Budd Inlet
Dissolved Oxygen
Total Maximum Daily Load

Water Quality Improvement Report
and Implementation Plan

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Photo: Budd Inlet and downtown Olympia from Squaxin Park (formerly Priest Point Park).

Photo credit: Ben Watson, Department of Ecology.

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Budd Inlet
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Water Quality Improvement Report and Implementation Plan

By

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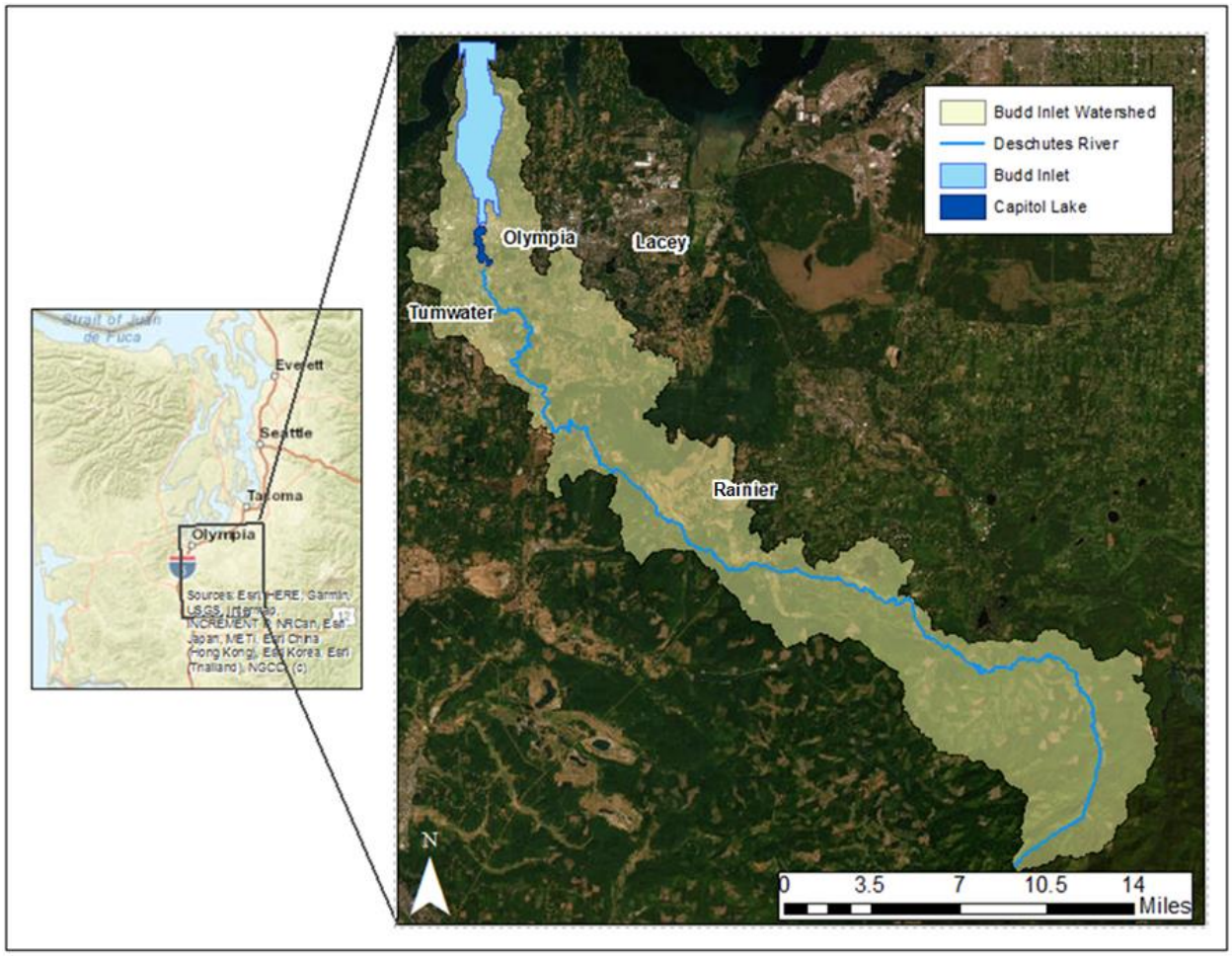
Chapter 1 - Introduction

Overview

Budd Inlet does not meet Washington State water quality standards for dissolved oxygen (DO). Located next to Olympia - Washington State's capital city - the waterbody is the southernmost

Figure 1. Location of the Budd Inlet watershed in southwestern Washington.



portion of the Puget Sound and the Salish Sea (Figure 1). The Deschutes River is the primary tributary flowing into Budd Inlet. Before it reaches Budd Inlet, the Deschutes River passes through Capitol Lake and the Capitol Lake Dam.

Because Budd Inlet does not meet Washington State's water quality standards for DO, it was placed on the federal Clean Water Act Section 303(d) list of impaired waters, triggering the development of this Total Maximum Daily Load (TMDL) study. A TMDL is a water quality improvement plan that sets limits on all pollution sources. These limits are set at levels needed to meet the DO water quality standards in Budd Inlet. More information on the TMDL process,

the 303(d) list, and how Washington State complies with the federal Clean Water Act is found on the Department of Ecology's TMDL information website[1] and in Appendix A.

Oxygen Depletion in Budd Inlet

Budd Inlet was first added to the 303(d) list for impaired waters in 1998, but its history of low dissolved oxygen and environmental degradation extends decades farther into the past. A 1986 study[2] commissioned by Ecology highlighted the problems caused by low DO within the Inlet, inculpating low-DO conditions in fish kills and water quality violations extending back to 1971. Fish and other aquatic organisms require oxygen dissolved within the water column to live and grow. If there is not enough DO in the water, their ability to function and reproduce is impaired, they may flee, or in extreme cases they may die. Budd Inlet, like many inlets within Puget Sound, is sensitive to DO-impairment because circulation patterns trap water in the inlet, which can exacerbate low-DO conditions. Humans further reduce DO in Budd Inlet by increasing the amount of carbon and nitrogen that enter the waterbody, contributing to excess nutrients in the waterbody, algal growth, and subsequent DO depletion. Appendix A provides further details on the relationship between Budd Inlet water quality, DO levels, and nutrients.

This TMDL identifies specific sources of pollution that result in Budd Inlet's DO impairment, the largest of which is Capitol Lake. The shallow lake stimulates the excessive growth of freshwater algae, which decompose once discharged to the marine waters of Budd Inlet and result in significant oxygen depletion. The lake also changes natural flow patterns resulting in an increased retention time in Capitol Lake and part of Budd Inlet (Albertson et al., 2010). Figure A-10 shows that when all other pollutant loads are kept constant, Capitol Lake drives minimum DO levels down throughout Budd Inlet, with particularly severe effects at the head of the inlet. DO depletion attributable to Capitol Lake in Budd Inlet's southernmost bottom-waters is as large as 3 mg/L. More information on how Capitol Lake causes oxygen depletion in Budd Inlet is found in Appendices A and D, the Department of Ecology's (Ecology's) 2015 Supplemental Monitoring Report[3], and Ecology's 2012 Water Quality Study Findings Report[4].

Additional human-caused (anthropogenic) sources of carbon and nitrogen enter Budd Inlet from the Deschutes River watershed, the greater Puget Sound, and permitted facilities that discharge into Budd Inlet. Sources that enter Budd Inlet through the Deschutes River include both upland discrete (point) sources subject to a National Pollutant Discharge Elimination System (NPDES) permit and diffuse (nonpoint) sources such as agricultural runoff, onsite septic systems, and unpermitted stormwater runoff. There are four wastewater treatment plants (WWTPs) that discharge directly into Budd Inlet, and their permits require them to remove organic compounds from wastewater before discharging it to surface waters. LOTT, the largest

[1] https://ecology.wa.gov/Water-Shorelines/Water-quality/Water-improvement/Total-Maximum-Daily-Load-process
[2] https://apps.ecology.wa.gov/publications/SummaryPages/86e37.html
[3] https://apps.ecology.wa.gov/publications/SummaryPages/1503002.html
[4] https://apps.ecology.wa.gov/publications/SummaryPages/1203008.html

WWTP within the watershed, has additional treatment processes in place that remove some nitrogen from its effluent, though WWTPs are unable to remove all nutrients from the water before discharge. Thus, they also contribute to DO depletion in Budd Inlet.

Puget Sound Nutrient Source Reduction Project

Ecology is currently developing a nutrient reduction plan for the entire Puget Sound, called the Puget Sound Nutrient Source Reduction Project (PSNSRP), to restore marine water quality to meet DO standards. PSNSRP is using the Salish Sea Model to determine the necessary nutrient reductions for WWTPs and watersheds in order to meet these standards. A draft nutrient management plan is scheduled to be released in 2024.

Budd Inlet is connected to the greater Puget Sound, which allows for the free-flowing exchange of water. Both natural and anthropogenic nutrient loads from nonpoint and point sources enter Budd Inlet with each incoming tide. The anthropogenic nitrogen and carbon includes both direct marine discharges to Puget Sound and discharges to rivers and streams that eventually flow into Puget Sound. Collectively, they are known as external sources that contribute anthropogenic nitrogen and carbon from outside Budd Inlet's watershed.

The Budd Inlet TMDL and PSNSRP will rely on each other's successful completion and implementation. The Budd Inlet TMDL determines an aggregate load allocation, or "bubble allocation," for external sources to Budd Inlet. The PSNSRP will show how nutrient reduction targets associated with the plan can meet the bubble allocation determined in this TMDL; and this TMDL will cap nutrient loads from Budd Inlet at amounts generally below 1997 levels for most sources (see Appendix A), in order to meet the PSNSRP's larger nutrient reduction schema.

Budd Inlet TMDL Process

Ecology began studying Budd Inlet, the Deschutes River, and Capitol Lake in the 1990s. All three waterbodies include numerous 303(d) listings. In 2015 Ecology submitted the freshwater river portions of the TMDL to EPA for approval. The Deschutes River, Percival Creek, and Budd Inlet Tributaries Multi-Parameter TMDL (Deschutes TMDL) includes TMDLs for 71 listings impaired by fecal coliform, DO, pH, fine sediment, and temperature. This TMDL did not include any allocations for nutrients aimed at protecting Capitol Lake or Budd Inlet. In 2018 EPA approved sections of the Deschutes TMDL associated with temperature impairments in the mainstem Deschutes River, Percival Creek, and Black Lake Ditch. EPA disapproved the remaining portions of the TMDL. In accordance with the Clean Water Act, EPA issued replacement TMDLs for these disapproved listings in 2020, which were subsequently revised in 2021 in response to public comments.[5] EPA's TMDLs established nutrient allocations for total phosphorous (TP) and total nitrogen (TN) in order to address DO and pH impairments in the Deschutes River watershed. These TMDLs called for nutrient reductions of up to 80% based on existing critical summer conditions in 2004 in the Deschutes River watershed upstream of Offut Lake but no reductions

[5] https://www.epa.gov/system/files/documents/2021-08/tmdl-deschutes-august-2021.pdf

in the downstream reaches. This TMDL establishes 65% daily load reductions in anthropogenic TN loads at the mouth of the Deschutes River and other Budd Inlet subwatersheds during April through October. The daily TN loads between November and March were capped at existing condition for the 1997 water year. Meeting these nutrient allocations is a component of this TMDL's strategy to achieve DO standards in Budd Inlet. In cases of overlapping allocations between TMDLs, permittees must comply with the more stringent requirements.

Since the initial submission of the Deschutes TMDL in 2015, Ecology has prioritized the development of a subsequent TMDL for the marine waters of Budd Inlet. Because the Budd Inlet TMDL and the co-occurring development of the Capitol Lake/Deschutes Estuary Long-Term Management Project Environmental Impact Statement, currently published in draft form[6], will likely affect the long-term status and management of Capitol Lake, Ecology chose not to include impairments in Capitol Lake in this TMDL. However, if these projects do not result in outcomes that restore Capitol Lake and remove it from the 303(d) list, Ecology will need to complete a TMDL for Capitol Lake. While this TMDL does not include allocations to protect water quality in Capitol Lake, it does include allocations for Capitol Lake aimed at protecting water quality in Budd Inlet. Ecology has not reviewed possible engineering designs for the long-term management of the lake. Our allocations are based on the impact of the lake's presence or absence, according to water quality models of Budd Inlet.

Ecology used a mechanistic model to simulate water quality and hydrology in Budd Inlet. The Budd Inlet model uses the Generalized Environmental Modeling System for Surface Waters (GEMSS) and incorporates four modules (hydrodynamics, water quality, macrophytes, and algae). The model simulates the physics, chemistry, and biology of Budd Inlet and Capitol Lake and was calibrated using observed water quality, circulation, and other geophysical data. The physics is driven by bathymetry; tidal movements; flows from rivers, lakes, and wastewater treatment plants; and climatic conditions like wind, precipitation, and water circulation. Chemistry and biology are linked through the cycling of nutrients and carbon.

Because 1997 is one of the years with the lowest DO levels in the historical record and there are ample observations for model set-up and calibration, we determined it to be the ideal model year for this TMDL (see Appendix F). The model was initially developed for LOTT's Budd Inlet Scientific Study and has been modified and recalibrated by Ecology over the past twenty years. Ecology had versions of the model peer-reviewed between 2009 and 2012. The final version of the model used to develop this TMDL went through an additional peer review in 2019 and 2020. More detailed information on the final model and peer review are found in Appendix D. Further, Ecology conducted a supplemental modeling study (Appendix G) focusing on more recent years (2006, 2008 and 2014) and utilizing a modeling system developed for understanding low DO dynamics in the greater Puget Sound.

[6] https://capitollakedeschutesestuaryeis.org/library#DEIS

A key finding of the Budd Inlet modeling studies is that human-derived loadings of both nitrogen and organic carbon compounds drive DO depletion in Budd Inlet. Further, hydraulic modification from the presence of Capitol Lake is a major driver in exacerbating low DO, particularly in inner Budd Inlet. Because the TMDL must allocate reductions to human sources, the contribution from human sources must be quantified. With the use of the GEMSS model, as described in detail in Appendix D, we predict how water quality in Budd Inlet will change when inputs of pollution are changed. Ecology used the model to determine how much we need to reduce the various sources of pollution in order to meet DO water quality standards in Budd Inlet.

Meeting the pollution limits set in this TMDL will require action from all partners in the watershed. This TMDL calls for every human source of pollution to be reduced in order to meet standards. Some pollution sources in the watershed have a permit from Ecology, allowing pollution limits to be enforced during the permitting process. Other sources do not have permits, and we rely on voluntary compliance through education and outreach, technical and financial assistance, and enforcement when necessary. The implementation plan in Chapter 3 describes what needs to be done to implement this TMDL.

Scope

This TMDL was developed to meet state water quality standards for DO in the marine waters of Budd Inlet.

Washington's 2018 Water Quality Assessment includes 13 segments within Budd Inlet that are listed as category 5 (impaired) for DO. Table 1 and Figure 2 identify these listings.

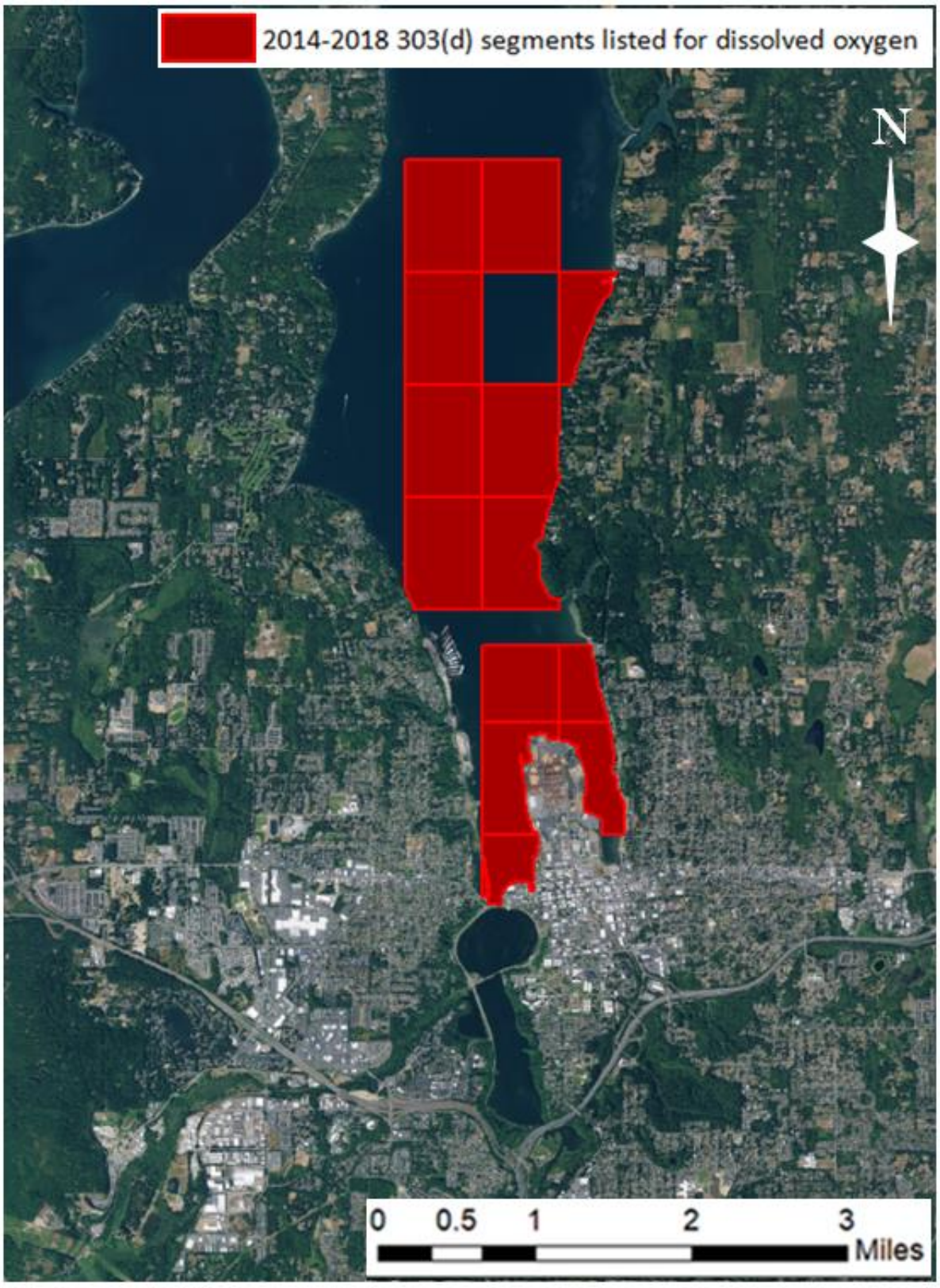
Table 1. Waterbodies on the 2018 303(d) list addressed by this TMDL.

Waterbody Name	Listing ID	Reach Code (Assessment Unit ID)
Budd Inlet (Inner)	5852	47122A9F0_01_01
Budd Inlet (Inner)	5853	47122A9E0_01_01
Budd Inlet (Inner)	5862	47122A9G0_01_02
Budd Inlet (Inner)	5863	47122A8F9_01_01
Budd Inlet (Inner)	5864	47122A8G9_01_02
Budd Inlet (Outer)	7582	47122A9I0_01_01
Budd Inlet (Outer)	7583	47122B9A1_01_01
Budd Inlet (Outer)	7584	47122A8J9_01_01
Budd Inlet (Outer)	7585	47122A9I1_01_01
Budd Inlet (Outer)	7586	47122B9A0_01_01
Budd Inlet (Outer)	7587	47122A9H1_01_01
Budd Inlet (Outer)	10188	47122A9J1_01_01
Budd Inlet (Outer)	81727	47122A9H0_01_01

DO impairments in this TMDL are addressed by limiting nitrogen (in the forms of total nitrogen and dissolved inorganic nitrogen) and carbon (in the forms of total organic carbon and five-day biological oxygen demand) that enter Budd Inlet. Additionally, since the Capitol Lake Dam alters flow patterns and water quality within Budd Inlet, this TMDL limits the amount of DO depletion that can occur due to this alteration. More information is found in *Target Parameters*.

This TMDL covers human and natural sources of pollution within the entire Budd Inlet watershed that affect marine water DO concentrations. It also includes an aggregated allocation, or "bubble allocation" for sources outside of the Budd Inlet watershed. Chapter 2 provides more details on sources assigned allocations in this TMDL.

Figure 2. Segments that are listed as impaired for dissolved oxygen in Budd Inlet.



There are other 303(d) listed segments in Budd Inlet for bacteria, copper, nickel, and a number of toxins that are found in fish tissue, but this report does not address them. Adequately addressing these additional parameters would require a different analysis than addressing the sources of DO depletion. There are other ongoing efforts addressing toxic sediments in Budd Inlet, including Ecology's Toxics Cleanup Program[7], which has several sediment cleanup sites[8] in inner Budd Inlet. While addressing sources of nitrogen and carbon may also reduce some sources of bacteria, a separate bacteria TMDL may be needed in the future to address these listings. The TMDL does not address the bacteria and phosphorus listing in Capitol Lake. It does address Capitol Lake's impact on DO in Budd Inlet. A separate TMDL will be needed for bacteria and phosphorus in Capitol Lake if those impairments are not corrected.

A full climate change impact analysis was not included within the TMDL, however we did conduct a low-freshwater-flow analysis to assess the impact of reduced estuarine flows for the TMDL scenario due to climatological variability (see Appendix A for more details). Ecology implements TMDLs using an adaptive management framework which will allow for the continued re-evaluation of the TMDL. Adaptive management allows for the evolution of restoration strategies in light of changes occurring within the watershed (eg., changes in flow and temperature patterns due to climate change). Our adaptive management approach is outlined in the implementation plan.

