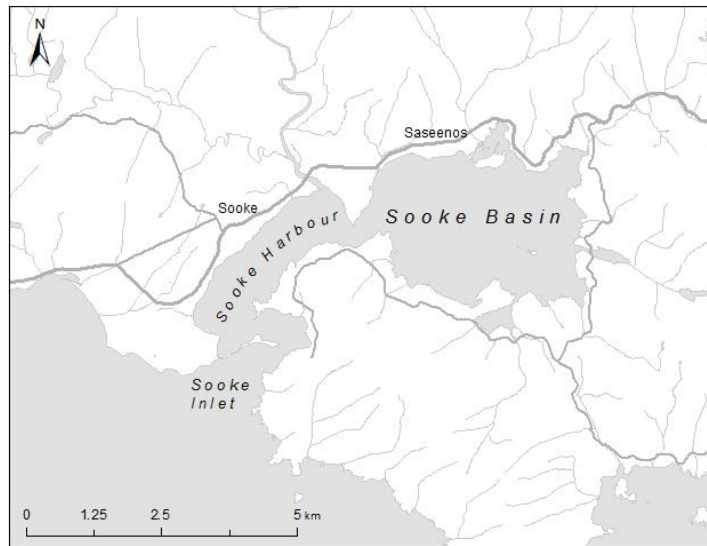


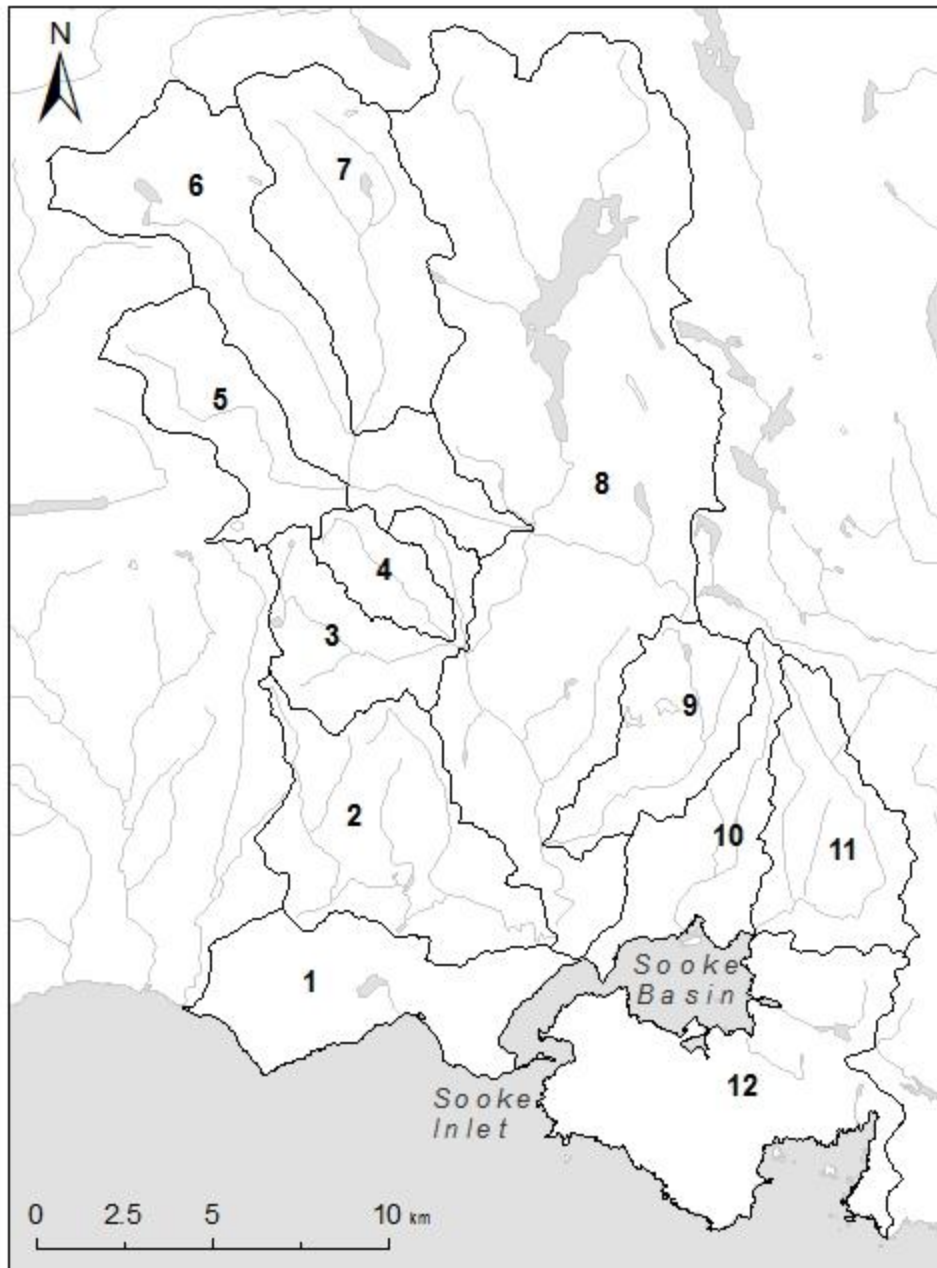
Figure 1: Map of Sooke Inlet, Sooke Harbour, and Sooke Basin.

Table 1: Major watersheds draining to Sooke Inlet, Sooke Harbour, and Sooke Basin. Numbers indicate watershed location as illustrated in Figure 2.

	<b>Watershed</b>	<b>Watershed Size (ha)</b>
1	Area west of Sooke Inlet and Sooke Harbour	2,987
2	DeMamiel Creek	3,817
3	Golledge Creek	2,030
4	Tributary to Golledge Creek	849
5	West Leech River	2,104
6	Leech River	4,515
7	Cragg Creek	3,732
8	Sooke River	14,926
9	Charters River	2,027
10	Ayum Creek	2,057
11	Veitch Creek	2,466
12	Area south and east of Sooke Basin	4,963

Table 2: Community watersheds within the Sooke Inlet, Sooke Harbour, and Sooke Basin drainage areas.

<b>Watershed</b>	<b>Watershed Size (ha)</b>
Wilfred Brook (near Matheson Lake)	2
William Brook (drains to Doerr Creek near Matheson Lake)	7
Mary Vine Creek (drains to the Sooke River)	308
Kemp Lake (drains to Juan de Fuca Strait)	549
Deception Gulch (drains to the Sooke Reservoir)	744
Council Creek (drains to the Sooke River)	1,034
Charters River	1,927
Sooke Lake (drains to the Sooke River)	6,982
Leech River (drains to the Sooke River)	9,357



*Figure 2: Map of the major watersheds draining to Sooke Inlet, Sooke Harbour, and Sooke Basin. Numbers correspond with the following watersheds: 1: Area west of Sooke Inlet and Sooke Harbour; 2: DeMamiel Creek; 3: Golledge Creek; 4: Tributary to Golledge Creek; 5: West Leech River; 6: Leech River; 7: Cragg Creek; 8: Sooke River; 9: Charters River; 10: Ayum Creek; 11: Veitch Creek; 12: Areas south and east of Sooke Basin.*

### **3. WATER VALUES**

In Sooke Inlet, Sooke Harbour, and Sooke Basin, the water values to be protected include aquatic life, wildlife, recreational and cultural uses, and shellfish harvesting. The harvest of shellfish in Sooke Inlet, Harbour, and Basin is currently closed due to sanitary contamination.

The freshwater tributaries in this area provide important fish and wildlife habitat, and water for domestic purposes. The freshwater values to be protected include drinking water and aquatic life. Protecting these values will ensure that other values, such as irrigation, recreational uses, cultural uses, and wildlife, are also protected.

Given the current level of development in this area, and the potential for future development, the goal of these WQOs is to protect current water values and uses and improve water quality to allow additional uses in the future, where appropriate (e.g., bivalve shellfish harvesting).