Uses of the Waterbodies

Budd Inlet has a number of beneficial uses. The Washington State water quality standards designate uses in WAC 173-201A-612. The uses that apply to all of Budd Inlet are aesthetics, boating, commerce and navigation, harvesting of fish, and wildlife habitat. Other uses apply differently to northern and southern Budd Inlet and are described below and shown in Figure 3 along with the applicable water quality criteria.

- Northern Budd Inlet (north of Squaxin Park at latitude 47°04'N) has the additional designated uses of excellent aquatic life, primary contact recreation, and shellfish harvesting.
- Southern Budd Inlet (south of Squaxin Park at latitude 47°04'N) has the additional designated uses of good aquatic life and secondary contact recreation.

Both the excellent and good aquatic life uses protect salmonid and other fish migration, rearing, and spawning; clam, oyster, and mussel rearing and spawning; and crustaceans and other shellfish rearing and spawning.

The most sensitive use for DO is aquatic life. Therefore, the TMDL's targeted DO levels to protect the aquatic life use in Budd Inlet protects all designated uses. For details, see *Appendix A. Background*.

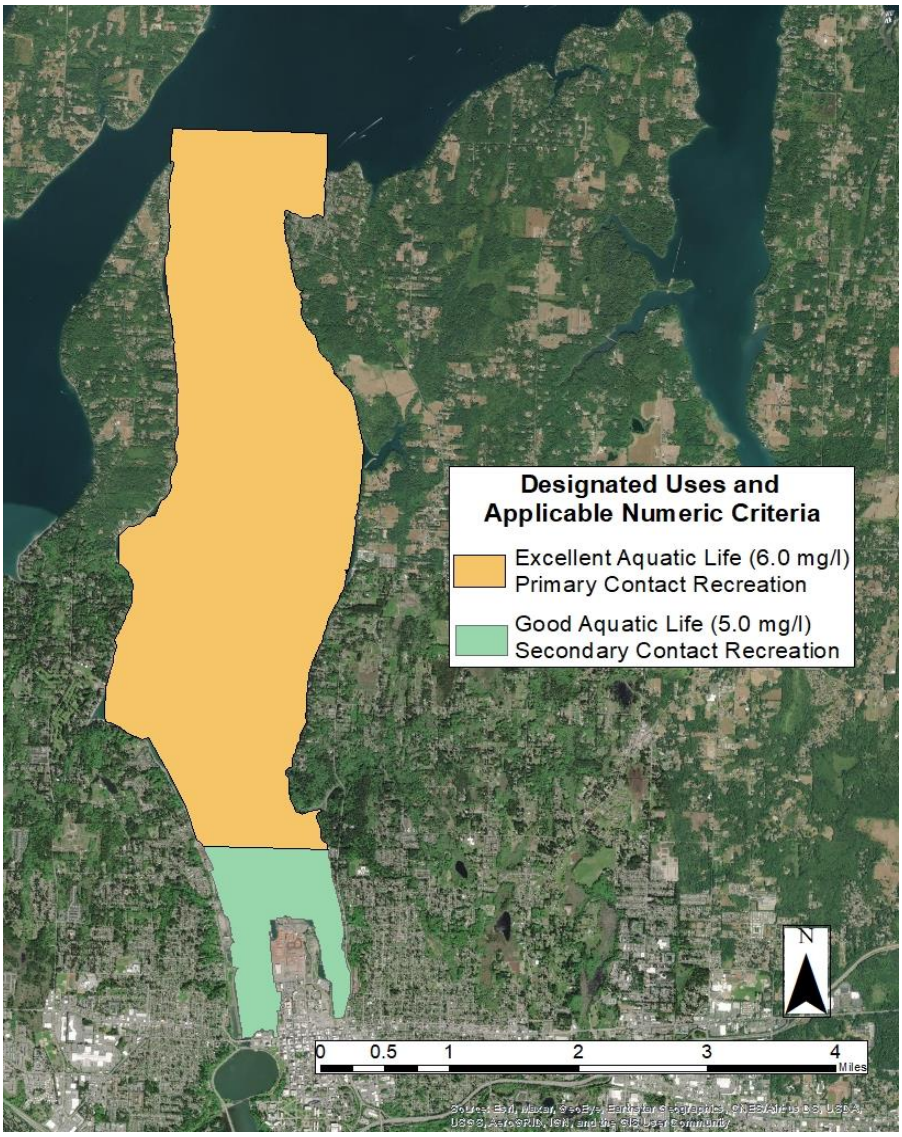
[7] https://ecology.wa.gov/About-us/Who-we-are/Our-Programs/Toxics-Cleanup
[8] https://apps.ecology.wa.gov/cleanupsearch/site/2245#:~:text=The%20Department%20of%20%20Ecology%20began,of%20the%20Puget%20Sound%20Initiative

With each tidal cycle, water from the rest of Puget Sound enters and leaves Budd Inlet at its northern boundary. This TMDL addresses sources of pollution entering Budd Inlet from elsewhere in Puget Sound. It also protects the rest of Puget Sound from sources of pollution in the Budd Inlet watershed that leave Budd Inlet. Additional details are also included in *Appendix A. Background.*

Water Quality Criteria

The Washington State water quality standards (WQS) set criteria for DO in WAC 173-201A-210. For excellent aquatic life use, the lowest 1-day minimum DO allowed is 6.0 milligrams per liter (mg/L). For good aquatic life use, the lowest 1-day minimum DO allowed is 5.0 mg/L.

Figure 3. Map of designated uses and numeric criteria for dissolved oxygen in Budd Inlet.



Washington WQS define "measurable change" as a DO decrease of 0.2 mg/L or greater [WAC 173-201A-320(3)(b)]. For this TMDL, Ecology targets the applicable numeric water quality criteria in its modeling scenarios and considers DO results that fall within this limit of measurability to be acceptable. Using this definition, modeling shows that the recommended actions within this TMDL will bring all listings into compliance with DO criteria in WAC 173-201A-210.

The WQS also include provisions for antidegradation in WAC 173-201A Part III. Because Budd Inlet violates water quality standards for DO, the Tier I requirements in section 310 apply. This TMDL achieves the "appropriate and definitive steps" required by section 310(2) to "bring the water quality back into compliance with the water quality standards."

Target Parameters

The Budd Inlet TMDL meets the water quality standards for DO by addressing several human-caused factors, which include nitrogen and organic carbon loads impacting DO concentrations. An overview of the scientific linkages between these pollutants and DO is presented in the section titled *Links between Dissolved Oxygen, Nutrients, and Circulation in Marine and Freshwater* in Appendix A. Organic carbon and nitrogen are linked to Budd Inlet's DO concentrations via mechanistic modeling as explained in detail in Appendix D. The numeric targets in the TMDL are nutrient loads for forms of nitrogen and carbon and a separate allocation in the form of DO deficit for Capitol Lake. More information on the selection of the targets is found in Table 2 and Appendix A and D.

Dissolved Oxygen Deficit: DO deficit is the difference between the numeric DO criteria as defined by WQS and the actual, measured DO concentration at a given place and time. Capitol Lake affects DO in Budd Inlet through both the increased production and decomposition of organic matter and the alteration of hydrodynamics and flow patterns. Since nitrogen and carbon allocations alone are not sufficient to mitigate Capitol Lake's effect on Budd Inlet, we account for the total cumulative effect of all oxygen-depleting sources in the form of DO deficit. Ecology uses the Budd Inlet model to account for hydraulic changes due to Capitol Lake and calculates the total impact on DO.

Nitrogen: Nitrogen enters Budd Inlet from a variety of sources, such as WWTPs, stormwater runoff, and nonpoint sources. While nitrogen is naturally present in marine waters and marine life requires nitrogen, too much nitrogen fuels excessive algae growth. When algae die and decompose, oxygen is depleted. Nitrogen allocations are given in the form of dissolved inorganic nitrogen (DIN) (DIN = ammonia + nitrate/nitrite) and total nitrogen (TN) (TN = inorganic nitrogen + organic nitrogen). Organic and inorganic forms of nitrogen are present in TN and cycle through the system. DIN can be used directly by algae for growth. Organic nitrogen can be converted to an inorganic form via the process of remineralization. TN and DIN play a role in biogeochemical reactions that can eventually lead to DO depletion, and are both used in this TMDL to establish nitrogen allocations.

Organic Carbon: Similar to nitrogen, organic carbon enters Budd Inlet from WWTPs, stormwater, and nonpoint sources. Organic carbon can also be generated by photosynthesis within the water column, as in Capitol Lake. Capitol Lake produces anthropogenic carbon loading and discharges it into Budd Inlet, but is not given allocations for organic carbon, because the lake's allocation for DO deficit includes the impact of increased organic carbon. Organic carbon depletes oxygen in the water column as it decomposes and is used as a source of energy for bacteria. Since organic carbon decomposition both within the water column and the sediments exerts DO demand, allocations of organic carbon are needed. Allocations for organic carbon are given in this TMDL in the form of total organic carbon (TOC) and 5-day biological oxygen demand (BOD_5) or dissolved organic carbon (DOC). This TMDL uses several organic carbon forms that are reflective of the parameters that source categories typically measure, in order to facilitate implementation. Across all forms of organic carbon, allocations do not exceed the load capacity. The bubble allocation is expressed in terms of TOC and DOC because those parameters are used most commonly for measurements in marine waters.

Chapter 2 - TMDL Allocations

TMDL Formula

A waterbody's **loading capacity** is the amount of a given pollutant that a waterbody can receive and still meet water quality standards. The loading capacity provides a reference for calculating the amount of pollution reduction needed to bring a water body into compliance with the standards.

The portion of the receiving water's loading capacity assigned to a particular pollution source is a wasteload allocation or load allocation, depending on the source. By definition, if the pollutant comes from a point source, such as a municipal or industrial facility's discharge pipe, that facility's share of the loading capacity is called a **wasteload allocation**. If the pollutant comes from nonpoint sources, such as general residential or farm runoff, the cumulative share is called a **load allocation**.

Human sources of nitrogen and carbon also enter Budd Inlet at the open boundary with Puget Sound. This includes both point sources and nonpoint sources of pollution that enter Puget Sound's marine waters directly and indirectly as discharges from rivers and streams. The Budd Inlet TMDL determines an aggregate load allocation, or **bubble allocation**, for these sources external to Budd Inlet.

TMDLs must also consider seasonal variations and critical conditions, as shown in Appendix D. The lowest annual DO concentrations in Budd Inlet usually occur near the head of the inlet during the critical period of late summer, when algae that proliferated in the warmer months begin to die and decay (see Appendix D5 for more information on this annual DO minimum). While this critical period is the most important time to reduce oxygen-depleting pollutants entering Budd Inlet, nutrient discharges that fuel algae growth must also be managed during the preceding months. This TMDL sets monthly allocations across the duration of the year, with tighter allocations during the critical period from April through October. The TMDL sets an implicit margin of safety that takes into account any lack of complete knowledge about the causes of the water quality problem or its loading capacity.

A TMDL is the sum of the wasteload allocations, load allocations, and margin of safety. The TMDL must be equal to or less than the loading capacity. The formula that describes this TMDL is:

$$LC = \sum WLA + bubble\ load\ allocation + \sum LA + MOS$$

As shown in the formula above, the overall loading capacity for Budd Inlet (Table 2) is equal to the sum of the wasteload allocation (Table 3), the bubble load allocation (Tables 23 and 24), the load allocation (Tables 25 and 26), and an implicit margin of safety (MOS). For example, the loading capacity for TN in January (45,860 kg/day) is equal to the sum of the TN WLA allocation

in January (3,670 kg/day), the bubble allocation for TN in January (2,470 kg/day from anthropogenic sources and 38,800 kg/day from natural sources), and the load allocation for TN in January (76 kg/day from Lewis County and 839 kg/day from Thurston County). Due to rounding, the sum of these numbers may not exactly match the loading capacity. The TMDL Calculation shown in Table 31 is equal to the annually averaged loading capacity.

Loading Capacity

A waterbody's loading capacity is the sum of anthropogenic and naturally occurring pollutant loading. The loading capacity is based on meeting the DO standard at the most critical time of the year (late summer/early fall; refer to Appendix D) and in the most critical location within Budd Inlet. By meeting water quality standards under these conditions, other areas of Budd Inlet will, according to water quality models, also meet water quality standards.

Budd Inlet's loading capacity is expressed for multiple parameters that must collectively be met to attain DO criteria (Table 2). The loading capacity is expressed in terms of daily loads in kg/day, averaged by month, and specified for all months of the year. An annual average daily loading capacity is also included. More details on the loading capacity are found in Appendix E. The loading capacity includes sources from within the watershed as well as oceanic loads (both natural background and anthropogenic) at the open boundary as described in Appendix D (*Establishing Open Boundary Water Quality for Reference and Other Scenarios).*

Table 2. Budd Inlet total loading capacity.

Month	TN (kg/day)	DIN (kg/day)	TOC (kg/day)
Jan	45860	33630	148660
Feb	37920	25010	100440
Mar	44600	30350	142400
Apr	37940	13180	134800
May	37970	14960	180400
Jun	33570	11720	153640
Jul	26320	8970	120740
Aug	27350	6750	167830
Sep	28120	7970	154670
Oct	35460	14580	138920
Nov	37870	16830	140570
Dec	46150	34460	156070
Annual	36610	18210	145280

Wasteload Allocations

This section presents wasteload allocations (WLAs) for all point sources of pollution. There is one table for each NPDES permittee or group of permittees, depending on permit type. All WLAs are given in kilograms per day (kg/day), averaged by month. Table 3 summarizes the total wasteload allocations for all point sources within the Budd Inlet watershed. Additional discussion and individual WLAs for each permittee is presented later in this section and in Appendix E.

Table 3. Wasteload allocations for all permitted sources (daily loads are expressed in kg/day and are adjusted for each month.

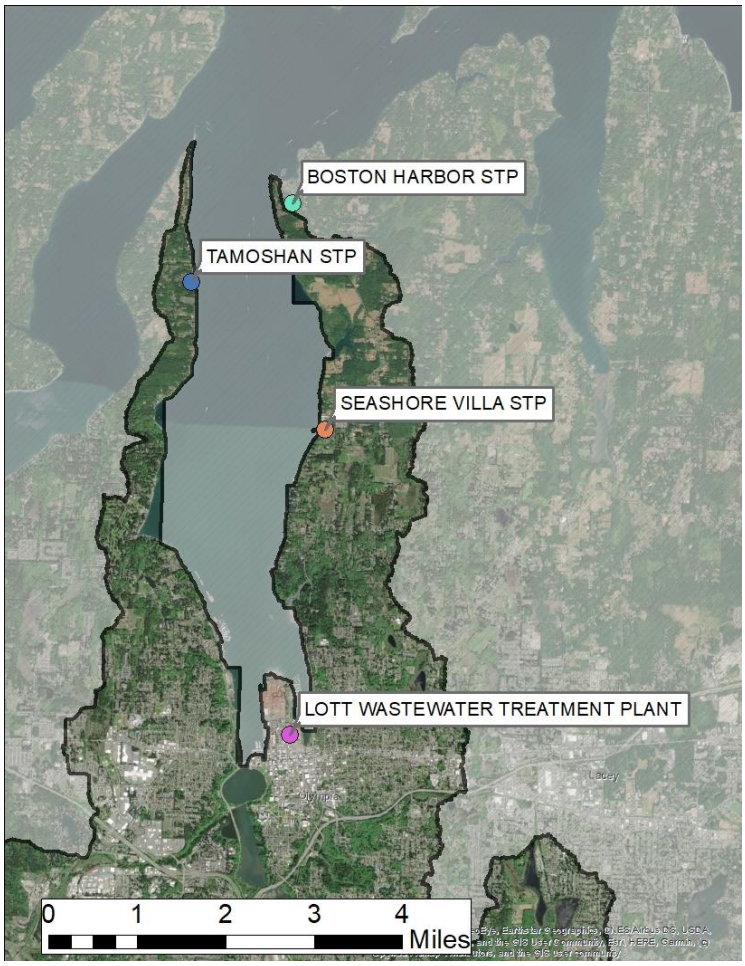
Month	TN (kg/day)	DIN (kg/day)	TOC (kg/day)
Jan	3670	2270	12940
Feb	2520	1720	7950
Mar	2470	1440	13900
Apr	980	570	3330
May	690	400	2540
Jun	590	320	2130
Jul	500	260	1440
Aug	470	230	1000
Sep	460	230	1030
Oct	730	460	2320
Nov	2100	1350	8190
Dec	3750	2280	14900
Annual	1580	960	5980

Wastewater Treatment Plants

There are four WWTPs (Figure 4) that discharge directly to Budd Inlet. This TMDL assigns them allocations for all months of the year. Allocations for the months of April through October represent a reduction in WLAs from 1997 levels, covering the most critical period of August and September. October is included to ensure that the entire potential critical period is considered. Allocations for November through March are also required as these loads may impact DO during the critical period, and represent a cap based on the 1997 water year. For LOTT, where permit limits in terms of monthly average daily loads were available for a given month, they were used as WLAs even if the WWTP performance, at times, was at or below these levels. For other months or other facilities, where effluent limits did not exist, the current performance (2016 – 2021) was used to establish WLAs as described in Appendix E. More information about WLAs and WWTP performance can be found in Ecology's Permitting and Reporting Information System (PARIS) database[9].

[9] https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Water-quality-permits-database

Figure 4. WWTPs discharging to Budd Inlet and receiving allocations in TMDL.



Permittee Name	LOTT Budd Inlet Water Reclamation Facility
Permit Number	WA0037061
Permit Type	Reclaimed Water Individual Permit
Waterbody Names	Budd Inlet (directly)
Listing ID of Receiving Water	5852, 5853, 5862, 5863, 5864, 7582, 7583, 7584, 7585, 7586, 7587, 10188, 81727 (includes all DO listings in Budd Inlet)

Table 4. LOTT, Municipal Wastewater Treatment Facility, Wasteload Allocations for Budd Inlet TMDL.

Month	TN (kg/day)	DIN (kg/day)	TOC (kg/day)	BOD_5 (kg/day)	DOC (kg/day)
January	1147	900	2746	2558	2124
February	871	656	2746	2558	2124
March	476	300	2746	2558	2124
April	310	153	583	408	339
May	310	153	583	408	339
June	285	131	479	304	253
July	285	131	479	304	253
August	265	113	387	213	177
September	265	113	387	213	177
October	310	153	583	408	339
November	1091	850	2746	2558	2124
December	1203	950	2746	2558	2124

Additional permit information:

- Permittee will continue with monitoring in accordance with current permit(s).
- Any pre-existing effluent limits included in LOTT's permit and not modified in the table above, shall be maintained as written in the permit. This includes annual BOD_5 limits.
- Numbers are intended to be applied on an average monthly basis.
- TN, DOC, and TOC allocations are assumed to be met if DIN and BOD allocations are met. (See Appendix E for WWTP regression equations). It is not necessary for TN and TOC allocations to be translated into permit effluent limits since meeting DIN and BOD_5 limits will ensure these allocations are met.

Permittee Name	Boston Harbor Sewage Treatment Plant
Permit Number	WA0040291
Permit Type	Municipal NPDES Individual Permit
Waterbody Names	Budd Inlet (directly)
Listing ID of Receiving Water	5852, 5853, 5862, 5863, 5864, 7582, 7583, 7584, 7585, 7586, 7587, 10188, 81727 (includes all DO listings in Budd Inlet)

Table 5. Boston Harbor, Municipal Wastewater Treatment Facility, Wasteload Allocations for Budd Inlet TMDL.

Month	TN (kg/day)	DIN (kg/day)	TOC (kg/day)	BOD_5 (kg/day)	DOC (kg/day)
January	7.4	5.4	9.7	6.4	3.5
February	7.4	5.4	9.7	6.4	3.5
March	7.4	5.4	9.7	6.4	3.5
April	7.4	5.4	9.8	6.4	3.5
May	7.4	5.4	9.8	6.4	3.5
June	7.4	5.4	9.8	6.4	3.5
July	7.4	5.4	9.8	6.4	3.5
August	7.4	5.4	9.8	6.4	3.5
September	7.4	5.4	9.8	6.4	3.5
October	7.4	5.4	9.8	6.4	3.5
November	7.4	5.4	9.7	6.4	3.5
December	7.4	5.4	9.7	6.4	3.5

Additional permit information:

- Permittee will continue with monitoring in accordance with current permit(s).
- Any pre-existing effluent limits included in Boston Harbor's permit and not modified in the table above, shall be maintained as written in the permit.
- Numbers are intended to be applied on an average monthly basis.
- TN, DOC, and TOC allocations are assumed to be met if DIN and BOD allocations are met. (See Appendix E for WWTP regression equations). It is not necessary for TN and TOC allocations to be translated into permit effluent limits since meeting DIN and BOD_5 limits will ensure these allocations are met.

Permittee Name	Seashore Villa Sewage Treatment Plant
Permit Number	WA0037273
Permit Type	Municipal NPDES Individual Permit
Waterbody Names	Budd Inlet (directly)
Listing ID of Receiving Water	5852, 5853, 5862, 5863, 5864, 7582, 7583, 7584, 7585, 7586, 7587, 10188, 81727 (includes all DO listings in Budd Inlet)

Table 6. Seashore Villa, Municipal Wastewater Treatment Facility, Wasteload Allocations for Budd Inlet TMDL.

Month	TN (kg/day)	DIN (kg/day)	TOC (kg/day)	BOD_5 (kg/day)	DOC (kg/day)
January	4.9	2.7	2.9	1.7	0.9
February	4.9	2.7	2.9	1.7	0.9
March	4.9	2.7	2.9	1.7	0.9
April	4.9	2.7	2.9	1.7	0.9
May	4.9	2.7	2.9	1.7	0.9
June	4.9	2.7	2.9	1.7	0.9
July	4.9	2.7	2.9	1.7	0.9
August	4.9	2.7	2.9	1.7	0.9
September	4.9	2.7	2.9	1.7	0.9
October	4.9	2.7	2.9	1.7	0.9
November	4.9	2.7	2.9	1.7	0.9
December	4.9	2.7	2.9	1.7	0.9

Additional permit information:

- Permittee will continue with monitoring in accordance with current permit(s).
- Any pre-existing effluent limits included in Seashore Villa's permit and not modified in the table above, shall be maintained as written in the permit.
- Numbers are intended to be applied on an average monthly basis.
- TN, DOC, and TOC allocations are assumed to be met if DIN and BOD allocations are met. (See Appendix E for WWTP regression equations). It is not necessary for TN and TOC allocations to be translated into permit effluent limits since meeting DIN and BOD_5 limits will ensure these allocations are met.

Permittee Name	Tamoshan SewageTreatment Plant
Permit Number	WA0037290
Permit Type	Municipal NPDES Individual Permit
Waterbody Names	Budd Inlet (directly)
Listing ID of Receiving Water	5852, 5853, 5862, 5863, 5864, 7582, 7583, 7584, 7585, 7586, 7587, 10188, 81727 (includes all DO listings in Budd Inlet)

Table 7. Tamoshan, Municipal Wastewater Treatment Facility, Wasteload Allocations for Budd Inlet TMDL.

Month	TN (kg/day)	DIN (kg/day)	TOC (kg/day)	BOD_5 (kg/day)	DOC (kg/day)
January	4.4	2.7	7.5	5.0	2.7
February	4.4	2.7	7.5	5.0	2.7
March	4.4	2.7	7.5	5.0	2.7
April	4.4	2.7	7.5	5.0	2.7
May	4.4	2.7	7.5	5.0	2.7
June	4.4	2.7	7.5	5.0	2.7
July	4.4	2.7	7.5	5.0	2.7
August	4.4	2.7	7.5	5.0	2.7
September	4.4	2.7	7.5	5.0	2.7
October	4.4	2.7	7.5	5.0	2.7
November	4.4	2.7	7.5	5.0	2.7
December	4.4	2.7	7.5	5.0	2.7

Additional permit information:

- Permittee will continue with monitoring in accordance with current permit(s).
- Any pre-existing effluent limits included in Tamoshan's permit and not modified in the table above, shall be maintained as written in the permit. This includes annual BOD_5 limits.
- Numbers are intended to be applied on an average monthly basis.

- TN, DOC, and TOC allocations are assumed to be met if DIN and BOD allocations are met. (See Appendix E for WWTP regression equations). It is not necessary for TN and TOC allocations to be translated into permit effluent limits since meeting DIN and BOD_5 limits will ensure these allocations are met.

Municipal Stormwater

The Cities of Lacey, Olympia, and Tumwater, and Thurston County hold Phase II Municipal Stormwater Permits in the Budd Inlet watershed. The Washington State Department of Transportation is a Phase I permitholder with permit coverage in both Phase I and Phase II areas. The Department of Enterprise Services (DES) and Port of Olympia have secondary coverage for the Capitol Campus and Port properties, respectively. The current Western Washington Phase II Municipal Stormwater Permit, issued in 2019, is the third version of the Permit. The first was issued in 2007. Figure 5 shows demarcations for these different jurisdictions. As permits are developed and issued, Ecology will provide opportunities for permittee and stakeholder engagement with respect to permits' TMDL-related obligations, so that permittees may plan and budget accordingly – a recommendation made by the 2024 Western Washington Municipal Stormwater General Permit Reissuance Ad Hoc White Paper[10] for TMDLs. If MS4 boundaries change, drainage areas and allocations between MS4 permittees may change accordingly, though the total allocation between all permittees will remain constant.

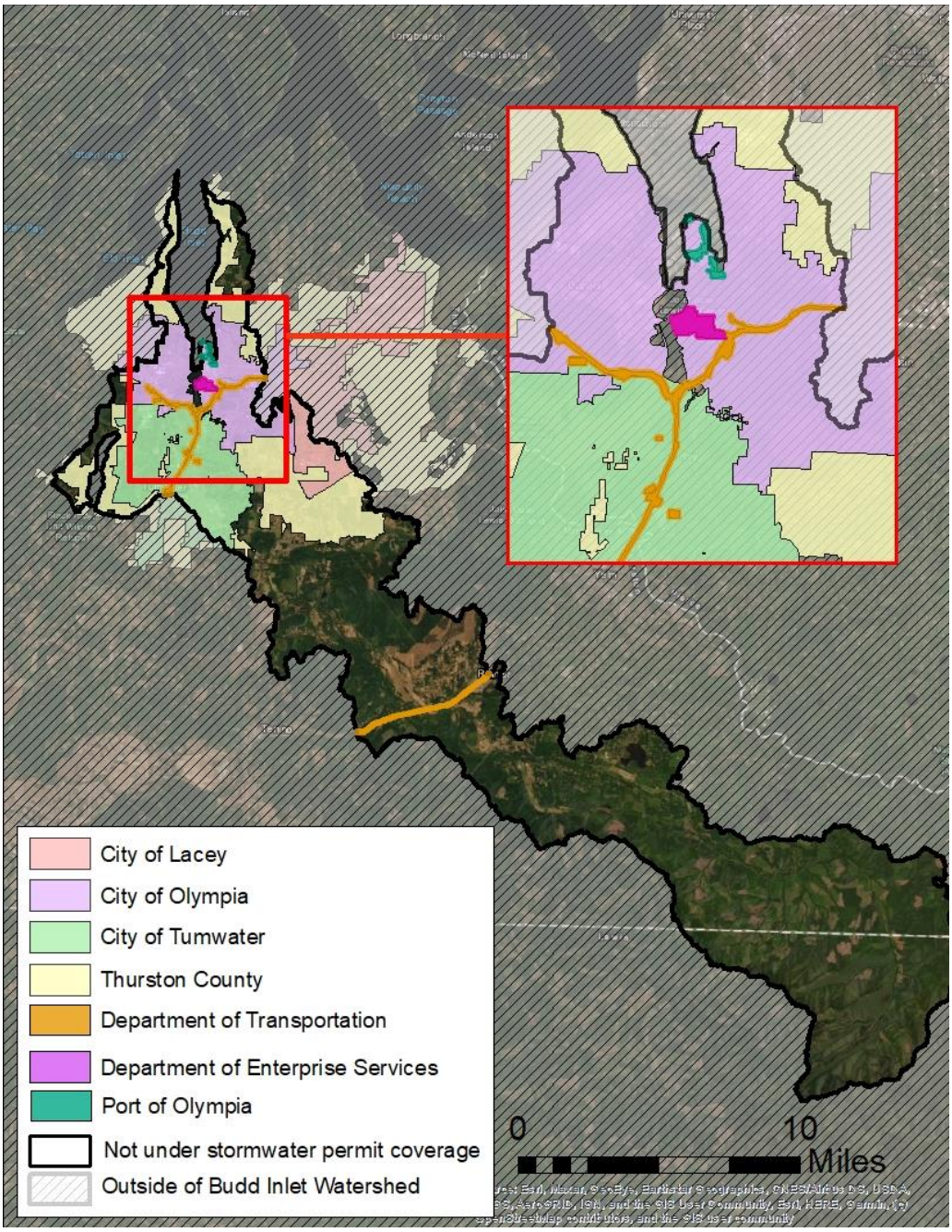
This TMDL assigns municipal stormwater allocations for all months, with reductions with respect to the 1997 water year for the months of April through October. These reductions were calculated based on the estimated relative contribution from each jurisdiction based on acreage and other variables as described in Appendix E. This covers the most critical period of late summer (August and September). Early fall may also comprise part of the critical period, and October is included to ensure that the entire potential critical period is covered.

Allocations were developed for four parameters (TN, DIN, TOC and BOD_5). In the case of TN, both forms of nitrogen (organic and inorganic) were included in the calculations. We used a variety of sources to estimate allocations for each of the four parameters, as detailed in Appendix E.

Allocations outside of the critical period are also required as these loads may impact DO during the critical period, and represent a cap based on the 1997 water year. Model predictions for the TMDL scenario showed that 1997 anthropogenic landbased loads flowing into the inlet during winter months resulted in meeting water quality standards in Budd Inlet.

[10] https://www.wastormwatercenter.org/wp-content/uploads/TMDL_Ad_Hoc_White_Paper-FINAL.pdf

Figure 5. Municipal stormwater permittees and permit coverages areas in Budd Inlet's contributing watersheds.



Permittee Name	City of Lacey
Permit Number	WAR045011
Permit Type	Western Washington Phase II Municipal Stormwater General Permit

Waterbody Names	Budd Inlet (via Deschutes River and/or tributaries)
Listing ID of Receiving Water	5852, 5853, 5862, 5863, 5864, 7582, 7583, 7584, 7585, 7586, 7587, 10188, 81727 (includes all DO listings in Budd Inlet)

Table 8. City of Lacey, Western Washington Phase II Municipal Stormwater Permit, Wasteload Allocations for Budd Inlet TMDL.

Month	TN (kg/day)	DIN (kg/day)	TOC (kg/day)	BOD_5 (kg/day)
January	373	166	1533	320
February	227	128	679	103
March	285	135	1641	367
April	88	44	335	73
May	43	22	222	40
June	35	18	189	31
July	23	11	93	20
August	20	10	60	12
September	20	11	56	12
October	49	30	167	35
November	129	47	609	112
December	373	155	1730	415

Additional permit information:

- Best management practices (BMPs) are required in all stormwater permits to protect designated aquatic life uses.
- Ecology estimates that in order to meet the wasteload allocations shown above, reductions of 65-70% of the anthropogenic portion of the discharges will be needed relative to 1997 levels. Because the model uses 1997 loadings that predate the first Western Washington Phase II Municipal Stormwater Permit, we anticipate the level of reduction needed may be significantly less.
- To comply with this TMDL permittees must continue to comply with all elements of the permit.
- In addition to existing permitting requirements, permittees must:
    - Track any BMPs implemented to meet the TMDL, and implement nutrient control BMPs as needed. Priority areas include those that drain more directly to Budd Inlet.

- Through a combination of analysis and/or monitoring, assess current stormwater loading to determine compliance with allocations.

Permittee Name	City of Olympia
Permit Number	WAR045015
Permit Type	Western Washington Phase II Municipal Stormwater General Permit
Waterbody Names	Budd Inlet (directly and via Deschutes River and/or tributaries)
Listing ID of Receiving Water	5852, 5853, 5862, 5863, 5864, 7582, 7583, 7584, 7585, 7586, 7587, 10188, 81727 (includes all DO listings in Budd Inlet)

Table 9. City of Olympia, Phase II Municipal Stormwater Permit, Wasteload Allocations for Budd Inlet TMDL.

Month	TN (kg/day)	DIN (kg/day)	TOC (kg/day)	BOD_5 (kg/day)
January	388	212	1673	306
February	274	159	998	155
March	326	179	1846	334
April	107	65	499	88
May	72	46	419	71
June	62	38	355	55
July	47	26	256	43
August	47	23	154	26
September	42	24	173	29
October	84	59	442	77
November	185	100	1236	233
December	406	228	2211	444

Additional permit information:

- BMPs are required in all stormwater permits to protect designated aquatic life uses.
- Ecology estimates that in order to meet the wasteload allocations shown above, reductions of 65-70% of the anthropogenic portion of the discharges will be needed relative to 1997 levels. Because the model uses 1997 loadings that predate the first Western Washington Phase II Municipal Stormwater Permit, we anticipate the level of reduction needed may be significantly less.
- To comply with this TMDL permittees must continue to comply with all elements of the permit.
- In addition to existing permitting requirements, permittees must:

- Track any BMPs implemented to meet the TMDL, and implement nutrient control BMPs as needed. Priority areas include those that drain more directly to Budd Inlet.
- Through a combination of analysis and/or monitoring, assess current stormwater loading to determine compliance with allocations.

Permittee Name	City of Tumwater
Permit Number	WAR045020
Permit Type	Western Washington Phase II Municipal Stormwater General Permit
Waterbody Names	Budd Inlet (via Deschutes River and/or tributaries)
Listing ID of Receiving Water	5852, 5853, 5862, 5863, 5864, 7582, 7583, 7584, 7585, 7586, 7587, 10188, 81727 (includes all DO listings in Budd Inlet)

Table 10. City of Tumwater, Phase II Municipal Stormwater Permit, Wasteload Allocations for Budd Inlet TMDL.

Month	TN (kg/day)	DIN (kg/day)	TOC (kg/day)	BOD_5 (kg/day)
January	824	399	3373	649
February	538	317	1649	233
March	637	329	3622	735
April	206	116	860	169
May	110	65	595	99
June	88	50	507	78
July	58	30	273	50
August	59	27	170	30
September	52	27	177	31
October	124	81	517	92
November	317	145	1765	310
December	807	369	3939	863

Additional permit information:

- BMPs are required in all stormwater permits to protect designated aquatic life uses.
- Ecology estimates that in order to meet the wasteload allocations shown above, reductions of 65-70% of the anthropogenic portion of the discharges will be needed relative to 1997 levels. Because the model uses 1997 loadings that predate the first Western Washington

Phase II Municipal Stormwater Permit, we anticipate the level of reduction needed may be significantly less.

- To comply with this TMDL permittees must continue to comply with all elements of the permit.
- In addition to existing permitting requirements, permittees must:
    - Track any BMPs implemented to meet the TMDL, and implement nutrient control BMPs as needed. Priority areas include those that drain more directly to Budd Inlet.
    - Through a combination of analysis and/or monitoring, assess current stormwater loading to determine compliance with allocations.

Permittee Name	Thurston County
Permit Number	WAR045025
Permit Type	Western Washington Phase II Municipal Stormwater General Permit
Waterbody Names	Budd Inlet (directly and via Deschutes River and/or tributaries)
Listing ID of Receiving Water	5852, 5853, 5862, 5863, 5864, 7582, 7583, 7584, 7585, 7586, 7587, 10188, 81727 (includes all DO listings in Budd Inlet)

Table 11. Thurston County, Phase II Municipal Stormwater Permit, Wasteload Allocations for Budd Inlet TMDL.

Month	TN (kg/day)	DIN (kg/day)	TOC (kg/day)	BOD_5 (kg/day)
January	587	377	1894	308
February	366	288	906	112
March	453	307	2072	357
April	140	100	447	74
May	72	55	308	44
June	60	45	264	34
July	40	28	143	22
August	37	25	88	14
September	37	27	95	15
October	88	75	276	43
November	228	127	943	142
December	606	367	2250	414

Additional permit information:

- BMPs are required in all stormwater permits to protect designated aquatic life uses.

- Ecology estimates that in order to meet the wasteload allocations shown above, reductions of 65-70% of the anthropogenic portion of the discharges will be needed relative to 1997 levels. Because the model uses 1997 loadings that predate the first Western Washington Phase II Municipal Stormwater Permit, we anticipate the level of reduction needed may be significantly less.
- To comply with this TMDL permittees must continue to comply with all elements of the permit.
- In addition to existing permitting requirements, permittees must:
    - Track any BMPs implemented to meet the TMDL, and implement nutrient control BMPs as needed. Priority areas include those that drain more directly to Budd Inlet.
    - Through a combination of analysis and/or monitoring, assess current stormwater loading to determine compliance with allocations.

Permittee Name	Department of Transportation
Permit Number	WAR043000
Permit Type	WSDOT Municipal Stormwater General Permit
Waterbody Names	Budd Inlet (directly and via Deschutes River and/or tributaries)
Listing ID of Receiving Water	5852, 5853, 5862, 5863, 5864, 7582, 7583, 7584, 7585, 7586, 7587, 10188, 81727 (includes all DO listings in Budd Inlet)

Table 12. Department of Transportation, Phase II Municipal Stormwater Permit, Wasteload Allocations for Budd Inlet TMDL.

Month	TN (kg/day)	DIN (kg/day)	TOC (kg/day)	BOD_5 (kg/day)
January	77	35	330	68
February	51	27	168	26
March	61	30	354	75
April	21.1	11.2	88.2	18.0
May	11.4	6.3	66.7	11.6
June	9.3	4.9	57.8	9.0
July	6.3	3.0	32.2	6.2
August	6.1	2.8	20.1	3.9
September	5.5	2.8	20.8	4.0
October	12.7	7.7	57.1	11.2
November	30.2	12.7	176.3	34.1
December	75.8	33.8	388.8	89.8

Additional permit information:

- BMPs are required in all stormwater permits to protect designated aquatic life uses.
- Ecology estimates that in order to meet the wasteload allocations shown above, reductions of 65-70% of the anthropogenic portion of the discharges will be needed relative to 1997 levels. Because the model uses 1997 loadings that predate the first Western Washington Phase II Municipal Stormwater Permit, we anticipate the level of reduction needed may be significantly less.
- To comply with this TMDL permittees must continue to comply with all elements of the permit.
- In addition to existing permitting requirements, permittees must:
    - Track any BMPs implemented to meet the TMDL, and implement nutrient control BMPs as needed. Priority areas include those that drain more directly to Budd Inlet.
    - Through a combination of analysis and/or monitoring, assess current stormwater loading to determine compliance with allocations.

Permittee Name	Department of Enterprise Services
Permit Number	WAR045210
Permit Type	Western Washington Phase II Municipal Stormwater General Permit
Waterbody Names	Budd Inlet (via Capitol Lake)
Listing ID of Receiving Water	5852, 5853, 5862, 5863, 5864, 7582, 7583, 7584, 7585, 7586, 7587, 10188, 81727 (includes all DO listings in Budd Inlet)

Table 13. Department of Enterprise Services, Phase II Municipal Stormwater Permit, Wasteload Allocations for Budd Inlet TMDL.

Month	TN (kg/day)	DIN (kg/day)	TOC (kg/day)	BOD_5 (kg/day)
January	16.5	9.9	57.9	12.4
February	10.5	7.1	30.1	5.4
March	13.9	8.5	60.8	13.4
April	5.7	3.8	16.9	3.2
May	2.9	2.0	15.4	2.3
June	2.3	1.5	14.5	1.8
July	1.5	0.9	7.0	1.4
August	1.3	0.8	4.4	0.9
September	1.3	0.8	4.3	0.9
October	3.1	2.2	11.0	2.4
November	6.4	3.6	26.5	5.1
December	16.2	9.8	67.1	15.7

Additional permit information:

- BMPs are required in all stormwater permits to protect designated aquatic life uses.
- Ecology estimates that in order to meet the wasteload allocations shown above, reductions of 65-70% of the anthropogenic portion of the discharges will be needed relative to 1997 levels. Because the model uses 1997 loadings that predate the first Western Washington Phase II Municipal Stormwater Permit, we anticipate the level of reduction needed may be significantly less.
- To comply with this TMDL permittees must continue to comply with all elements of the permit.
- In addition to existing permitting requirements, permittees must:
    - Track any BMPs implemented to meet the TMDL, and implement nutrient control BMPs as needed. Priority areas include those that drain more directly to Budd Inlet.
    - Through a combination of analysis and/or monitoring, assess current stormwater loading to determine compliance with allocations.

Permittee Name	Port of Olympia
Permit Number	WAR045206
Permit Type	Western Washington Phase II Municipal Stormwater General Permit
Waterbody Names	Budd Inlet (directly)
Listing ID of Receiving Water	5852, 5853, 5862, 5863, 5864, 7582, 7583, 7584, 7585, 7586, 7587, 10188, 81727 (includes all DO listings in Budd Inlet)

Table 14. Port of Olympia, Phase II Municipal Stormwater Permit, Wasteload Allocations for Budd Inlet TMDL.

Month	TN (kg/day)	DIN (kg/day)	TOC (kg/day)	BOD_5 (kg/day)
January	2.7	1.5	16.0	3.4
February	2.2	1.2	11.5	2.3
March	2.9	1.5	17.1	3.3
April	1.1	0.6	4.7	0.7
May	1.0	0.5	6.2	1.2
June	0.9	0.5	4.8	0.8
July	0.9	0.4	5.1	0.9
August	0.7	0.4	3.3	0.6
September	0.7	0.4	3.2	0.6
October	1.1	0.7	6.3	1.3
November	1.4	0.8	10.7	2.2
December	2.6	1.6	21.2	4.6

Additional permit information:

- BMPs are required in all stormwater permits to protect designated aquatic life uses.
- Ecology estimates that in order to meet the wasteload allocations shown above, reductions of 65-70% of the anthropogenic portion of the discharges will be needed relative to 1997 levels. Because the model uses 1997 loadings that predate the first Western Washington Phase II Municipal Stormwater Permit, we anticipate the level of reduction needed may be significantly less.
- To comply with this TMDL permittees must continue to comply with all elements of the permit.
- In addition to existing permitting requirements, permittees must:
    - Track any BMPs implemented to meet the TMDL, and implement nutrient control BMPs as needed. Priority areas include those that drain more directly to Budd Inlet.
    - Through a combination of analysis and/or monitoring, assess current stormwater loading to determine compliance with allocations.

Fish Hatcheries

The Washington Department of Fish and Wildlife (WDFW) currently operates the Tumwater Falls Fish Hatchery on a seasonal basis at production levels under the threshold requiring an Upland Fish Hatchery General Permit. Additionally, WDFW plans to build a new hatchery on the Deschutes River. Ecology has included an allocation for the combined discharge of both of these facilities, even if the Tumwater Falls facility remains under the permit production threshold.

Permittee Name	Department of Fish and Wildlife
Permit Number	N/A
Permit Type	No current permit
Waterbody Names	Budd Inlet (via Deschutes River and/or tributaries)
Listing ID of Receiving Water	5852, 5853, 5862, 5863, 5864, 7582, 7583, 7584, 7585, 7586, 7587, 10188, 81727 (includes all DO listings in Budd Inlet)

Table 15. Fish Hatcheries and Department of Fish and Wildlife Wasteload Allocation for Budd Inlet TMDL.