### **4. WATER QUALITY OBJECTIVES**

#### **4.1 Sooke Inlet, Sooke Harbour, Sooke Basin**

##### ***4.1.1 Microbiological Indicators***

Fecal contamination of the marine waters surrounding Sooke is the primary water quality concern. WQOs for microbiological indicators are established to ensure protection of human health in Sooke Inlet, Harbour, and Basin with respect to primary contact (full immersion with likelihood of swallowing water) and secondary contact (only limbs immersed with low risk of swallowing water) through recreational and cultural activities. As the area is currently closed to bivalve shellfish harvest (Closure 20.1 Sooke Harbour and Sooke Basin), a long-term WQO is also provided with the goal of eventually removing this closure.

The preferred indicator organism for the protection of recreational uses in marine waters is enterococci. **The WQO for enterococci is a geometric mean of  $\leq 35/100$  mL, based on 5 weekly samples collected over a 30-day period. The single sample maximum allowable concentration is  $70/100$  mL.** The units reported, either most probable number (MPN) or colony-forming units (CFU), will depend on the analytical method used (multiple tube fermentation or membrane filtration, respectively). Either method is acceptable.

To support the long-term (10 years) goal of allowing bivalve shellfish harvesting in Sooke Inlet, Harbour, and Basin, a WQO for fecal coliforms is defined based on the requirements of the Canadian Shellfish Sanitation Program (CSSP) (Canadian Food Inspection Agency, 2012). **The WQO for fecal coliforms is a median or geometric mean of  $14$  MPN/100 mL, based on 5 weekly samples collected over a 30-day period, with a 90<sup>th</sup> percentile  $\leq 43$  MPN/100 mL.** Note that the CSSP specifies that multiple-tube fermentation is the analytical method to be used with results reported as MPN.

#### **4.2 Tributary Streams**

##### ***4.2.1 Temperature***

The Sooke River and other tributary streams in this area provide important habitat for aquatic life including salmonids. The available data (see Barlak, 2019) show there is potential for water temperatures in the lower Sooke River to exceed the approved water quality guidelines (Oliver and Fidler, 2001) at certain times of the year. To protect the rearing habitat of cold-water species such as



coho salmon, a WQO for water temperature in the Sooke River is defined. **The WQO is a maximum temperature of 17 °C.**

Many of the tributary streams flowing into Sooke Inlet, Harbour, and Basin are drinking water sources. Although water temperature does not have a direct relationship to health, the importance of temperature is recognized as a determinant of other water quality parameters that may directly affect human health. Water temperatures greater than 15 °C can reduce residual chlorine levels and, from an aesthetic perspective, encourage the growth of nuisance organisms leading to unpleasant tastes and odours (ENV, 2017). **To protect the aesthetic quality of source drinking water, a WQO for water temperature is defined as a maximum of 15 °C near domestic water intakes.**

#### **4.2.2 Dissolved Oxygen**

Dissolved oxygen (DO) is an important characteristic of aquatic habitats and crucial to the survival of aquatic life. DO levels do not appear to be a concern in the Sooke tributary streams, based on the available information (see Barlak, 2019). However, to help ensure conditions remain healthy, a WQO for DO is defined. **The WQO for DO is an average concentration  $\geq 8$  mg/L based on a minimum of 5 weekly samples collected over a 30-day period, with an instantaneous minimum of 5 mg/L DO at any given time.**

#### **4.2.3 Turbidity**

Turbidity is a concern with respect to drinking water quality and risks to human health. Turbidity can interfere with disinfection, provide a medium for microbial growth, and indicate the presence of pathogens. Flows in the Sooke River tend to be higher from October through April and increased turbidity levels are generally associated with increased flow. Elevated turbidity levels likely reflect the impacts of urban and rural development in the lower reaches of the Sooke tributary watersheds.

A WQO for turbidity is defined to protect drinking water quality in the tributary streams and applies to areas near domestic intakes. The WQOs recognize that turbidity levels are not static and fluctuate throughout the year. **The WQO for turbidity is a maximum of <5 NTU from October through December, and a maximum of <2 NTU from January through September. Additionally, the 95<sup>th</sup> percentile for any site near a domestic intake should be  $\leq 1$  NTU for all measurements collected in a 12-month period to help achieve the Island Health Authority's goal for surface source drinking water.** The need for a WQO emphasizes the importance of adequate treatment of source water to minimize risks to human health.