Month	TN (kg/day)	DIN (kg/day)	TOC (kg/day)	BOD_5 (kg/day)
January	3	3	31	4
February	9	9	125	11
March	14	13	168	26
April	18	16	156	24
May	14	9	72	12
June	4	3	41	9
July	5	5	25	4
August	4	4	26	3
September	5	5	23	2
October	5	5	43	4
November	6	5	42	5
December	7	7	49	8

Additional information:

- Wasteload allocations shall be translated into permit effluent limits for all facilities. The total of the permit effluent limits must not exceed the WLA.
- If the Tumwater Falls Hatchery does not obtain a permit, its effluent discharge should be estimated and the cumulative loading from this facility and any other fish hatchery must not exceed the WLA.
- Deschutes River influent loading may be subtracted from final loading at point of discharge.
- Permit effluent limits may be defined based on timeframes different than monthly, such as seasonal, while remaining consistent with the associated waste load allocations developed in this TMDL study.

Capitol Lake

Capitol Lake is managed by the Department of Enterprise (DES) services. To derive an allocation for Capitol Lake we remove the Capitol Lake Dam from the Budd Inlet model and determine the modeled DO under the TMDL scenario in Budd Inlet. Capitol Lake's wasteload allocation is the minimum difference between the modeled DO in Budd Inlet across all grid cells and the water quality standard. The allocation is for the total DO deficit the lake may cause in Budd Inlet.

Permittee Name	Department of Enterprise Services
Permit Number	N/A
Permit Type	No current permit
Waterbody Names	Budd Inlet (directly)
Listing ID of Receiving Water	5852, 5853, 5862, 5863, 5864, 7582, 7583, 7584, 7585, 7586, 7587, 10188, 81727 (includes all DO listings in Budd Inlet)

DES may not deplete dissolved oxygen levels in Budd Inlet at any time or location beyond the impact of the natural estuary condition. The natural estuary condition is described in Appendix D.

If DES continues to manage the waterbody differently than the natural estuary condition, Capitol Lake must not cause water quality standards violations at any time or location in Budd Inlet. The amount of DO deficit the lake may cause in Budd Inlet varies by locations. DO varies temporally and by location, as described within Appendix E. DES must show how water quality standards will be met through mechanistic water quality modeling using the same assumptions as this TMDL. DES must submit any request for an alternative to Ecology, and may implement an alternative if approved by Ecology under an administrative order.

By meeting this allocation, DES provides capacity for other discharges into Budd Inlet. DES's inability to meet this WLA will jeopardize other point and nonpoint source load allocations into Budd Inlet.

Other Permittees

The remaining permittees are not expected to contribute a significant amount of nitrogen and organic carbon and have allocations based on stormwater generated on the property. In cases of overlapping allocations between this plan and the Deschutes River TMDLs, permittees must comply with the more stringent requirements. Allocations are based on estimates of existing loading and reductions are generally not required. Aggregated allocations for permitting types are found in Tables 20-22.

The Port of Olympia holds an Industrial NPDES Individual Permit for the operation of a groundwater pump and treat system that discharges into Inner Budd Inlet via LOTT's outfall. The permit regulates the discharge of 14,400 gallons per day of treated groundwater from a Model Toxics Control site.

The Port of Olympia also holds a Boatyard General Permit for the operation of Swantown Boatworks. The Boatyard GP covers facilities that build, maintain, or repair small vessels and discharge stormwater to waters of the State or generate wastewater from a pressure washing process.

The Sand and Gravel General Permits cover facilities that are associated with sand and gravel operations, concrete batch plants, or asphalt batch plants and discharge process water, stormwater, or mine dewatering water into waters of the State. There are currently 11 Sand and Gravel GP permittees in the Budd Inlet watershed, listed below in Table 16. Some sand and gravel permittees may discharge to groundwater or ditches instead of directly to surface water. We include them in the aggregated allocation as a margin of safety. The aggregated allocation accounts for turnover in individually listed permittees over time.

Table 16. Current Sand and Gravel GP Permittees included in aggregate allocation.

Permit Number	Permittee Name
WAG501275	Thurston County PW Rainier Pit
WAG501357	Segale Properties LLC Olympia Pit
WAG501236	CW O'Neill Pit
WAG501042	Lakeside Industries Olympia Airport
WAG501037	Alpine Sand & Gravel Alpine Pit
WAG501029	Holroyd Co Tumwater Plant 6
WAG501118	Black Lake Quarry
WAG501199	Tumwater Ready Mix Plant
WAG501507	Concrete Recyclers Inc
WAG501431	Sundberg Sand and Gravel
WAG501231	Deschutes Aggregate & Recycle -Waldrick Road

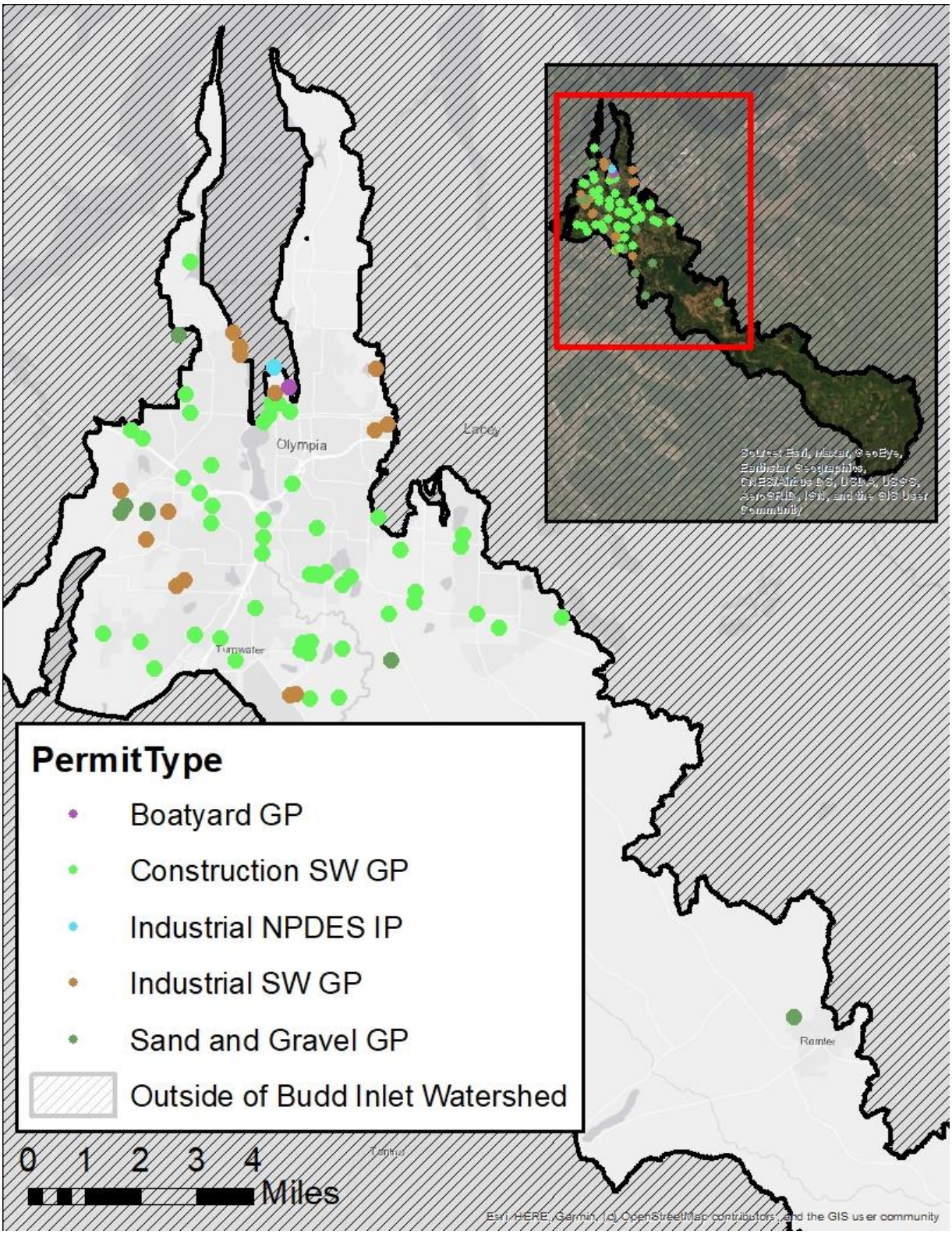
The Industrial Stormwater General Permit (ISGP) covers most industrial facilities and requires them to monitor, measure, and reduce stormwater leaving their site. Some industries have benchmarks relevant to this TMDL, which were considered in our analysis. There are currently 16 facilities with permit coverage under the ISGP, listed below in Table 17. Some industrial stormwater permittees may discharge to groundwater or ditches instead of directly to surface water, and one facility has a "conditional no exposure exemption." They are included in the aggregated allocation. The aggregated allocation accounts for turnover in individually listed permittees over time.

Table 17. Current Industrial Stormwater GP Permittees included in aggregate allocation.

Permit Number	Permittee Name
CNE308879	Regency Technologies
WAR000084	Intercity Transit
WAR000106	Dunlap Towing Olympia Log Yard
WAR000287	Summit Auto Wrecking
WAR000758	Truss Component of WA, INC
WAR001168	Port of Olympia Ocean Terminal
WAR001404	ONEILL & SONS
WAR002183	Mikes Welding Olympia
WAR004082	Pepsi Northwest Beverages LLC
WAR009171	Kloeckner Metals Corporation
WAR009988	Pepsi Northwest Beverage CO, LLC
WAR304006	Bay Marine Leased Yard
WAR304313	PSE Olympia Service Center
WAR304545	Pacific NW Bulkhead Yard
WAR306846	Olympia Bin
WAR308937	Midway Recycling

Finally, the Construction Stormwater General Permit (CSGP) covers all construction sites greater than one acre and discharging stormwater to a surface water of the State. Coverage under the CSGP changes frequently, as construction sites are often temporary and terminated when construction is complete. There are currently 62 CSGP permittees in the watershed, six of which are pending transfer or termination. The aggregated allocation accounts for turnover in individually listed permittees over time.

Figure 6. Other permittees receiving allocations in TMDL.



Permittee Name	Port of Olympia, Swantown Marina
Permit Number	WAG031043
Permit Type	Boatyard GP
Waterbody Names	Budd Inlet (directly)
Listing ID of Receiving Water	5852, 5853, 5862, 5863, 5864, 7582, 7583, 7584, 7585, 7586, 7587, 10188, 81727 (includes all DO listings in Budd Inlet)

Table 18. Swantown Marina, Port of Olympia, Boatyard General Permit, Wasteload Allocation for Budd Inlet TMDL.

Month	TN (kg/day)	DIN (kg/day)	TOC (kg/day)	BOD_5 (kg/day)
January	0.49	0.49	3.41	0.81
February	0.41	0.40	2.44	0.55
March	0.54	0.50	3.63	0.78
April	0.2	0.2	1.0	0.2
May	0.2	0.2	1.3	0.3
June	0.2	0.2	1.0	0.2
July	0.2	0.1	1.1	0.2
August	0.1	0.1	0.7	0.1
September	0.1	0.1	0.7	0.1
October	0.2	0.3	1.3	0.3
November	0.3	0.3	2.3	0.5
December	0.5	0.6	4.5	1.1

Additional permit information:

- BMPs are required in all Boatyard General Permits to protect designated aquatic life uses.
- There are no additional TMDL-required conditions in Boatyard GPs, and compliance with the permit constitutes compliance with the goals of the TMDL. This TMDL does not contain any additional TMDL-related actions for Swantown Marina Port of Olympia.
- Permittee must continue to comply with all permit conditions.

Permittee Name	Port of Olympia, Cascade Pole
Permit Number	WA0040533
Permit Type	Industrial NPDES IP
Waterbody Names	Budd Inlet (directly)
Listing ID of Receiving Water	5852, 5853, 5862, 5863, 5864, 7582, 7583, 7584, 7585, 7586, 7587, 10188, 81727 (includes all DO listings in Budd Inlet)

Table 19. Cascade Pole, Port of Olympia, Individual NPDES Industrial Permit, Wasteload Allocation for Budd Inlet TMDL.

Month	TN (kg/day)	DIN (kg/day)	TOC (kg/day)	BOD_5 (kg/day)
January	1.07	1.08	7.45	1.77
February	0.89	0.88	5.34	1.19
March	1.18	1.10	7.94	1.70
April	0.4	0.5	2.2	0.3
May	0.4	0.4	2.9	0.6
June	0.4	0.4	2.2	0.4
July	0.3	0.3	2.4	0.5
August	0.3	0.3	1.5	0.3
September	0.3	0.3	1.5	0.3
October	0.4	0.5	3.0	0.7
November	0.56	0.58	5.00	1.16
December	1.06	1.21	9.86	2.36

Additional permit information:

- BMPs are required in all Individual Industrial Permits to protect designated aquatic life uses.
- There are no additional TMDL-required conditions and compliance with the permit constitutes compliance with the goals of the TMDL. This TMDL does not contain any additional TMDL-related actions for Cascade Pole, Port of Olympia Individual Industrial Permit.
- Permittee must continue to comply with all permit conditions.

Permittee Name	Various
Permit Number	Various
Permit Type	Construction SW GP

Waterbody Names	Budd Inlet (directly and via Deschutes River and/or tributaries)
Listing ID of Receiving Water	5852, 5853, 5862, 5863, 5864, 7582, 7583, 7584, 7585, 7586, 7587, 10188, 81727 (includes all DO listings in Budd Inlet)

Table 20. Construction Stormwater General Permit, Wasteload Allocation for Budd Inlet TMDL.

Month	TN (kg/day)	DIN (kg/day)	TOC (kg/day)	BOD_5 (kg/day)
January	111	70	586	145
February	68	53	263	48
March	86	57	626	165
April	28	19	131	33
May	14	10	90	19
June	11	8	77	14
July	7	5	38	10
August	6	5	24	6
September	6	5	23	6
October	15	13	67	16
November	39	20	235	51
December	111	65	662	188

Additional permit information:

- BMPs are required in all Construction Stormwater General Permits to protect designated aquatic life uses.
- There are no additional TMDL-required conditions in CSGPs, and compliance with the permit constitutes compliance with the goals of the TMDL. This TMDL does not contain any additional TMDL-related actions.
- Permittee must continue to comply with all permit conditions.

Permittee Name	Various
Permit Number	Various
Permit Type	Industrial SW GP
Waterbody Names	Budd Inlet (directly and via Deschutes River and/or tributaries)
Listing ID of Receiving Water	5852, 5853, 5862, 5863, 5864, 7582, 7583, 7584, 7585, 7586, 7587, 10188, 81727 (includes all DO listings in Budd Inlet)

Table 21. Industrial Stormwater General Permit, Wasteload Allocation for Budd Inlet TMDL.

Month	TN (kg/day)	DIN (kg/day)	TOC (kg/day)	BOD_5 (kg/day)
January	24	18	118	53
February	17	14	70	28
March	21	16	125	56
April	8	7	37	18
May	5	4	34	14
June	4	4	30	11
July	3	2	20	8
August	3	2	12	5
September	3	2	13	5
October	5	5	31	15
November	11	8	76	48
December	23	18	148	78

Additional permit information:

- BMPs are required in all Industrial Stormwater General Permits to protect designated aquatic life uses.
- There are no additional TMDL-required conditions in ISGPs, and compliance with the permit constitutes compliance with the goals of the TMDL. This TMDL does not contain any additional TMDL-related actions for Industrial Stormwater General Permittees.
- Permittee must continue to comply with all permit conditions.

Permittee Name	Various
Permit Number	Various
Permit Type	Sand and Gravel GP
Waterbody Names	Budd Inlet (directly and via Deschutes River and/or tributaries)
Listing ID of Receiving Water	5852, 5853, 5862, 5863, 5864, 7582, 7583, 7584, 7585, 7586, 7587, 10188, 81727 (includes all DO listings in Budd Inlet)

Table 22. Sand and Gravel General Permit, Wasteload Allocation for Budd Inlet TMDL.

Month	TN (kg/day)	DIN (kg/day)	TOC (kg/day)	BOD_5 (kg/day)
January	101	63	553	134
February	66	49	276	50
March	79	52	593	150
April	27	19	147	36
May	14	10	104	22
June	11	8	90	17
July	7	5	48	11
August	7	4	29	7
September	7	4	31	7
October	16	13	90	21
November	40	23	300	69
December	99	59	651	179

Additional permit information:

- BMPs are required in all Sand and Gravel General Permits to protect designated aquatic life uses.
- There are no additional TMDL-required conditions in SGGPs, and compliance with the permit constitutes compliance with the goals of the TMDL. This TMDL does not contain any additional TMDL-related actions for Sand and Gravel General Permittees.
- Permittee must continue to comply with all permit conditions.

Puget Sound Aggregate "Bubble" Load Allocation

This TMDL calculated an aggregated bubble load allocation for all anthropogenic sources of nitrogen and organic carbon that enter Budd Inlet from the rest of Puget Sound. This bubble load allocation is based upon a 61% reduction in 1997 anthropogenic loads (based on landward concentrations and flows) at the Budd Inlet open boundary as described in Appendix E. The Puget Sound Nutrient Source Reduction Project will show how the targets it sets for marine discharge sources and the watersheds meet this allocation. The allocation will be met through a combination of point and nonpoint actions to be described in the 2024 nutrient management plan. The table below shows the magnitude of the bubble load allocation as a daily anthropogenic load, averaged on a monthly basis. It is recommended that the daily anthropogenic load averaged on an annual basis be used to comply with the bubble load allocation at the open boundary.

Table 23. Anthropogenic Daily Load Allocation, Averaged by Month and by Year, at the Open Boundary of Budd Inlet.

Month	TN (kg/day)	DIN (kg/day)	TOC (kg/day)	DOC (kg/day)
Jan	2470	1900	7610	3500
Feb	2090	1410	5730	2240
Mar	2490	1760	7790	3780
Apr	2130	780	8050	4000
May	2090	900	10360	5430
June	1850	710	8850	4020
Jul	1440	550	6990	2790
Aug	1480	410	9710	4730
Sept	1510	480	8840	4310
Oct	2000	880	8210	3860
Nov	2060	950	7900	3650
Dec	2480	1950	7880	3670
Annual	2010	1060	8180	3840

Table 24. Daily Load Allocation from Natural Sources, Averaged by Month and by Year, at the Open Boundary of Budd Inlet.

Month	TN (kg/day)	DIN (kg/day)	TOC (kg/day)	DOC (kg/day)
Jan	38800	28640	124730	57660
Feb	32750	21240	85250	34880
Mar	38940	26480	117070	58410
Apr	34620	11620	122680	62200
May	35090	13550	167000	84810
June	31050	10600	142230	62970
Jul	24320	8110	112100	43670
Aug	25350	6060	156980	74160
Sept	26100	7200	144670	69160
Oct	32610	13090	128010	59560
Nov	33380	14290	123090	56720
Dec	39000	29460	129450	60390
Annual	32680	15880	129730	60550

Load Allocations

Nonpoint Sources

This section presents load allocations for all nonpoint sources of pollution within each jurisdiction and to natural background sources. There is one table showing load allocation for Lewis County (Table 25); a table summarizing load allocation for Thurston County (Table 26); a table showing the total anthropogenic load allocation (Table 27); and a table summarizing natural load allocations (Table 28). All load allocations are given in kilograms per day (kg/day).

Table 25. Total nonpoint load allocations for Lewis County.

Month	TN (kg/day)	DIN (kg/day)	TOC (kg/day)	BOD_5 (kg/day)
January	76	75	618	20
February	46	58	275	7
March	58	61	661	22
April	19	20	137	5
May	9	10	93	3
June	7	8	80	2
July	5	5	38	1
August	4	5	25	1
September	4	5	23	1
October	10	13	69	3
November	27	22	246	7
December	76	70	698	26
Annual	28	29	248	8

Table 26. Total nonpoint load allocations for Thurston County.

Month	TN (kg/day)	DIN (kg/day)	TOC (kg/day)	BOD_5 (kg/day)
January	839	749	2765	134
February	512	578	1237	46
March	640	609	2976	156
April	197	193	608	31
May	96	99	402	18
June	78	83	341	14
July	53	50	170	9
August	46	46	109	5
September	46	49	105	6
October	112	135	315	16
November	299	218	1144	53
December	846	701	3143	176
Annual	314	292	1115	56

Table 27. Total anthropogenic nonpoint load allocations.

Month	TN (kg/day)	DIN (kg/day)	TOC (kg/day)	BOD_5 (kg/day)
January	641	512	2812	116
February	390	425	1202	31
March	463	406	3095	142
April	99	81	520	23
May	51	46	244	11
June	45	48	141	8
July	37	35	126	5
August	33	33	88	3
September	33	35	80	2
October	67	85	242	7
November	214	125	1122	44
December	612	457	3193	157
Annual	224	190	1078	46

Table 25. Natural nonpoint load allocations.

Month	TN (kg/day)	DIN (kg/day)	TOC (kg/day)	DOC (kg/day)
Jan	274	312	571	38
Feb	169	211	310	22
Mar	236	265	542	36
Apr	117	133	225	13
May	54	64	251	9
Jun	41	43	280	8
Jul	20	20	82	5
Aug	17	18	46	4
Sep	17	18	48	4
Oct	56	63	142	12
Nov	111	116	268	16
Dec	310	314	648	45
Annual	119	131	285	18

Watersheds

To inform implementation, watershed loads were established for each subwatershed based upon a 65% reduction in anthropogenic nitrogen and organic carbon loads for April through October for the 1997 water year. Here we define 'watershed load' as the sum of all natural and anthropogenic sources of pollution – point and nonpoint – distributed within a particular subwatershed. Watershed loads are included as a supplemental analysis. They are an alternative way of describing this TMDL's load allocations. Table 29 summarizes total watershed loads for all subwatersheds, expressed in kg/day for each month. Table 30 shows the total watershed loads for individual subwatersheds. Allocations for organic carbon in this TMDL are given in the form of total organic carbon (TOC), 5-day biological oxygen demand (BOD_5), or dissolved organic carbon (DOC). A more detailed description is included in Appendix E.

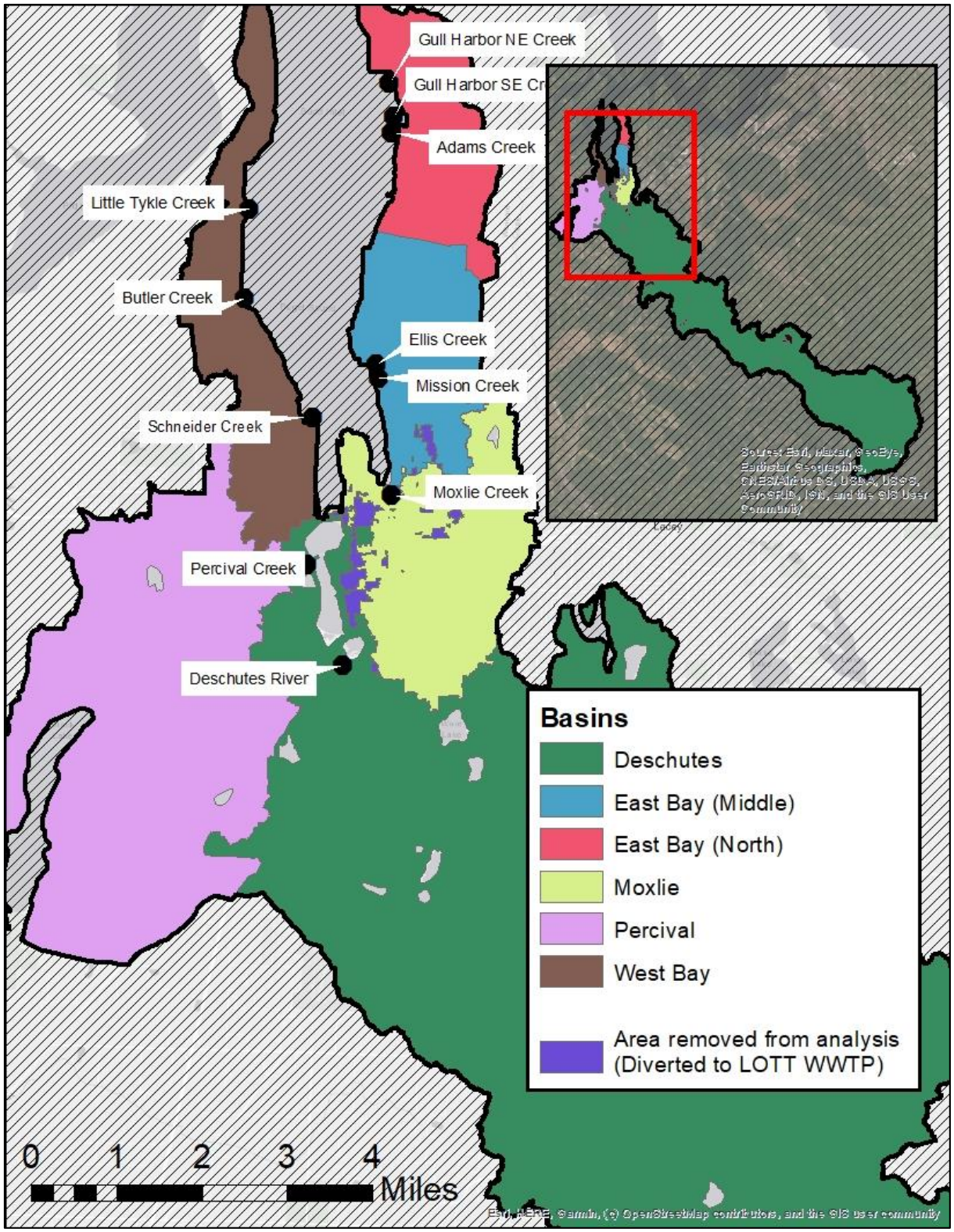


Figure 7. Locations of subwatersheds and primary tributaries within the Budd Inlet model.

Table 26. Total watershed loading capacity for all subwatersheds. These numbers represent the total load at the mouth of each subwatershed and include both point and nonpoint sources within each of the subwatersheds.

Month	TN (kg/day)	DIN (kg/day)	TOC (kg/day)	DOC (kg/day)
Jan	3420	2180	13560	8500
Feb	2190	1690	6690	3250
Mar	2680	1800	14770	9700
Apr	870	610	3470	2240
May	470	340	2430	1390
Jun	370	270	2060	1080
Jul	260	170	1150	730
Aug	240	160	730	450
Sep	230	160	750	470
Oct	530	440	2100	1320
Nov	1320	730	6820	4230
Dec	3450	2090	15970	11430
Annual	1340	880	5900	3760

Table 27. Watershed loading capacity for individual subwatersheds within the greater Budd Inlet watershed (figures represent total maximum daily loads expressed in kg/day, which vary by month).

Month	Stream	TN	DIN	TOC	BOD_5	DOC	Stream	TN	DIN	TOC	BOD_5	DOC
Jan	Moxlie	71	51	401	84	331	Mission	18.9	12.2	28.6	3.6	14.2
Feb		59	41	287	57	223		9.3	7.0	22.6	3.4	13.5
Mar		78	52	427	81	318		13.5	8.2	57.8	10.7	42.0
Apr		30	21	116	16	63		2.7	2.0	9.0	1.2	4.8
May		25	19	155	29	115		1.6	1.1	4.6	0.7	2.8
Jun		25	18	119	19	76		1.7	1.3	4.2	0.5	2.1
Jul		23	14	127	23	91		0.9	0.6	1.9	0.2	0.9
Aug		20	14	82	15	58		0.6	0.4	1.0	0.2	0.7
Sep		18	14	80	16	61		2.0	1.4	6.4	1.3	5.2
Oct		28	26	159	31	121		3.5	3.0	12.9	2.5	9.8
Nov		37	27	269	55	217		6.5	4.4	26.7	4.4	17.4
Dec		70	57	530	112	440		20.7	13.6	53.6	8.3	32.8
Jan	GullSE	9.0	3.9	39.9	7.0	27.7	GullNE	3.7	1.6	16.3	2.8	11.1
Feb		4.9	2.6	14.8	2.1	8.2		2.9	1.5	8.9	1.3	5.1
Mar		8.1	3.9	45.3	8.3	32.7		3.5	1.7	18.2	3.3	12.9
Apr		1.6	1.1	6.7	0.9	3.7		1.2	0.8	4.7	0.6	2.5
May		0.7	0.4	2.7	0.4	1.6		0.9	0.6	3.8	0.6	2.2
Jun		1.0	0.7	3.3	0.4	1.7		1.1	0.7	3.3	0.4	1.5
Jul		0.4	0.3	1.2	0.1	0.5		0.7	0.5	2.0	0.2	0.9
Aug		0.4	0.2	0.9	0.1	0.5		0.4	0.2	0.9	0.1	0.5
Sep		1.2	0.8	2.6	0.3	1.1		0.8	0.5	1.6	0.2	0.7
Oct		3.2	2.2	9.1	1.4	5.4		1.8	1.2	5.0	0.7	2.9
Nov		10.9	4.2	39.0	6.7	26.4		5.5	2.1	19.6	3.4	13.3
Dec		17.5	5.4	63.7	11.8	46.4		6.6	2.0	23.5	4.3	17.1
Jan	Little Tykle	2.8	1.7	11.7	2.0	7.8	Butler	24.6	16.6	96.4	18.8	73.8
Feb		1.9	1.2	5.6	0.7	2.6		10.8	5.6	25.1	3.9	15.1

Month	Stream	TN	DIN	TOC	BOD_5	DOC	Stream	TN	DIN	TOC	BOD_5	DOC
Mar		3.3	1.9	14.3	1.9	7.6		20.3	10.6	69.5	11.0	43.2
Apr		0.7	0.6	2.6	0.4	1.7		1.1	0.8	6.6	1.3	5.1
May		0.7	0.5	2.1	0.3	1.0		0.5	0.3	2.6	0.4	1.7
Jun		0.6	0.4	2.5	0.4	1.5		0.7	0.5	2.3	0.3	1.2
Jul		0.5	0.3	2.1	0.3	1.1		0.5	0.4	0.9	0.1	0.4
Aug		0.5	0.2	1.8	0.2	1.0		0.2	0.1	0.2	0.0	0.1
Sep		0.4	0.2	1.7	0.2	0.8		1.3	1.0	2.9	0.3	1.2
Oct		1.0	0.7	4.2	0.6	2.2		2.7	2.5	8.5	1.1	4.4
Nov		2.8	2.1	9.4	1.5	5.9		6.8	4.7	28.8	5.0	19.5
Dec		7.7	4.5	26.0	4.6	18.2		35.6	24.5	158.9	31.9	125.5
Jan	Deschutes	2910	1899	11103	1708	6725	Percival	290	134	1553	279	1097
Feb		1780	1469	5038	562	2209		263	123	1117	169	666
Mar		2236	1558	12014	1975	7775		242	118	1694	291	1144
Apr		712	512	2589	414	1616		98	62	683	131	516
May		350	263	1698	229	889		71	45	525	92	360
Jun		274	212	1430	175	681		56	29	453	75	294
Jul		186	131	699	112	434		34	15	285	47	184
Aug		162	121	461	70	271		51	13	167	28	108
Sep		160	127	428	68	264		36	12	208	32	125
Oct		388	342	1258	192	743		77	46	582	100	393
Nov		1015	546	4442	604	2377		176	106	1779	361	1421
Dec		2914	1775	12545	2214	8719		248	120	2115	429	1690
Jan	Ellis	36	22	188	36	142	Adams	12.1	5.2	40.0	6.3	24.7
Feb		19	13	96	16	64		6.7	3.6	26.4	4.2	16.5
Mar		32	16	235	46	182		6.7	3.7	69.9	13.3	52.4
Apr		6	4	26	4	15		2.4	1.7	8.0	1.2	4.6
May		4	3	16	3	10		1.1	0.8	4.8	0.8	3.2
Jun		3	2	12	2	6		1.1	0.7	4.6	0.7	2.7
Jul		3	2	8	1	4		0.7	0.5	2.5	0.3	1.0
Aug		2	1	4	1	3		0.5	0.4	0.8	0.1	0.4
Sep		2	2	6	1	4		1.9	1.3	4.2	0.5	2.2
Oct		6	5	19	3	13		3.8	3.4	10.7	1.5	6.0
Nov		15	9	66	12	46		9.3	7.3	30.5	4.2	16.4
Dec		53	53	53	53	53		16.6	10.5	53.0	8.2	32.4
Jan	Schneider	46.4	32.7	80.5	12.6	49.4						
Feb		31.9	21.7	52.8	7.5	29.5						
Mar		36.5	26.1	127.8	21.7	85.3						
Apr		11.8	9.0	16.8	2.1	8.4						
May		9.5	8.3	17.5	1.8	7.0						
Jun		9.1	7.2	21.9	3.0	11.8						
Jul		7.9	6.0	21.0	2.8	10.9						
Aug		6.0	4.6	8.5	1.0	3.8						
Sep		5.7	3.8	8.8	0.8	3.3						
Oct		12.0	9.6	27.4	3.6	14.2						
Nov		34.4	21.1	106.7	18.3	72.1						
Dec		61.3	43.1	169.7	32.0	126.0						

Margin of Safety

Within the TMDL framework, a margin of safety accounts for uncertainty inherent in the modeling system, including pollutant loading. A margin of safety must be included in all TMDLs to ensure water quality standards are met, despite these uncertainties. Implicit margins of

safety do not set aside a specific allocation, but are based rather on building conservative assumptions into the analysis. In this TMDL, the margin of safety is implicit, and our assumptions are as follow:

- The year used for this analysis (1997) is within the 2nd percentile of the DO measurements made between 1973 and 1998 at a long-term monitoring station located in central Budd Inlet (see water quality data in Appendices A and F). Though differences in methodologies and sensor technology introduced in Budd Inlet in 1999 preclude the direct comparison of DO data from before and after this date, the observed 1997 minima during the critical period approximate the minima observed in the 1999-2017 period. Using this year with significantly low minima for DO ensures the TMDL allocations meet standards even in the most critical conditions.

- GEMSS results show a slight negative bias in the bottom one-third of the water column, where the lowest DO levels are typically observed, resulting in the model slightly under-predicting DO by 0.04 mg/L. We use these model results, without any bias correction, providing an additional margin of safety. Further details on model bias and performance are found in Appendix D4.
- The Deschutes River and Budd Inlet Tributaries Multi-Parameter TMDL sets additional allocations for temperature in the Deschutes River. Implementation of riparian shade practices to lower river temperature will lower biological activity at the mouth of the Deschutes River to levels below what was assumed in the model, slightly reducing organic carbon entering Budd Inlet.
- Watershed allocations were calculated at the point of discharge, however most sources do not discharge directly to Budd Inlet. Natural filtration as the pollutants move towards Budd Inlet will provide a greater level of reduction.
- The Budd Inlet Model uses an hourly time series and no averaging across time periods is done in post processing. This ensures that standards are met at all times throughout the day.
- The Budd Inlet Model covers the time period of January 1st through September 15th. However, we included allocations for all sources through the end of the year. This ensures that standards will be met should the critical period last for an extended duration or occur later in the season. This will also serve to reduce the overall accumulation of loading into the inlet.
- The aggregated allocations assigned to Sand and Gravel, Industrial Stormwater, and Construction Stormwater permittees include permittees that are unlikely to discharge into surface waters.

TMDL Calculation

Table 31 presents a summary of all allocations used in calculating the TMDL loading capacity in terms of total loads for wasteload allocations and load allocations. These are shown as annual average daily loads, rounded to the nearest ten.

Table 28. Annual average total maximum daily loads.

Source	TN (kg/day)	DIN (kg/day)	TOC (kg/day)
NPDES Permitted Point Sources (WLA)	1580	960	5980
Nonpoint and Natural Sources (LA)	340	320	1360
Bubble Allocation (LA)	34690	16930	137940
Capitol Lake (WLA)	0 *(see App. E)*	0 *(see App. E)*	0 *(see App. E)*
Margin of Safety	*Implicit*	*Implicit*	*Implicit*
Loading Capacity	36610	18210	145280

The loading capacity for Capitol Lake is the amount of oxygen depletion the lake may cause in Budd Inlet that allows Budd Inlet to meet DO standards. This varies based on the location within Budd Inlet, with the overall wasteload allocation to Capitol Lake being driven by the most stringent grid cells. Thus, Capitol Lake's assigned wasteload allocation is 0.0 mg/L of DO depletion. Please see *TMDL Scenario* in Appendix E for more information.

Chapter 3 - Implementation Plan

Introduction

This implementation plan describes what needs to be done to improve water quality in Budd Inlet. It explains the roles and authorities of cleanup partners (those organizations with jurisdiction, authority, or direct responsibility for cleanup), along with the programs or other means through which they will address these water quality issues. It prioritizes specific actions planned to improve water quality and achieve water quality standards. TMDL reductions should be achieved by 2040.

The most important action needed to reach water quality standards in Budd Inlet is the development and implementation of a long-term management solution for Capitol Lake. Capitol Lake is the largest source of oxygen depletion within Budd Inlet. Ecology's modeling indicates that WQS in Budd Inlet cannot be met if the existing dam remains in place as currently designed. The modeling shows that when the dam is removed, WQS can be met as long as stakeholders take additional action to reduce pollution from other sources within the watershed. Ecology has not determined whether any draft lake design and management scenarios can meet water quality standards if the dam and Capitol Lake are redesigned but kept in place. Therefore, Ecology recommends the removal of Capitol Lake Dam as the single most important action to restore water quality in Budd Inlet. However, if other Capitol Lake management plans are able to meet water quality standards as demonstrated by water quality mechanistic modeling equivalent to that conducted for this TMDL, other actions may be taken.

The combination of point and nonpoint sources elsewhere in the Puget Sound watershed also contribute to oxygen depletion within Budd Inlet. This TMDL creates an aggregated allocation (referred to as a "bubble allocation") for all of these sources collectively, but it does not assign load or wasteload allocations for individual sources outside of the Budd Inlet watershed. Ecology and partners are continuing to advance the Puget Sound Nutrient Source Reduction Project to identify these external point and nonpoint sources in order to meet the bubble allocation at the northern boundary of Budd Inlet.

Additional actions are required to meet standards in Budd Inlet, including the reduction of nonpoint source pollution in the Budd Inlet watershed. In the past decade several reports and community processes have developed a robust body of work on the watershed, sources of nonpoint pollution, and prioritization of implementation actions that will benefit the Budd Inlet and Deschutes watersheds (eg. EPA, 2021; Thurston County, 2020). Many of these actions will result in long term nutrient reductions that align with meeting the water quality targets associated with this TMDL. This report provides guidance on how, when, and by whom these actions should be completed. The intention is to build on previous work by stakeholders and the community to reinvigorate nonpoint implementations actions within the watershed.

Landcover Distribution

Landcover throughout the Budd Inlet watershed varies, with highly developed areas near the cities of Olympia, Lacey, and Tumwater. Proceeding upstream, the watershed is home to more intensive agricultural land use, while the southern headwaters are more densely forested. We used the 2016 National Land Cover Database from the Multi-Resolution Land Characteristics Consortium[11] to quantify land coverage by sub-basin at 30-meter resolution within the watershed (Figure 8). We broke the watershed into six sub-basins that were also used to divide up wasteload and load allocations (see Appendix E). Definitions for each of the classifications are provided in Table 34. The largest sources of nutrient pollution include agricultural landcovers - such as Pasture/Hay and Cultivated Crops – and areas of medium and high intensity development.

Table 29. Land cover by subbasin within the Budd Inlet watershed. The top three landcover classifications for each basin are highlighted in yellow.

Classification	Deschutes (mi^2)	East Bay – Middle (mi^2)	East Bay – North (mi^2)	Moxlie (mi^2)	Percival (mi^2)	West Bay (mi^2)
Open Water	1.6	0.01	0.04	0.03	0.9	0.2
Developed, Open Space	10.6	0.9	0.5	0.9	3.1	1.0
Developed, Low Intensity	8.8	0.8	0.3	1.9	2.7	1.2
Developed, Med. Intensity	4.6	0.2	0.1	1.1	1.7	0.4
Developed, High Intensity	1.1	0.01	0.01	0.7	0.8	0.1
Barren Land (Rock/Sand/Clay)	0.3	0.02	0.05	0.02	0.04	0.1
Deciduous Forest	2.8	0.3	0.4	0.2	0.7	0.4
Evergreen Forest	70.8	0.3	0.4	0.1	1.4	0.3
Mixed Forest	9.9	0.4	0.5	0.2	1.1	0.5
Shrub/Scrub	17.2	0.1	0.1	0.02	1.0	0.1
Grassland/Herbaceous	13.4	0.03	0.02	0.02	0.2	0.04
Pasture/Hay	13.3	0.1	0.4	0.02	0.7	0.02
Cultivated Crops	0.2			0.003		
Woody Wetlands	5.8	0.3	0.2	0.05	1.1	0.04
Emergent Herbaceous Wetlands	2.0	0.1	0.1	0.02	0.4	0.1
Total Area	162.5	3.5	3.1	5.3	16.1	4.3

[11] https://www.mrlc.gov/

Table 30. Percentage of land cover classification within each sub-basin of the Budd Inlet watershed. The top three landcover classifications for each basin are highlighted in yellow.

Classification	Deschutes	East Bay - Middle	East Bay - North	Moxlie	Percival	West Bay
Open Water	1.0%	0.4%	1.1%	0.6%	5.7%	4.7%
Developed, Open Space	6.5%	24.8%	16.6%	17.7%	19.5%	23.1%
Developed, Low Intensity	5.4%	22.9%	8.7%	36.2%	16.9%	26.8%
Developed, Medium Intensity	2.8%	5.8%	1.7%	21.8%	10.5%	10.4%
Developed, High Intensity	0.7%	0.3%	0.2%	12.5%	5.2%	1.7%
Barren Land (Rock/Sand/Clay)	0.2%	0.6%	1.6%	0.5%	0.2%	2.4%
Deciduous Forest	1.7%	9.8%	11.6%	2.9%	4.5%	8.3%
Evergreen Forest	43.6%	8.1%	14.0%	1.7%	8.9%	6.2%
Mixed Forest	6.1%	10.4%	17.0%	3.6%	7.0%	11.5%
Shrub/Scrub	10.6%	3.1%	3.5%	0.4%	6.4%	1.4%
Grassland/Herbaceous	8.3%	0.7%	0.5%	0.4%	1.5%	0.9%
Pasture/Hay	8.2%	2.7%	13.8%	0.4%	4.3%	0.4%
Cultivated Crops	0.2%	--	--	0.1%	--	--
Woody Wetlands	3.6%	8.0%	6.5%	0.9%	6.7%	1.0%
Emergent Herbaceous Wetlands	1.2%	2.4%	3.2%	0.4%	2.7%	1.3%

Figure 8. Land cover by sub-basin for the Budd Inlet watershed. (MRLC, 2014).