#### **4.2.4 Total Phosphorus**

On Vancouver Island, phosphorus concentrations are a concern during summer low flow periods when elevated levels are most likely to lead to the deterioration of aquatic habitats and the quality of source drinking water. A WQO is defined to protect these values in the Sooke tributary streams and is based on guidance developed specifically for Vancouver Island streams (British Columbia Ministry of Environment, 2014). **The WQO is an average total phosphorus concentration of 5  $\mu\text{g/L}$  and a maximum concentration of 10  $\mu\text{g/L}$ , based on a minimum of 5 monthly measurements from May through September.** No more than 20% of individual measurements should exceed 5  $\mu\text{g/L}$ .

#### **4.2.5 Microbiological Indicators**

Fecal contamination of the Sooke tributary streams is a concern because some are used as drinking water sources and contact through recreational use is common in these watersheds. The Drinking Water Protection Regulation under the *Drinking Water Protection Act* requires no presence of *E. coli* and other microbiological indicators in finished potable water. Although source drinking water must be treated to ensure compliance with the Drinking Water Protection Regulation, a WQO is provided, to protect the

existing quality of drinking water sources and help prevent its deterioration over time. **The WQO is a 90<sup>th</sup> percentile for *E. coli* of ≤10/100 mL (MPN or CFU) between January through September, and ≤40/100 mL (MPN or CFU) from October through December, based on a minimum of 5 weekly samples collected within a 30-day period.** An additional WQO is provided to protect the recreational and cultural uses of the tributary streams. **The WQO for *E. coli* is a geomean of ≤200 (MPN or CFU)/100 mL, based on a minimum of 5 weekly samples collected within a 30-day period. The single sample maximum value is 400 (MPN or CFU)/100 mL.** Units will depend on the analytical method used, multiple tube fermentation (MPN) or membrane filtration (CFU), either of which is acceptable.

## 5. MONITORING RECOMMENDATIONS

There are several established monitoring sites in both the marine and freshwater areas of Sooke which contributed to these WQOs (see Tables 3 and 4, and Figures 3 and 4). Although it may not be feasible to sample all sites in any given water quality monitoring effort, using these sites is encouraged to build the long-term data set to support management of the water resources in the area. Sites should be selected based on the specific goals of any monitoring efforts conducted in this area.

*Table 3: Established water quality monitoring sites in Sooke Inlet, Sooke Harbour, and Sooke Basin. Sites have identifying numbers for the ENV's Environmental Monitoring System (EMS) and the Capital Region District (CRD).*

EMS #	CRD #	Site Name	UTM Northing	UTM Easting
E272569	SO-1	Sooke Inlet Mid-Inlet (CRD SO-1) (control)	5355410.185	446213.313
E272570	SO-2	Sooke Inlet Nearshore (CRD SO-2)	5356471.328	447856.647
E272571	SO-3	Sooke Harbour Mid-harbour (CRD SO-3)	5357037.499	446527.948
E272572	SO-4	Sooke Harbour Nearshore (CRD SO-4)	5357929.685	447716.707
E272573	SO-5	Sooke Harbour Nearshore (CRD SO-5)	5358137.089	448786.368
E272574	SO-6	Sooke Basin Nearshore (CRD SO-6)	535853.705	449486.565
E272575	SO-7	Sooke Basin Nearshore (CRD SO-7)	5357410.678	449816.179
E272576	SO-8	Sooke Basin Nearshore (CRD SO-8)	5357011.090	450921.577
E272577	SO-9	Sooke Basin Nearshore (CRD SO-9)	5356722.152	451393.848
E272578	SO-10	Sooke Basin Nearshore (CRD SO-10)	5356941.823	452235.525
E272579	SO-11	Sooke Basin Nearshore (CRD SO-11)	5356929.399	452898.629
E272580	SO-12	Sooke Basin Nearshore (CRD SO-12)	5357768.946	453510.712
E272581	SO-13	Sooke Basin Nearshore (CRD SO-13)	5358484.212	453068.089
E272582	SO-14	Sooke Basin Nearshore (CRD SO-14)	5359556.245	452957.821
E272583	SO-15	Sooke Basin Nearshore (CRD SO-15)	5360008.404	451585.238
E272584	SO-16	Sooke Basin Nearshore (CRD SO-16)	5359690.440	450879.757
E272585	SO-17	Sooke Basin Nearshore (CRD SO-17)	5359644.247	450285.139
E272586	SO-18	Sooke Basin Nearshore (CRD SO-18)	5359410.236	449328.204
E272587	SO-19	Sooke Basin Nearshore (CRD SO-19)	5358674.255	449062.492
E272588	SO-20	Sooke Harbour Nearshore (CRD SO-20)	5359099.246	448420.963
E272589	SO-21	Sooke Harbour Mid-harbour (CRD SO-21)	5358607.509	447908.388
E272590	SO-22	Sooke Harbour Nearshore (CRD SO-22)	5358623.744	447207.174
E272591	SO-23	Sooke Harbour Nearshore (CRD SO-23)	5358196.186	446777.636
E272592	SO-24	Sooke Harbour Nearshore (CRD SO-24)	5357562.737	446187.449
E272593	SO-25	Sooke Harbour Nearshore (CRD SO-25)	5356895.821	445946.911
E272594	SO-26	Sooke Inlet Nearshore (CRD SO-26)	5356375.040	446836.008
E272595	SO-27	Sooke Basin Mid-basin (CRD SO-27)	5358459.069	450775.938
E272596	SO-28	Sooke Basin Mid-basin (CRD SO-28)	5358445.343	451698.569
E275003	n/a	Sooke Basin Deepest Point	5358490.960	449736.930