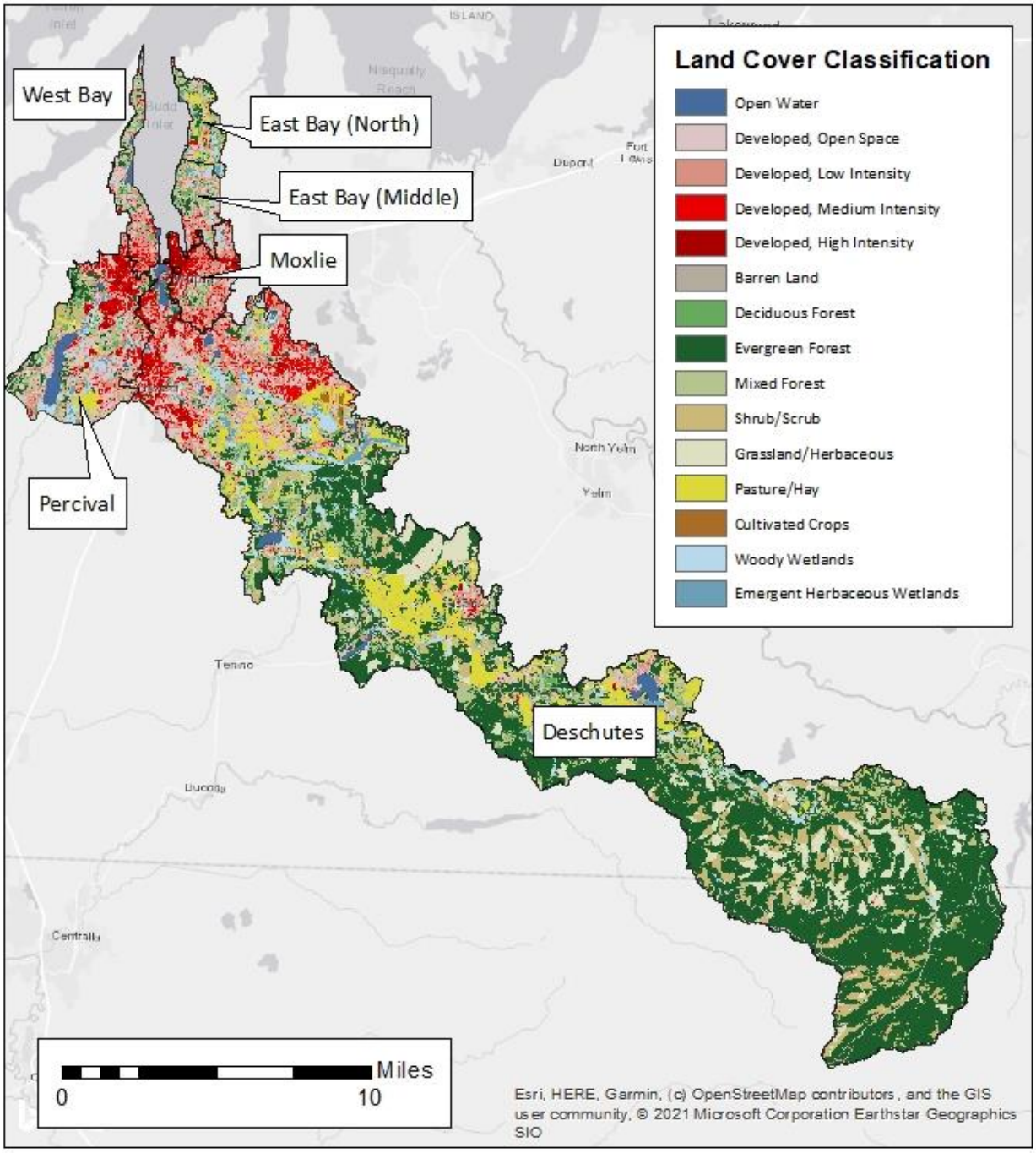


Table 31. Land cover classification description. (MRLC, 2014).

Class	Classification Description
Water	**Open Water**: areas of open water, generally with less than 25% cover of vegetation or soil.
	Perennial Ice/Snow: areas characterized by a perennial cover of ice and/or snow, generally greater than 25% of total cover.
Developed	**Developed, Open Space**: areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20% of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.
	Developed, Low Intensity: areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20% to 49% percent of total cover. These areas most commonly include single-family housing units.
	Developed, Medium Intensity: areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50% to 79% of the total cover. These areas most commonly include single-family housing units.
	Developed High Intensity: highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80% to 100% of the total cover.
	Barren Land (Rock/Sand/Clay): areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.
Forest	**Deciduous Forest**: areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species shed foliage simultaneously in response to seasonal change.
	Evergreen Forest: areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species maintain their leaves all year. Canopy is never without green foliage.
	Mixed Forest: areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75% of total tree cover.
Shrubland Herbaceous	**Shrub/Scrub**: areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.
	Grassland/Herbaceous: areas dominated by gramanoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.
Planted/ Cultivated	**Pasture/Hay**: areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20% of total vegetation.
	Cultivated Crops: areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20% of total vegetation. This class also includes all land being actively tilled.
Wetlands	**Woody Wetlands**: areas where forest or shrubland vegetation accounts for greater than 20% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.
	Emergent Herbaceous Wetlands: Areas where perennial herbaceous vegetation accounts for greater than 80% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

The southern portion of the Deschutes sub-basin is dominated by forest lands in Lewis and Thurston Counties. Commercial timber production is owned and managed primarily by the Weyerhaeuser Company, Department of Natural Resources (DNR) and the United States Forest Service (USFS). Agricultural uses are primarily in the middle of the Deschutes sub-basin and include dairy, livestock, poultry, food and other crops, hay and Christmas tree farms. The northern portion of Deschutes sub-basin, Moxlie sub-basin, and the southern portions of East and West Bay are highly developed mixed residential, commercial, and industrial land cover. Downtown Olympia, Tumwater, and the Port of Olympia occur in this region. The northern portion of East and West Bay and the majority of the Percival sub-basin are mixed residential, pasture/hay and forested land cover.

Extensive land use studies have been conducted in the Deschutes Watershed. In 2015 and 2016 Thurston County, along with partners from the Squaxin Island Tribe, the cities of Olympia, Rainer, and Tumwater, and the Thurston Regional Planning Council convened a workgroup to detail existing conditions and provide further recommendations associated with land management and water quality. The Current Conditions Report[12] (Thurston County, 2015) includes maps, descriptions of land uses, and summaries of the county's basin evaluation efforts.

Pollution Sources

Capitol Lake

Capitol Lake contributes to oxygen depletion in Budd Inlet (for more information on how Capitol Lake depletes oxygen in Budd Inlet see Appendix A). As mentioned above, the single most important action associated with this TMDL is the long-term management of Capitol Lake in a way that sufficiently limits its impact on DO in Budd Inlet.

This TMDL shows that a restoration of Capitol Lake to an estuarine system will meet this goal. Ecology recommends this action be taken to restore water quality in Budd Inlet. Ecology has not determined whether any lake design and management scenarios can meet water quality standards if the Capitol Lake Dam is kept in place. If other Capitol Lake management plans are able to meet this goal as demonstrated by water quality mechanistic modeling equivalent to that conducted for this TMDL, other actions may be taken.

[12] https://www.thurstoncountywa.gov/planning/planningdocuments/deschutes-current-conditions-report.pdf

The development of viable alternatives to the present lake management plan at Capitol Lake will take substantial time and effort. The Department of Enterprise Services's planning effort[13] for the long-term management of Capitol Lake and the Deschutes Estuary is an ongoing collaborative process that is identifying these alternative management strategies, and it encompasses three phases. The first phase, completed in 2016, collaboratively established the purpose and goals of long-term management. A copy of this final report[14] is available online.

The second phase of this process is the production of an Environmental Impact Statement (EIS) to determine a preferred alternative to the present system of lake management. A draft EIS is available online and has received significant public comment (DES, 2020). The outcome of Phase 2 of this EIS will be the selection of a preferred management alternative in 2022. While this selction has not been finalized, DES identified the removal of the Capitol Lake Dam as its 'likely preferred alternative' in March 2022. Further, DES "expect[s] that the likely preferred alternative will be confirmed as the preferred alternative in the Final EIS" to be issued in Fall 2022.[15] More information is available on the project website.[16]

Phase 3 of the EIS will begin upon completion of Phase 2. Phase 3 will encompass the design and permitting of the preferred alternative and is estimated to take three to five years, followed by four to eight years of construction.

External Sources of Pollution (Greater Puget Sound)

Watersheds and point sources that discharge into other areas of Puget Sound contribute to loading and DO deficit in Budd Inlet. This TMDL sets an aggregate bubble allocation for all of these external sources. It does not create individual load or wasteload allocations for these sources. Ecology is continuing to advance the Puget Sound Nutrient Source Reduction Project to identify reduction targets in order to meet the bubble allocation at the northern boundary of Budd Inlet.

EPA's 2006 Clarification Regarding "Phased" Total Maximum Loads[17] indicates that the phased approach may be used to allow a TMDL to move forward when it is possible that allocations may need to be revised as additional information is collected. Further, the guidance notes that available data may be used to provide estimates, as long as they are calculated to meet water quality standards. In accordance with this guidance the Budd Inlet TMDL uses the Budd Inlet Model to determine the total aggregate load allowable from external sources, but will rely on the PSNSRP and information from the Salish Sea Model to substantiate that this allocation can be met with specific reductions.

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[13] https://des.wa.gov/about/projects-initiatives/capitol-lake/long-term-planning-capitol-lake-deschutes-estuary
[14] https://des.wa.gov/sites/default/files/public/documents/About/CapitolLake/2016MeetingDocs/ProvisoReport-Phase1-2016-12-30.pdf?=93a64
[15] https://capitollakedeschutesestuaryeis.org/Media/Default/documents/20220316_CLDE_LPA_FAQs-FINAL.pdf
[16] https://capitollakedeschutesestuaryeis.org/
[17] https://www.epa.gov/sites/default/files/2015-10/documents/2006_08_08_tmdl_tmdl_clarification_letter.pdf

Point Sources of Pollution

All point sources that discharge directly to Budd Inlet or into the Budd Inlet watershed via the Deschutes River or a tributary are given wasteload allocations in this TMDL. Point source wasteload allocations will be largely self-implemented through the administration of the NPDES Program. However, the Southwest Regional Office Watershed Implementation Lead is tasked to working with permit managers to ensure that new TMDL-related requirements become permit conditions when permits are renewed. Point source allocations and additional permit language are found in Chapter 2.

Nonpoint Sources of Pollution

The Deschutes River, Percival Creek, and Budd Inlet Tributaries Multi-parameter Water Quality Improvement Report and Implementations Plan (Deschutes TMDL; Ecology, 2021) identified a number of actions to address DO impairments in these water bodies. Many of these actions and techniques will also reduce DO depletion in Budd Inlet. Of these actions, those that are relevant to DO in Budd Inlet are incorporated into this TMDL's implementation action tables (see Tables 35-41). The Deschutes TMDL also specifies critical areas for restoration, conservation, and other implementation actions. This TMDL includes and expands upon these areas - previously prioritized within the Deschutes River TMDL – in our assessment of prioritized areas for Budd Inlet. This expansion incorporates areas that drain directly to Budd Inlet (not via a river or tributary), and will lead to additional water quality benefits.

Riparian Buffers and Channel Function

Mature riparian buffers help to reduce nutrients by acting as a filter strip to increase infiltration, reducing erosion, and stabilizing streambanks. Although this TMDL focuses on reducing nitrogen and carbon loads, implementation efforts should be designed to be fully protective of other nutrient loads like phosphorous, which is included in the Deschutes TMDLs, and of overall water quality. Streambank stability is largely a function of near-stream vegetation. Specifically, channel morphology is often highly influenced by land-cover type and condition by affecting flood plain and instream roughness and influencing sedimentation, stream substrate compositions, and streambank stability. A mature riparian buffer also provides large woody debris that protects banks from enhanced erosion, which could improve fine sediment and phosphorus loads. Large woody debris also increases channel complexity, enhances hyporheic exchanges, and reduces transport of fine sediment. Increased channel complexity provides more zones where biogeochemical processes decrease nutrient transport downstream (Roberts et al., 2007).

Protective buffer widths can be found on Ecology's Riparian Buffer Width Map[18] and are summarized below.

[18] https://waecy.maps.arcgis.com/home/webmap/viewer.html?webmap=d5478a4aaf704d81bac63ffc934e1549

Riparian buffer guidance:

- For ephemeral streams, install a minimum 35-foot wide riparian buffer, measured horizontally from the top of the streambank. The buffer should include the reestablishment of streamside vegetation sufficient to filter out pollutants before they reach the stream, and to stabilize stream banks. The buffer width may be increased, if needed.
- For intermittent streams, install a minimum 35-foot wide riparian buffer, measured horizontally from the top of the streambank. The buffer should include the reestablishment of streamside vegetation sufficient to filter out pollutants before they reach the stream, and to stabilize stream banks. The buffer width may be increased, if needed.
- For perennial water courses classified as rivers or streams, install a minimum 100-foot wide (50-foot wide, if non-fish bearing) riparian buffer, measured horizontally from the top of the streambank. The main stem Deschutes River requires a 100-foot buffer.

Urbanization and Development

Urbanization and development also have the potential to worsen DO conditions in Budd Inlet. Urbanization may lead to higher nutrient levels in the watersheds by increasing impervious cover and runoff, changing land cover type and management practices, and increased onsite septic usage (Brett et al., 2005). Residential land cover produces much higher nutrient loads than do natural forest lands. Because the Deschutes River and tributaries already violate the water quality standards, and because development will continue, both new development and redevelopment must improve DO in surface waters to the maximum extent practicable. The acquisition of land, easements, and development rights may help limit development in sensitive areas. Low impact development (LID) should be instituted for future development in the watershed, with particular attention to decreasing nutrient contributions below current levels. Future development must not worsen DO. This TMDL's wasteload allocations for stormwater permittees will also help to control pollution from urbanization and development in the future, and these allocations will be revisited and revised as necessary during the permit renewal process.

Most septic systems are not designed to remove nutrients and even a properly functioning onsite septic system releases much higher nitrogen loads than a home connected to a sewage treatment plant (Thurston County Public Health and Social Services, 2020; EPA, 2002). Septic systems on non-porous soils create an increased risk for runoff into nearby surface water. Of particular concerns are course grained glacial deposits, like Vashon recessional outwash which exist throughout the Deschutes and Budd Inlet watersheds (Ecology, 2018).

Agriculture and Livestock

The majority of agricultural land uses occur along the middle of the main stem Deschutes River. This area has commercial and non-commercial agricultural operations, including dairy and other livestock, poultry, food and other crops, hay, and Christmas Tree plantations (Thurston County, Current Conditions Report).

To prevent water pollution problems from livestock, owners must prevent animal access to local water bodies and prevent manure from entering surface waters, including ditches, streams, and rivers.

Ecology staff are working with an advisory group to research and write the Voluntary Clean Water Guidance for Agriculture. The guidance is a technical resource for agricultural producers that describes Ecology's recommended BMPs to protect water quality. It is intended to support healthy farms while helping producers meet clean water standards. While this document is still in development, Ecology plans to finalize five chapters of this guidance by the end of 2022, including chapters on Tillage and Residue Management, Riparian Areas, Sediment Basins, Livestock Pasture and Rangeland Management BMPs, and Livestock Heavy Use Area and Waste Storage BMPs. The remaining chapters are scheduled to be finalized by the end of 2025.

Spreading and incorporating manure into agricultural fields is a common practice that supplies nutrients to croplands. However without proper management, including the rate, timing, and location of applications, this practice can adversely affect water quality. Manure should not be applied close to waterways, during or immediately prior to large rainstorms that could lead to runoff, or on flooded fields. The proper storage of manure is important to ensure it will be both useful as a beneficial nutrient and to prevent it from polluting local waters. Manure should be managed in well maintained, engineered lagoons or storage tanks the meet Natural Resource Conservation Service (NRCS) or equivilant construction standards. Waste storage facilities should have permanent roofs, curbed concrete floors, and gutters and downspouts to divert clean water away from stored waste. Waste storage facilities should be located in areas where diverted water will not impact surface waters by concentrating flow via steep slopes or creating preferential flow paths. Efforts to store any manure away from a watercourse or potential drainage path are critical for both large-scale industrial operations and non-industrial farm residences.

Heavy-use area protection stabilizes ground surfaces that are frequently and intensively used by people, animals, or vehicles. These methods provide a stable, non-eroding surface that prevents erosion and polluted run-off from reaching a watercourse. Heavy-use area protection is especially important to prevent pasture damage during winter months or to prevent mud and runoff around a watering location.

Exclusion fencing in combination with adequate vegetated buffers are needed wherever livestock can access surface waters. Where livestock have direct access to waterways water quality is adversely affected by direct inputs of manure, which increase bacteria and nutrient levels in the surface waters onsite and downstream. This includes non-commercial livestock, such as individual horses, chickens, or other small scale farming animals.

Exclusion fencing should be set back at a sufficient distance from stream banks, watercourses, and wetlands to establish a vegetated buffer. In cases where riparian vegetation is left unprotected from trampling and overgrazing by livestock, increases in water temperature, turbidity/suspended sediments, nutrients, and bacteria and decreases in DO and altered pH values are often observed (eg., Belsky et al., 1999). The damaged stream banks are subject to additional sloughing and bank failures, further degrading instream habitat and negatively impacting water qulity.

Businesses and Private Landowners/Homeowners

Local businesses are responsible for taking actions to prevent pollution their activities may generate. They in turn can be partners in increasing public awareness on local water quality issues in Budd Inlet and its tributaries. Examples of businesses include those with activities related to forestry or agriculture; automotive shops; golf courses; turf, berry, or tree farms; shopping centers; garden centers; or stockyards. Commercial forestry businesses are responsible for following the Forest Practices Rules[19] to protect public resources such as water, fish, and wildlife.

Landowners and homeowners are responsible for following best management practices when using and disposing of fertilizers, weed killers, pesticides, and other lawncare products. Many homeowners have the additional responsibility of managing their septic system. On a per capita basis, septic systems release much higher nitrogen loads than homes connected to sewage treatment plants. Thus, regularly inspecting and maintaining septic systems is an effective way of limiting their impact on the surrounding environment and water quality. Many municipalities also have sewer connection programs to connect septic systems to larger wastewater treatment infrastructure.

Lands Subject to Forest and Fish Rules

The state's forest practices rules are intended to bring waters into compliance with the load allocations established in this TMDL on private and state forest lands. This strategy, referred to as the Clean Water Act (CWA) Assurances, was established as a formal agreement to the 1999 Forests and Fish Report[20] and subsequent Habitat Conservation Plan (2006).[21]

The state's Forest Practices Rules were developed with the expectation that the stream buffers and harvest management prescriptions were to be stringent enough to meet state water quality standards for temperature and turbidity, and provide protection equal to what would be required under a TMDL. As part of the 1999 agreement, new Forest Practices Rules for roads were also established. These new road construction and maintenance standards are intended to provide better control of road-related sediments, provide better stream bank stability protection, and meet current best management practices.

To ensure the rules are as effective as necessary, a formal adaptive management program was established to assess the rules and recommend revision to the Forest Practices Rules, as needed. The agreement to rely on the Forest Practices Rules in lieu of developing separate TMDL load allocations or implementation requirements for forestry is conditioned on maintaining an effective adaptive management program.

Consistent with the directives of the 1999 Forests and Fish agreement, Ecology conducted a formal 10-year review of the forest practices and adaptive management programs in 2009.[22]

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[19] https://apps.leg.wa.gov/wac/default.aspx?cite=222
[20] www.dnr.wa.gov/Publications/fp_rules_forestsandfish.pdf
[21] https://www.dnr.wa.gov/programs-and-services/forest-practices/forest-practices-habitat-conservation-plan
[22] https://fortress.wa.gov/ecy/publications/SummaryPages/0910101.html

Ecology noted numerous areas where improvements were needed, but also recognized the state's forest practices program provides a substantial framework for bringing the Forest Practices Rules and associated activities into full compliance with water quality standards. Therefore, Ecology decided to conditionally extend the CWA Assurances with the intent to stimulate needed improvements. Ecology, in consultation with key stakeholders, established specific corrective milestones for program accomplishment and improvement. These corrective milestones were designed to provide Ecology and the public with confidence that forest practices in the state will be conducted in a manner that does not cause or contribute to a violation of state water quality standards.

In 2019 Ecology granted a two-year extension of the Assurances. This extension was provided to give time to address deficiencies in the rules for protecting non-fish-bearing headwater streams, as identified through research conducted by the adaptive management program. At the end of 2021 Ecology granted an addtional one-year extension to the Assurances (until December 31, 2022). Extension of the Clean Water Act Assurances beyond 2021 is in large part depedent upon Ecology determining that the program is on a clear path to making rule changes that will support cool, clean water in fishless headwater streams.

State Environmental Policy Act and Land Use Planning

TMDLs should be considered during State Environmental Policy Act (SEPA) and other local land use planning reviews. If the land use action under review is known to potentially impact temperature and DO as addressed by this TMDL, then the project may have a significant adverse environmental impact. SEPA lead agencies and reviewers are required to look at potentially significant environmental impacts and alternatives and to document that the necessary environmental analyses have been made. Land-use planners and project managers should consider findings and actions in this TMDL to help prevent new land uses from violating water quality standards. Additionally, the TMDL should be considered in the issuance of land use permits by local authorities.

Organizations that Implement TMDL

Federal, tribal, and state entities

U.S. Environmental Protection Agency

The United States Environmental Protection Agency (EPA) is responsible for the implementation of the federal Clean Water Act. A 1997 Memorandum of Agreement between EPA Region 10 and Ecology requires both agencies to jointly evaluate the implementation of TMDLs in Washington.

These evaluations address whether interim targets are being met, whether implementation measures such as BMPs have been put into effect, and whether NPDES permits are consistent with TMDL WLAs. The EPA approves TMDL Water Quality Improvement Reports (also referred to as water cleanup plans).

The EPA provides water quality related loan and grant funding opportunities to states and tribes to implement the Clean Water Act. For example, the EPA's Clean Water Act Section 319 grants, combined with Ecology's grant and loan funds, are made available to stakeholders through Ecology's annual Water Quality Grant and Loan Process.

Puget Sound is part of the National Estuary Program (NEP), a designation established by Congress in 1987 to protect estuaries of national significance that are threatened by degradation caused by human activities. Puget Sound was given priority status in the 1987 amendments to the Clean Water Act (CWA) and became one of the original programs of the NEP. This funding source can help local, state, and tribal governments implement applicable actions identified in an EPA-approved TMDL water cleanup plan. The EPA oversees NEP activities, including the efforts of state and tribal lead organizations administering grants.

Region 10 of the EPA oversees the Pacific Northwest, which consists of Alaska, Idaho, Oregon, Washington, and Native Tribes.

U.S. Army Corps of Engineers

With environmental sustainability as a guiding principle, the US Army Corps of Engineers (USACE) works to strengthen our Nation's security by building and maintaining America's infrastructure. They energize the economy by dredging America's waterways to support the movement of critical commodities and providing recreation opportunities at our campgrounds, lakes and marinas. With respect to Budd Inlet, the USACE will be involved with any recurring dredging operations required as a result of Capitol Lake dam removal. This would be a collaborative effort between Ecology, DES, the City of Olympia, the Port of Olympia, Swantown Marina, and other partners.

Squaxin Island Tribe

This TMDL boundary area lies within the "usual and accustomed" lands of the Squaxin Island Tribe (SIT), known as the "People of the Water". Tribal members historically resided in the seven inlets of southern Puget Sound. Now the tribal headquarters and trade center are located in Mason County, six miles south of Shelton, in Kamilche at Little Skookum Inlet. The SIT is responsible for co-managing fisheries within the Deschutes River system.

The SIT is a historic steward and a conscientious co-manager and protector of natural resources, working in cooperation with numerous federal, state, and county government agencies and organizations. The SIT participates in natural resources enhancement and protection programs with the Northwest Indian Fisheries Commission, the Puget Sound Partnership, the Washington Department of Fish and Wildlife, and other groups and agencies to ensure that today's decisions provide for a healthy future.

Washington State Department of Ecology

The Washington State Department of Ecology (Ecology) has the responsibility by delegated authority from EPA to establish water quality standards, develop TMDLs (commonly referred to as water quality improvement projects), and enforce water quality regulations. EPA delegated

authority to Ecology to implement many aspects of the federal Clean Water Act. These include the National Pollution Discharge Elimination System (NPDES) permitting and the TMDL program. Ecology also has state authority to regulate nonpoint sources of pollution and to issue state waste discharge permits to point sources not covered by the national NPDES permitting system. The Deschutes River watershed, located in Water Resources Inventory Area 13, is within the jurisdictional area of Ecology's Southwest Regional Office.

Ecology helps local governments, tribes, and conservation districts with funding for water quality projects through the Centennial Clean Water Fund, 319 Fund, and State Revolving Loan Fund. These funds are used to develop and implement stream restoration and water quality improvement projects.

Washington State Department of Agriculture

The Washington State Department of Agriculture (WSDA) serves the people of Washington by supporting the agricultural community and promoting consumer and environmental protection. The major goals of the WSDA are:

- Protect and reduce the risk to public health by ensuring the safety of the state's food supply.
- Ensure the safe and legal distribution, use, and disposal of pesticides and fertilizers in Washington.
- Protect Washington State's natural resources, agricultural industry, and the public from selected plant and animal pests and diseases.
- Facilitate the movement of Washington agricultural products in domestic and international markets.

The WSDA manages Washington's Dairy Nutrient Management program associated with licensed dairies, provides technical assistance and enforces the Dairy Nutrient Management Act. It also works with Ecology to manage and address agriculture related inspections and complaints associated with NPDES permits for concentrated animal feeding operations.

Washington State Department of Enterprise Services

The Washington State Department of Enterprise Services (DES), formerly known as General Administration, provides stewardship, oversight and planning of state facilities. The DES is responsible for maintaining the historic capitol in Olympia, including 435 acres of grounds, more than 50 buildings, four parks, and Capitol Lake.
DES is currently developing the Capitol Lake – Deschutes Estuary Long-Term Management Project Environmental Impact Statement[23] which will determine a preferred alternative for the long-term management of Capitol Lake.

[23] https://capitollakedeschutesestuaryeis.org/

Washington Department of Fish and Wildlife

WDFW is responsible for preserving, protecting, and perpetuating the state's fish and wildlife resources. Their legislative mandate includes protecting and enhancing fish and wildlife and their habitats and providing sustainable, fish-related and wildlife-related recreational and commercial opportunities. A key responsibility involves construction, land use, and environmental permits, including hydraulic project approval (HPA). Any construction activity or other work that uses, diverts, obstructs, or changes the natural flow or bed of state waters requires an HPA.

WDFW also operates fish hatcheries across the state, including the Tumwater Falls Fish Hatchery in the Deschutes River. Currently, WDFW is seeking another location for an additional hatchery in the Deschutes River.

Washington State Department of Health

The Washington State Department of Health (DOH) is responsible for protecting public health by promoting the safe treatment and disposal of domestic and other non-industrial wastewater in areas not served by municipal wastewater treatment. The DOH can provide assistance to local health jurisdictions for residential on-site wastewater issues on large on-site sewage (LOSS) plan reviews (Chapter 246.272B WAC). Chapter 246-272A WAC establishes minimum on-site requirements.

- Individual On-site Sewage System (OSS): Individual and small (up to 3,500 gallons/day) OSS are permitted and regulated by local health jurisdictions. For this watershed, the Thurston County Public Health and Social Services Department, Environmental Health Division, is responsible for oversight and implementation.
- Large On-Site Sewage System (LOSS): The DOH reviews and approves plans for LOSS designed to handle wastewater flows from 3,500 to 100,000 gallons/day and issues annual permits to all LOSS operators.
- Water Reclamation and Reuse: The DOH works with Ecology on public health aspects of permitted and proposed reclaimed water facilities. They directly work with those proposing minimum or zero discharge reuse and reclamation facilities and developments.
- Technical Support: The DOH provides technical assistance, guidance, and social marketing tools for local health jurisdictions to implement and build upon operation and maintenance programs for on-site sewage systems.

Washington State Department of Natural Resources

The Washington State Department of Natural Resources (DNR) is responsible for protecting Washington's natural heritage. Their conservation and restoration programs help to ensure the health of the state's landscapes for the benefit of the people, plants, and animals that live here. Active management and long-term stewardship are needed to maintain or restore ecological quality and function to native habitats, and to prevent forestlands and other native landscapes from conversion to other uses.

They gather information and find better ways to sustainably manage diverse forested state trust lands and natural areas in their care. Key areas they address include:

- Aquatic Land Habitat Conservation Plan (HCP)
- Aquatic Lands Management and Stewardship
- Climate Change
- Forest Health & Ecology
- Forest Research
- Natural Areas Program
- State Trust Lands Forest Management
- Trust Lands HCP
- Urban Forestry

Washington State Department of Transportation

The Washington State Department of Transportation (WSDOT) implements their National Pollutant Discharge Elimination System (NPDES), WSDOT Municipal Stormwater General Permit (WAR043000), and Stormwater Management Program Plan in all applicable Phase I and Phase II coverage areas. Implementation of the permit includes but is not limited to the following:

- Discharge inventory and mapping.
- Illicit Discharge Detection and Elimination (IDDE).
- Stormwater design per the WSDOT Highway Runoff Manual (HRM). (WSDOT revised the HRM in 2014 to maintain equivalency with Ecology's Stormwater Management Manual).
- Water quality monitoring (at selected sites statewide per the permit requirements).
- Stormwater BMP retrofit program.
- Highway maintenance program.

WSDOT actively participates in TMDL development and implementation in cases where WSDOT is assigned a WLA or action items in an EPA-approved TMDL.

Washington State Conservation Commission

The Washington State Conservation Commission is the coordinating state agency for all 45 conservation districts in Washington State.

Together, the Conservation Commission and conservation districts provide voluntary, incentive-based programs that empower people to practice conservation and ensure healthy natural resources and agriculture for all. Among other responsibilities, the Conservation Commission:

- Provides financial and operational support and oversight to our state's 45 conservation districts.

- Facilitates collaborative solutions that meet state natural resource priorities and work on the ground.

Puget Sound Partnership

The Puget Sound Partnership (PSP) is a state agency whose main focus is the recovery of Puget Sound. The PSP coordinates the efforts of citizens, governments, tribes, scientists, businesses and nonprofits to set priorities, implement a regional recovery plan, and ensure accountability for results. They have created a 2020 Action Agenda establishing science-based goals to achieve recovery and protection. The agenda addresses habitat protection, toxic contamination, pathogen and nutrient pollution, stormwater runoff, water supply, ecosystem biodiversity, species recovery, and capacity for action. It prioritizes cleanup and improvement projects, coordinates with federal, state, tribal, and private resources to ensure all work cooperatively.

The Alliance for a Healthy South Sound was established by the PSP Leadership Council as a local integrating organization to support coordinated and collaborative decision-making aimed at restoring and protecting the ecological and socio-economic health of South Puget Sound. It consists of local governments, tribes, non-profit organizations, watershed, marine resource, and salmon recovery groups, and citizens. They develop and coordinate the implementation of Action Agenda priorities.

Local Government Resources

Lacey, City of

The Community Development Department is responsible for the City's full range of community planning, land use development, environmental protection policies and construction code compliance. Their Public Works Department is responsible for designing, operating and maintaining the City's transportation, water, sewer and stormwater systems to protect critical water resources.

LOTT Clean Water Alliance

The LOTT Clean Water Alliance (LOTT) is a non-profit corporation responsible for wastewater management services for the urban area surrounded by Thurston County, Washington. Their mission is to preserve and protect public health and the environment by cleaning and restoring water resources for its communities. Its services include wastewater treatment, reclaimed water production, and long-range planning. "LOTT" stands for its four government partners – Lacey, Olympia, Tumwater, and Thurston County. Functioning as a local government, LOTT is governed by a Board of four elected officials appointed from its partner jurisdictions and operates under the authority of an intergovernmental agreement. Joint facilities include a large centralized treatment plant, a satellite treatment plant, three major pump stations, major sewer interceptor pipelines, and reclaimed water distribution pipelines.

Olympia, City of

The City of Olympia's Water Resources division is responsible for drinking water, storm and surface water, and wastewater. The Storm and Surface Water Utility maintains over 165 miles

of underground pipe, over 7,600 storm drains, over 190 flow control facilities (stormwater ponds, etc.), and over 140 treatment facilities (manufactured structures, wetponds, etc.) that carry stormwater runoff from roads and rooftops to local streams and Budd Inlet. Stormwater runoff from approximately 267 acres within the City of Olympia is conveyed to the LOTT Clean Water Alliance's Budd Inlet Treatment Plant. They work on many levels to protect water quality and prevent flooding. Most of Olympia drains to Budd Inlet.

Olympia, Port of

The Port of Olympia is a municipal corporation governed by three elected commissioners. The Port's mission is to create economic opportunities by connecting Thurston County to the world by air, land, and sea. The port manages operations for a breakbulk deepwater marine terminal, Swantown Marina and Boatworks, the Olympia Regional Airport, and a wide range of commercial and industrial properties throughout Thurston County. The Port's environmental programs include:

- Implementation of BMPs and ongoing improvement of their marine terminal stormwater management program.
- Incorporation of sustainable practices, such as recycling of materials and energy and water conservation in Port operations.
- Partnerships with tenants to improve environmental practices at the Port.
- Remediation of historic industrial contamination to benefit the environment, facilitate redevelopment and improve cargo efficiency.

Thurston Conservation District

The Thurston Conservation District (TCD) is a non-regulatory organization assisting land owners and managers in implementing conservation practices. The TCD educates landowners about water quality problems and steps they can take to help reduce pollutants reaching streams. They provide technical assistance, outreach, and education to Thurston County residents related to developing and implementing farm conservation plans. They also provide assistance for the design and installation of BMPs. Ecology normally refers farmers who have received a Notice of Correction to the TCD for assistance. The TCD assists with conservation planning and provides technical and cost-share assistance to landowners. They receive annual base operational funding from the Washington Conservation Commission.

Thurston County Government

Thurston County Public Health and Social Services (PHSS)

PHSS addresses gravel mines, health codes and regulations (for example, sewage disposal and nonpoint source pollution), land use review, septic systems, surface water, solid waste permitting and enforcement, and single family drinking water supplies. Surface water protection (also known as Resource Protection) activities include elements to protect and maintain the quality of the natural environment. Specific activities include sanitary surveys on marine and freshwater shorelines, ambient monitoring of streams and lakes, surface water quality data management and analysis, nonpoint pollution source identification, stormwater

sampling and investigations, septic system dye-tracing along shorelines, assessing the effectiveness of BMPs for pollution prevention, agriculture and solid waste complaint response, and education. PHSS has recently increased their capacity by adding full-time positions to address pollution identification and correction (PIC), and septic operations and maintenance.

Thurston County Community Planning and Economic Development
Community Planning and Economic Development includes two divisions: Community Planning and Development Services. The Department also works with WSU Thurston County Extension and the Thurston County Fair. They work together to protect Thurston County's natural and built environment, and to engage residents in programs that inspire them to enjoy and protect the County's natural resources.

- The Community Planning division develops policies and programs related to sustainable land use and development within unincorporated areas of the county. Key projects include critical area and prairie protections, shoreline master planning, watershed planning, and preservation of working lands. This division encompasses education and outreach programs, environmental monitoring, hydrogeological analyses, and overall stormwater program coordination.
- The Development Services division performs a wide array of activities to protect the health of streams, lakes, and Puget Sound, and are responsible for permitting and environmental review. Their work is guided by basin plans and watershed characterizations that take into account the unique characteristics and challenges in each watershed.

Thurston Public Utility District
The Thurston Public Utility District owns and operates water systems and connections for water systems owned by towns, private companies, and homeowner associations. They provide water planning and utility services to the citizens of Thurston County. They have three districts, with the Deschutes River watershed located in District 1.

Thurston Regional Planning Council
The Thurston Regional Planning Council (TRPC) is a regional council of governments in Thurston County. TRPC fosters the region's livability through collaborative, informed planning, carrying out regionally focused plans and studies on topics such as transportation, growth management, and environmental quality.

The Council is composed of decision-makers from 23 jurisdictions and organizations, holds monthly meetings, and hosts community forums to educate and promote public participation and dialogue.

Tumwater, City of
The City of Tumwater is a non-charter code city with a mayor-council form of government. The Mayor and seven Council members are elected by the registered voters of the City to staggered four-year terms. The City provides general government services authorized by state law,

including public safety, highways and streets, parks and recreation, planning and zoning, permits and inspections, general administration and water, sewer and stormwater services. The Community Development Department provides permitting services, plan review, inspections, code enforcement, and long-range comprehensive planning. The Public Works Department is comprised of two divisions: Engineering and Operations and Maintenance. The Engineering Division is responsible for the overall management of the capitol projects in the Capital Facilities Plan and the administrative aspects of the transportation and utility systems. Water Resources is also under this division, responsible for the implementation and management of water-related programs, such as the NPDES Phase II permit, utilities planning, water quality, water conservation, wellhead protection, and associated education and outreach functions. The Operations and Maintenance Division is responsible for the operation, maintenance, and repair of the transportation and utility infrastructure, and the maintenance and repair of city-owned vehicles and rolling stock. City parks and the Tumwater Valley Municipal Golf Course are maintained by the Parks Department.

Washington State University Thurston County Extension

The Washington State University (WSU) Thurston County Extension is an educational resource to Thurston County residents. They assist forest owners, shoreline residents, community members, and decision makers to gain easy access to information and resources related to natural resource management and ownership. Their Water Resources programs provide outreach and educational services. They develop research-based publications and educational workshops to offer practical guidance for protecting natural resources associated with streams, rivers, lakes, wetlands, estuaries, and marine waters, and the resources these water bodies provide. Topics of special interest include landscaping and water quality, rain gardens, Low Impact Development (LID), realtor education, septic systems, and shoreline living. Other activities include outreach at local public events, and developing and submitting newspaper articles and radio spots about water quality issues.

Nonprofit, Educational, and Volunteer Organizations

Black Hills Audubon Society

The Black Hills Audubon Society is a chapter of the National Audubon Society, representing Lewis, Mason, and Thurston counties. It is a volunteer-based, non-profit organization whose members share interests in birds and other wildlife, their habitats, and natural history. Their goals are to promote environmental education and recreation and to maintain and protect ecosystems for future generations.

Capitol Lake Improvement and Protection Association

The Capitol Lake Improvement and Protection Association is a 501(c) non-profit advocacy group. They represent the interests of local environmentalists, government activists, business owners, and community leaders. They provide an alternative platform for input for the public-at-large on the future management of Capitol Lake.

Capitol Land Trust

Capitol Land Trust is a non-profit organization that works to strategically conserve vital natural areas and working lands in the South Puget Sound and Chehalis Basin watersheds for their ecological and community benefits. They strive to maintain and improve the effectiveness, efficiency, and accountability of land conservation efforts; and they emphasize conservation and education as tools to build more sustainable communities.

Deschutes Estuary Restoration Team

The Deschutes Estuary Restoration Team is a 501(c) non-profit advocacy group. They represent the interests of the natural environment and a community that values wildlife, water quality, ecosystem services, economic opportunities, and natural beauty.

Stream Team

Stream Team is an education-to-action program for citizens interested in protecting and enhancing water resources in Thurston County watersheds. The program is cooperatively sponsored and funded by the storm and surface water utilities of the cities of Lacey, Olympia, and Tumwater and Thurston County. Stream Team began in 1990 as a way for local governments to involve citizens in the watershed planning process for a few local creeks. They have since found a niche in the South Sound for providing free, quality environmental education programs and activities and hands-on action projects. Stream Team volunteers perform a variety of actions for clean water, such as planting native trees, monitoring local streams, and marking storm drains with the important message: "No Dumping – Flows to Waterways." They provide information about car washing, Natural Yard Care, pet waste, vehicle care, and rain gardens. Stormwater runoff and management is a primary focus of many of these actions.

Local Businesses

Local businesses are responsible for taking actions to prevent pollution their activities may generate. They in turn can be partners in increasing public awareness on local water quality issues in the Deschutes River, Percival Creek, and Budd Inlet tributaries. Examples of businesses include those with activities related to forestry or agriculture; automotive shops; golf courses; turf, berry, or tree farms; shopping centers; garden centers; or stockyards. Commercial forestry businesses are responsible for following the Forest Practices Rules to protect public resources such as water, fish, and wildlife. Other businesses may require coverage under one of the NPDES permits or a state waste discharge permit for discharge of process water or stormwater to waters of the State.

Watershed Residents and Property Owners

Local residents and property owners play a critical role in improving the water quality of Budd Inlet and its tributaries. They implement actions to improve or protect the watershed. Examples include increasing or protecting the riparian vegetation along streambanks, appropriately managing pet and livestock waste, excluding livestock from surface waters, appropriately disposing of household hazardous waste and other toxic substances, properly maintaining and operating on-site septic systems, and restoring and protecting natural wetlands.

Priorities and Timeline

In order to restore water quality in Budd Inlet, efforts will need to happen concurrently. Due to the variety of ways that oxygen depletion occurs in Budd Inlet, a diverse group of stakeholders and project partners can focus work on different areas at the same time.

Capitol Lake

The priority action for the Budd Inlet TMDL is identifying and implementing a long-term management solution for Capitol Lake. To ensure this occurs the most important action is the successful completion of the EIS and implementation of a preferred alternative that meets water quality standards.

Ecology's goal is to pair the timeline of TMDL priorities for Capitol Lake with the timeline associated with the EIS. As such, to be in compliance with this TMDL, DES must determine a preferred alternative by the end of 2022. This is in accordance with the EIS schedule.

DES does not yet have a timeline associated with Phase 3 of their planning process. This TMDL determines the following milestones and timeline:

Table 32. Priority implementation actions for Long Term Management of Capitol Lake - Deschutes Estuary.

Action	Partners	Timeline
Complete the Capitol Lake - Deschutes Estuary Long-Term Management Project (CLDE) Environmental Impact Statement (EIS). Ensure preferred alternative is capable of meeting Budd Inlet TMDL allocation.	Department of Enterprise Services (lead). Members of the CLDE EIS advisory boards.	Complete by end of 2022.
Initiate Phase Three (Design and Permitting) of the preferred alternative. Include designs, modeling, and a monitoring plan to indicate how the lake will meet TMDL allocations.	Department of Enterprise Services (lead). Members of the CLDE EIS advisory boards.	Complete by 2026.
Implement long-term management strategy.	Department of Enterprise Services (lead). Members of the CLDE EIS advisory boards.	Complete by 2035.
Monitor impacts of the long-term strategy. Adaptively manage if TMDL allocation is not met.	Department of Enterprise Services (lead). Members of the CLDE EIS advisory boards.	2035 and onward.
Complete the implementation actions highlighted in the Deschutes River TMDL.	Various, as outlined in the TMDL.	2030

External Aggregate "Bubble" Load

The Puget Sound Nutrient Reduction Project will determine point source and nonpoint source reduction targets and ensure water quality standards are met throughout the entire Puget Sound. The following milestones are associated with the project:

Table 33. Priority implementation actions for the External Aggregate Load.

Action	Partners	Timeline
Complete a nutrient reduction schema at Budd Inlet's boundary with Puget Sound.	Ecology (lead) and partners	Complete by end of 2024.

This will include percent reductions at the marine open boundary using the Salish Sea Model. Demonstrate that open boundary reductions - when applied to the 1997 critical year conditions and using the GEMSS model - meet the bubble allocations established in this TMDL. This schema will be developed as part of the larger Puget Sound Nutrient Reduction Plan.		
Implement nutrient reductions in accordance with a timeline established in the Nutrient Reduction Plan.	Ecology (lead) and partners	Timelines will be established by the plan.
Reissue Puget Sound Nutrient General Permit with Water Quality Based Effluent Limits. The General Permit will be reissued with new effluent limits five years after its initial issuance.	Ecology (lead) and partners	2026

These milestones will show that the aggregate bubble allocations can be met. Further implementation planning will be necessary to ensure that reductions occur.