Table 4: Established water quality monitoring sites in the tributary freshwater streams to Sooke Inlet, Sooke Harbour, and Sooke Basin.

EMS #	CRD #	Site Name	UTM Northing	UTM Easting
E276444	2100-1	Nott Brook	5356912.212	444138.931
E276445	2045-1	Throup Stream	5359089.334	447696.931
E236671	2043-1a	DeMamiel Creek	5359903.978	447474.150
E276446	2043-1	Lower Sooke River	5360244.374	447568.362
E276447	2043-1b	Baker Creek	5360187.663	447690.733
E276448	2043-2	Charters Creek	5362556.370	447481.013
E276449	2043-3	Todd Creek	5364357.281	447536.520
E276450	2043-4	Upper Sooke River	5364481.655	447147.568
E276451	2042a-1	Alderbrook Stream	5359405.506	448250.693
E276452	2039-1	Lannon Creek	5359572.866	449290.866
E245800	2036-1	Ayum Creek	5360344.235	451050.691
E276584	2036-2(E)*	Ayum Creek Upper	5361737.254	452709.065
E276453	2030-1	Veitch Creek	5359759.765	453151.765
E276585	2030-2(E)*	Veitch Creek Upper	5360349.886	454198.306
E276454	2027-1	Wildwood Creek	5357586.654	453821.656
E269000	n/a	DeMamiel Cr. 400 m u/s Robertson Cr. Bridge	5361430.460	442177.976
E269002	n/a	Charters Cr. 1.2 km d/s Charter Reservoir	5362564.780	447741.262

\* E: Ephemeral

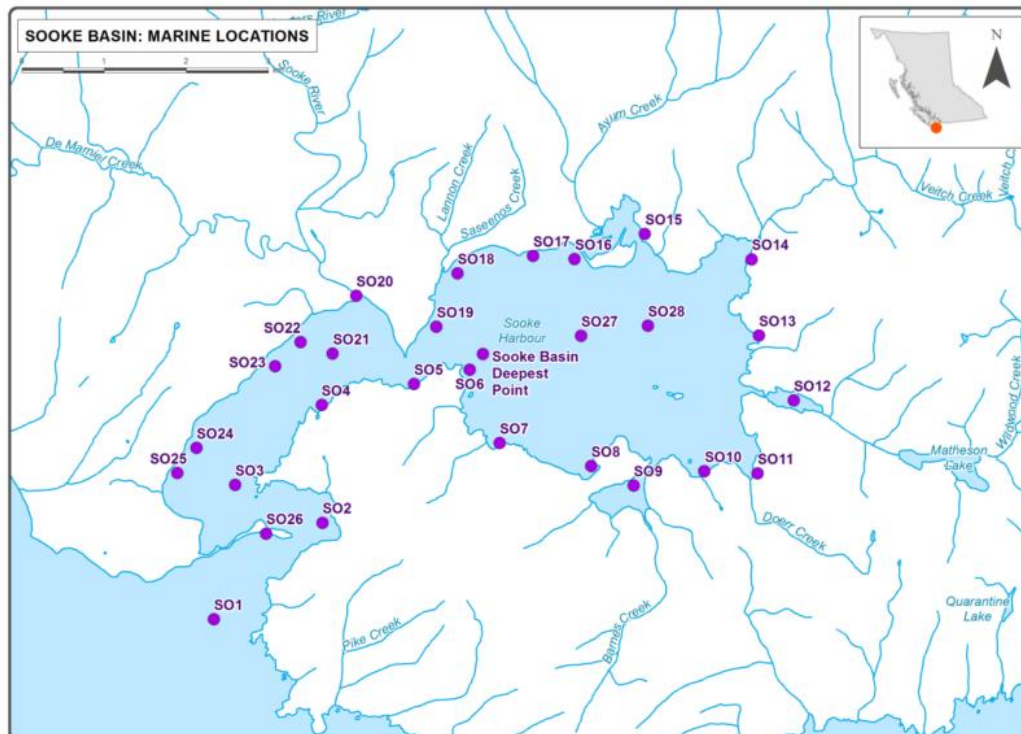


Figure 3: Marine water quality sampling sites in Sooke Inlet, Sooke Harbour, and Sooke Basin. Sites are identified with CRD site names (see Table 3) (Barlak, 2019).



Figure 4: Freshwater water quality monitoring sites within the Sooke watersheds. Sites are identified with ENV site names (see Table 3) (Barlak, 2019).

The recommended water quality monitoring program is outlined in Tables 5 and 6. Following these recommendations will provide the information necessary to determine attainment of the WQOs and support the ongoing water quality assessment for this area.

It is recommended to include benthic invertebrate biomonitoring in key tributary streams to help assess impacts from upstream activities. Benthic invertebrate biomonitoring offers the advantage of assessing the cumulative effects of upstream conditions using the composition of the invertebrate community at the site in question. Sampling must follow Canadian Aquatic Biomonitoring Network (CABIN) protocols (Environment Canada, 2012) and should be conducted for a minimum of 3 years (sampling takes place once per year in late summer or early fall) before determining the frequency of future monitoring.

Table 5: Recommended water quality monitoring program for Sooke Inlet, Sooke Harbour, and Sooke Basin.

Waterbody	Parameter	Timing and Frequency
Sooke Inlet, Harbour, and Basin	Enterococci	Aug – Sep; Oct – Nov: 5 weekly samples in 30 days.
	Total metals, hardness	Oct – Nov: 5 weekly samples in 30 days.
Sooke Inlet (SO-3), Sooke Basin (SO-28)	Field measurements: temperature, DO, pH, salinity	Aug – Sep; Oct – Nov: 5 weekly samples in 30 days.
Potential bivalve shellfish harvest areas	Fecal coliforms	Any monitoring effort requires a minimum of 5 weekly samples collected in a 30-day period.

Table 6: Recommended water quality monitoring program for the freshwater tributaries to Sooke Inlet, Sooke Harbour, and Sooke Basin.

Waterbody	Parameter	Timing and Frequency
All freshwater tributaries	<i>E. coli</i>	Aug – Sep; Oct – Nov: 5 weekly samples in 30 days
	Field measurements: temperature, DO, pH, specific conductivity Lab measurements: turbidity, dissolved organic carbon, total organic carbon, true colour, water hardness	Aug – Sep; Oct – Nov: 5 weekly samples in 30 days
	Total and dissolved metals	Oct – Nov: 5 weekly samples in 30 days
	Total phosphorus	Monthly, May - Sep
Lower reaches of any freshwater tributary of interest	Benthic invertebrate sampling as per CABIN protocols	Annually (late summer – early fall) for a minimum of 3 years. Frequency of future monitoring to be determined.

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