Nonpoint Sources

The following tables identify priority actions that need to occur in order to remedy nonpoint sources of pollution identified above. Where possible, general timelines and priority locations are identified. Properties that fall within 100 feet of surface water are considered a priority for implementation purposes. Parcels further from surface water are less likely to be significant contributors of nutrients. Ecology does not assume that all parcels close to surface water cause pollution; only watershed evaluation work can make this determination.

In addressing nonpoint pollution, Ecology first works with partners to identify pollution problems and follows up with landowners to offer options and funding to help them fix water pollution problems. We offer grants and loans to implement effective management practices that prevent pollution. If necessary, we provide a regulatory backstop to protect downstream users from the negative impacts of nonpoint source water pollution, in accordance with WAC 173-201-510.

Table 34. Priority implementation actions for riparian buffers and channel function.

Action	Partners	Timeline
Plant, enhance, and maintain native riparian vegetation, including both deciduous trees and shrubs and conifer trees, establishing forested stream-side vegetation corridors. Preserve existing riparian vegetation and restore degraded areas. Applies to the Deschutes River system-wide, including the area within the U.S. Forest Service (USFS), and other direct tributaries to Budd Inlet. This should be done with native plants, and in accordance with buffer guidance.	Various	Completed in priority areas by 2035, with all work completed by 2040.
Enhance channel complexity. Enhanced restoration includes large woody debris within the active river bed to promote bank stabilization and pool formation, and within riparian zones to provide self-armoring elements as banks are eroded.	Various	Completed in priority areas by 2035, with all work completed by 2040.
Restore and protect natural wetlands.	Various	Ongoing
Consider a water management strategy that recognizes the benefits of maintaining summer baseflows while meeting the community's need for water. This may be developed as a more detailed plan for restoring instream flows. There are other, more effective processes for establishing instream flows rather than TMDLs. A detailed groundwater model of the Budd Inlet watershed could help evaluate the effect of further groundwater withdrawals, as well as the effects of solutions such as water conservation, groundwater recharge, and low impact development.	Cities of Lacey, Olympia, Tumwater, Thurston County, Ecology	Ongoing
Maintain and enforce the current status of the Deschutes River watershed closed water withdrawal, eliminate illegal withdrawals, and quantify and mitigate the effect of exempt wells.	Cities of Lacey, Olympia, and Tumwater, Thurston County, Ecology	Ongoing

Action	Partners	Timeline
Future groundwater infiltration facilities for reclaimed water should quantify the potential increases in nutrient loads to the Deschutes River and tributaries and offset any inputs by reducing other local sources so that DO and pH do not worsen.	Various, LOTT, Ecology, Thurston Co.	As needed
Ensure that all timber harvests and other forestry-related work must comply with the state Forest Practices Rules. Applies to state and privately owned forest lands.	Various	Ongoing
Implement Memorandum of Agreement (MOA) between the USDA Forest Service, Region 6, and the WA State Department of Ecology in 2000. The intent of the MOA is meeting environmental responsibilities on federally owned forest lands under federal and state water quality laws. This applies to all National Forest System lands within the TMDL coverage area.	USFS and Ecology	Ongoing
Restore riparian areas and river channels in private non-commercial forests not managed by the U.S. Forest Service (USFS) or subject to the state Forest Practices Rules. Applies to the Deschutes River watershed system-wide, including the areas within the USFS boundary.	Various	Ongoing
Explore the re-institution of a Deschutes River and Budd Inlet Workgroup. This workgroup would meet periodically to strategize and catalyze cleanup actions on the Deschutes River and within the Budd Inlet watershed. It would provide a continuing focus on implementation of these TMDLs; (2) a regular forum to review progress; and (3) a forum to recommend adaptive management actions which would enhance the success of the TMDLs.	Department of Ecology Public and private partners	2023 and onward.

- **Priority areas to address for Budd Inlet:** East Bay Drive, West Bay Drive, and Deschutes Parkway; tributaries draining directly to Budd Inlet, with extra emphasis on Schneider Creek, Ellis Creek, Mission Creek, and Moxlie Creek.
- **Priority areas identified in the Deschutes TMDL**: Between RK 12 and 20; Henderson Blvd., Waldrick Rd., State Route 507, Old Camp Lane. Deschutes River between Rainier and Old Camp Lane, Thurston Creek at 3000 Rd.*, Johnson Creek at 3000 Rd.*, Huckleberry Creek at 3000 Rd.*, Mitchell Creek at 3000 Rd.*, Reichel Creek at Vail Loop

Rd., Spring near Cowlitz Dr., Tempo Lake outflow at Stedman Rd., Spurgeon Creek at Rich Rd., Ayer Creek off Sienna Court; Percival Creek; and Black Lake Ditch.

  - *These areas are subject to the Forest Practice Act rules for riparian buffer widths.

- **Priority wetlands areas identified in the Deschutes TMDL:** Ayer/Elwanger, Reichel, and Spurgeon Creeks.

Table 35. Priority implementation actions for septic systems.

Action	Partners	Timeline
Replace noncompliant septic systems, with an emphasis on areas that drain directly to Budd Inlet.	Thurston County PHSS	Complete by 2035
Expand septic system analyses to include all areas draining directly to Budd Inlet. Include septic parcel to neighborhood analysis, neighborhood density analysis, groundwater and surface water risk, and urban area septic system analysis.	Thurston County PHSS (lead)	Complete by 2025
Expand septic systems operation, inspection, and maintenance program, with an emphasis on areas that drain directly to Budd Inlet**.** This was a high-level priority actions item identified in the Deschutes Watershed Land Use Analysis: Scenario Development Report and received the support of all workgroup members. In addition, future efforts should examine and implement options to reduce nutrient loading from OSS systems. This includes conversion to sewer in urban areas and nitrogen reducing onsite systems in rural areas.	Thurston County PHSS (lead)	Ongoing, with priority areas complete by 2035.
Expand and enhance pollution identification and correction work.	Thurston County PHSS (lead)	Ongoing, with priority areas complete by 2035.
Increase septic to sewer conversions. Prioritize areas within 100 feet of surface water.	Thurston County PHSS (lead); Cities of Olympia, Tumwater,	Beginning in 2023 and onward

Action	Partners	Timeline
	and Lacey; LOTT Clean Water Alliance	
Identify and fix potential bacteria and nutrient pollutant sources such as cross-connected infrastructure, recreational users, and homeless populations.	Thurston County PHSS (lead); Cities of Olympia, Tumwater, and Lacey; LOTT Clean Water Alliance	Ongoing

- **Priority areas to address for Budd Inlet:** East Bay Drive, West Bay Drive and Deschutes Parkway, tributaries draining directly to Budd Inlet, with extra emphasis on Schneider Creek, Ellis Creek, Mission Creek, Moxlie Creek, Percival Creek, Black Lake, and Black Lake Ditch. Priority areas include all areas within 100 feet of surface waters.
- **Priority areas identified in the Deschutes TMDL:** the Deschutes River upstream of Offutt Lake, Chambers Lake and its outlet creek, Tempo Lake and its outlet creek, and the Ayer Creek watershed.

Table 36. Priority implementation actions for development and stormwater.

Action	Partners	Timeline
Use low-impact development techniques. Low-impact development should be instituted for future development in appropriate areas in the watershed, with particular attention to decreasing nutrient contributions below current levels. Future development should not worsen DO.	Cities of Lacey, Olympia, and Tumwater; Thurston County	Ongoing
Continue studies of watershed characterization. Evolving challenges (eg., nutrient and bacterial pollution from homeless encampments) will continue to affect water quality in Budd Inlet. Continued watershed characterization studies will inform the management of these evolving environmental issues and help to identify practical solutions.	Various, including Cities of Lacey, Olympia, and Tumwater; Thurston County	Ongoing
Include more lands and funding in the Transfer of Development Rights and Purchase of Development Rights programs. This was a mid-level priority actions item identified in the Deschutes Watershed Land Use Analysis: Scenario Development Report and received the support of all workgroup members.	Cities of Lacey, Olympia, and Tumwater; Thurston County	Ongoing
Seek opportunities to acquire land, easements, or development rights for conservation, preservation, and riparian and channel restoration efforts. Look to integrate land acquisition with current programs and sources of funding.	Cities of Lacey, Olympia, and Tumwater; Thurston County; Capitol Land Trust	Ongoing, as opportunities and funding allow
Comply with all requirements of the NPDES and State Waste Discharge General Permit for Stormwater Discharges Associated with Construction Activity.	Various	Ongoing
Use BMPs, as applicable, to manage stormwater outside of the Phase II Municipal Stormwater permit boundary. These BMPs are outlined in the 2019 Stormwater Management Manual for Western Washington.[24]	Various	Ongoing

[24] https://apps.ecology.wa.gov/publications/SummaryPages/1910021.html

Action	Partners	Timeline
Comply with all requirements of the NPDES and State Waste Discharge General Permit for Stormwater Discharges Associated with Industrial Activity. This is generally referred to as the Industrial Stormwater General Permit. The permit applies within the TMDL coverage area.	Existing and new ISGP Permittees	Ongoing
Where applicable, implement additional monitoring or source controls to prevent pollutants released into the watershed.	Various	Ongoing
Work with existing commercial businesses and landowners to identify pollution sources and BMPs needed to prevent discharge of TMDL pollutants of concern to the MS4. Continue to implement local source control plans for new development in the NPDES permit coverage area.	Various	Ongoing

Table 37. Priority implementation actions for agriculture and livestock.

Action	Partners	Timeline
Prevent soil and nutrient loss from cropland. Control soil erosion on property by using conservation based tillage practices, planting ground cover and stabilizing erosion-prone areas.	Private landowners. Thurston Conservation District. Washington Department of Agriculture, Washington Department of Ecology, Washington Conservation Commission Squaxin Island Tribe	Ongoing
Implement protective nutrient manage plans for agricultural and livestock operations. Plans should result in the reduction and elimination of offsite transport of nutrients through implementation of BMPs to properly manage heavy use areas and manure generated onsite.	Private landowners. Thurston Conservation District. Washington Department of Agriculture, Washington Department of Ecology, Washington Conservation Commission Squaxin Island Tribe	Ongoing
Set back confinement and feeding areas at least 100 feet from surface waters. Place animal confinement and feeding areas away from locations that will concentrate runoff or increase the potential for polluted runoff to reach surface water such as steep slopes, unstable or erodible soils, natural or constructed drainages, or topography that concentrates runoff. Keep away from areas that become flooded or saturated during the winter months. Stabilize confinement areas with compacted gravel or concrete to allow for manure collection and prevent erosion. Divert clean water from confinement areas	Private landowners. Thurston Conservation District. Washington Department of Agriculture, Washington Department of Ecology, Washington Conservation Commission Squaxin Island Tribe	Ongoing

Action	Partners	Timeline
through the use of gutters, berms, roofs, or other means of conveyance to prevent contact with manure. Implement other prescribed BMPs.		
Collect, store and use livestock manure in a manner preventing contamination of runoff and leaching to groundwater.	Private landowners. Thurston Conservation District. Washington Department of Agriculture, Washington Department of Ecology, Washington Conservation Commission	Ongoing
Collect manure from confinement areas and other areas where manure has accumulated, and store it in a covered waste storage facility. Set back waste storage facilities at least 100 feet from surface waters. Design waste storage facilities to provide adequate storage based on the volume of manure generated at the site. Cover the waste storage facility and install it on an impermeable surface. Divert clean water from waste storage facilities through the use of gutters, berms, roofs, or other means of conveyance to prevent contact with manure.	Private landowners. Thurston Conservation District. Washington Department of Agriculture, Washington Department of Ecology, Washington Conservation Commission Squaxin Island Tribe	Ongoing
Use manure in a manner preventing contaminating runoff and leaching to groundwater. Apply manure to fields consistent with the Nutrient Application BMPs.	Private landowners. Thurston Conservation District. Washington Department of Agriculture, Washington Department of Ecology, Washington Conservation Commission Squaxin Island Tribe	Ongoing

Action	Partners	Timeline
Exclude livestock from stream-side vegetation corridor and flooded or seasonally inundated areas during periods of saturation.	Private landowners. Thurston Conservation District. Washington Department of Agriculture, Washington Department of Ecology, Washington Conservation Commission Squaxin Island Tribe	Ongoing
Set back off-stream water facilities at least 100 feet from surface waters.	Private landowners. Thurston Conservation District. Washington Department of Agriculture, Washington Department of Ecology, Washington Conservation Commission Squaxin Island Tribe	Ongoing
Complete the Voluntary Clean Water Guidance for Agriculture. This guidance is a technical resource for agricultural producers that describes Ecology's recommended BMPs to protect water quality. It is intended to support healthy farms while helping producers meet clean water standards. Ecology is currently working on the first set of chapters in preparation for public comment, with the remaining chapters to be completed by 2025. We want to give agricultural producers a comprehensive set of BMPs for protecting water quality.	Department of Ecology, advisory group members, relevant stakeholders	Phase 1 completion by end of 2022; Phase 2 completion by 2025.

- **Priority areas identified in the Deschutes TMDL**: Old Camp Lane and Lake Lawrence tributary. Deschutes River between Rainier and Old Camp Lane.

Table 38. Priority implementation actions for homeowners and businesses.

Action	Partners	Timeline
Use "salmon safe certified" [25] program or equivalent to ensure environmental protection of urban water quality. Include assessment of management issues including irrigation efficiency, stormwater management, pesticide reduction, and stream and wetlands area management. (Inclusion of these resources does not represent endorsement by Ecology).	Private businesses, residences, and landowners	Ongoing
Apply lawn and garden chemicals sparingly and according to directions. Use best management practices when using and disposing of fertilizers, weed killers, and pesticides. For example, applications used on turf, berry, or Christmas tree farms.	Private businesses, residences, and landowners	Ongoing
Do not apply nutrients within stream-side vegetation corridors. Consider all nutrient sources when determining recommended application rates for crops. Base nutrient applications on soil testing by field. Apply nutrients at rates and times commensurate with crop-specific removal and growth patterns, and consistent with university recommendations or standard agricultural practices. To prevent surface or leaching losses, apply nutrients at times closest to plant uptake, and do not spread manure from late fall through winter. Additionally, do not apply nutrients and manure to saturated, frozen, or snow covered soils, in flood prone areas during seasons when flooding or inundation is likely, or prior to forecasted precipitation that will lead to nutrient loss from runoff or leaching.	Various	Ongoing

[25] www.salmonsafe.org/getcertified

Action	Partners	Timeline
Implement BMPs to prevent discharge of pollutants from facilities concentrating or boarding domestic animals, including cats, dogs, and horses.	Various	Ongoing

Table 39. Priority implementation actions for homeowners and businesses.

Action	Partners	Timeline
Implement Forests and Fish Law. This includes environmental protections to restore riparian habitat to support harvestable levels of salmon; meet requirements of the Endangered Species Act for aquatic species; meet requirements of the Clean Water Act for water quality; and ensure forest industry economic viability.	Private landowners, DNR, and Ecology	Ongoing
All timber harvests and other forestry-related work must comply with the state Forest Practices Rules. Applies to state and privately owned forest lands. Comply with Memorandum of Agreement (MOA) between the USDA Forest Service, Region 6, and the WA State Department of Ecology (2000). Applies to all National Forest System lands. Restore riparian areas and river channels in private non-commercial forests not managed by the U.S. Forest Service (USFS) or subject to the state forest practices rules. Applies to the Deschutes River watershed system-wide, including	Private landowners, DNR, and Ecology	Ongoing

the areas within the USFS boundary.		

- Priority areas identified in the Deschutes TMDL: Between river kilometers 12 and 20.

Technical Feasibility

Ecology's modeling indicates that the implementation of all recommended actions identified by this TMDL would enable Budd Inlet to meet water quality standards. To determine this, Ecology uses a mechanistic model to simulate water quality and hydrology in Budd Inlet. The Budd Inlet Model relies on GEMSS and simulates the physics, chemistry, and biology of Budd Inlet and Capitol Lake, and it was calibrated using decades of observed water quality, circulation, and other geophysical data. Collectively, these tailored characteristics of the Budd Inlet Model significantly increase its accuracy and applicability.

This TMDL calls for the successful completion of PSNSRP in order to meet the assigned bubble allocation – a goal that will require wider implementation of more advanced wastewater treatment technologies. Many of these technologies are already in use at LOTT's WWTP, enabling LOTT to treat their effluent to a demonstrably higher standard, as shown by water quality monitoring data.

This TMDL also calls for the implementation of the Deschutes River TMDLs and a long-term management solution for Capitol Lake. Across both of these efforts, coalitions have been built and the necessary management networks are in place to identify new and creative management solutions, and to implement those that have already been recommended.

The levels of reduction identified in this TMDL are large and may take years to complete. Some actions will be iterative and occur over time and require adaptive management. Meeting water quality standards in Budd Inlet is feasible as long as all partners continue implementation actions until they fully meet their allocation. The actions identified in this TMDL will result in significant improvements to DO in Budd Inlet. Improving oxygen levels in Budd Inlet will require a combination of actions from multiple partners throughout the Budd Inlet watershed and around Puget Sound.

Costs

Introduction

This chapter provides implementation cost estimates to achieve water quality goals outlined within this TMDL. This activity was completed to satisfy EPA's requirements for TMDL development and Section 319 grant funding guidelines. Cost estimates incorporated into this chapter represent the estimated costs to implement projects using funding from public sources, including State and Federal grant programs. If private stakeholders choose to implement water

quality BMPs without financial assistance from public funders, costs for self-implementation may be significantly lower. Cost estimates are based on current dollars in 2022 and are not adjusted for further inflation. The most significant action identified by Ecology with the highest impact on meeting water quality standards is the removal of the Capitol Lake Dam. Draft cost analyses conducted by DES estimate that this action will cost $179 – 336 million (DES, 2021). Ecology acknowledges that other Capitol Lake management solutions may exist that could allow Budd Inlet to reach water quality standards, but these have not yet been identified. DES estimates that other Capitol Lake Management scenarios that could meet water quality criteria could cost $249 – 607 million (DES, 2021).

Other costs associated with this plan include implementation actions related to riparian zone management, septic pollution, stormwater and development, and agriculture and livestock land uses. However, not all of these suites of implementation actions have corresponding cost estimates. Ecology only estimates costs within this plan for sectors that have adequate information to support and inform a reasonable estimate. Ecology makes no cost estimates for the possible expenses incurred by homeowners and private business who choose to adopt optional BMPs on private property. By sector, these estimated costs total $5.21 million for riparian zone management and restoration; $28.64 – 70.24 million to address water quality impairments from septic systems; and $2.82 - 10.97 million to address water quality impairments from stormwater sources. The total estimated cost needed to restore water quality in Budd Inlet is $223 - 388 million.

Achieving this investment goal will require collaboration and shared investment from multiple funding sources including, federal, state, and local governments, as well as investment from private landowners, private business, philanthropic organizations, taxpayers, and ratepayers. Future work to evaluate costs compared to water quality benefits may support project prioritization. Opportunities to strategically sequence projects, share resources, and coordinate across jurisdictions and organizations are critical to this plan, and are expected to generate major long-term cost efficiencies. If WQS are achieved before the full estimated investment is implemented, implementation strategies and cost estimates should be revisited and adaptively managed.

The following cost estimate assumptions were adopted while developing this chapter.

Cost estimate assumptions:

- **Current costs** – Cost estimates provided in this chapter are based on current costs in 2022. When using this resource for budget development, future costs and inflation should be considered.

- **Public grant funding** – These cost estimates reflect the cost to complete projects using public grant funding from federal and state sources. They also reflect the cost for a public or nonprofit organization to assist private landowners with project implementation. State fiscal years are

referenced in the document as SFY and federal fiscal years are referenced as FFY. If landowners choose to complete implementation on their own, cost estimates may be significantly lower.

- **Omissions** – Cost estimates provided in this document do not include total costs for program administration or project management, or education and outreach to private landowners. The full costs for engineering and design are also not included in all cost estimates. Final project costs may be higher depending on landowner willingness, site conditions, hydrogeology, and complexity of BMPs needed to address water quality concerns.

- **Adaptive management** – Implementation needs could change based on water quality and habitat conditions, and any relevant land use changes. If new water quality priorities emerge and more tributaries have water quality impairments, costs to achieve clean water in Budd Inlet may be higher. If WQS are achieved, certain tributaries may be de-prioritized, resulting in lower implementation costs.

The following table provides an overview of the estimated costs to implement water quality BMPs to eliminate DO-impairment in Budd Inlet. More detailed cost estimates and alternative cost scenarios are provided throughout this chapter.

Table 40. Estimated costs by implementation sector.

Implementation Sector	Description	Estimated Cost ($M)
Long-term Management of Capitol Lake	This cost includes the initial removal of Capitol Lake Dam, as well as estimated maintenance and dredging costs for the next 30 years.	$179 – $336
Riparian Actions	This cost assumes full riparian buffer implementation in all 312 acres of prioritized land within the Budd Inlet and Deschutes River watersheds.	$5.2
Septic Actions	This cost includes inspection, maintenance, and replacement for an estimated number of noncompliant septic systems in priority subwatersheds that drain directly to Budd Inlet.	$28.6 – $70.2
Stormwater Actions	This cost represents the average expense of retrofitting impervious surfaces with water quality treatment facilities.	$2.8 – $10.9
Total		**$216 – $422**

Long-term Management of Capitol Lake

The Department of Enterprise Services's draft Environmental Impact Statement includes comprehensive economic analyses for different Capitol Lake action alternatives. These analyses sought to determine the extent to which Capitol Lake action alternatives could result in changes

to the economic activity or economic value of the region. This assessment evaluated the longterm economic impacts and potential benefits related to four primary topics: downstream economic activity, downtown development, demand for and value of recreation, and demand for and value of ecosystem services.

To calculate the economic effects of Capitol Lake management alternatives, the analysis used the 2018 version of an economic model named IMPLAN.[26] The numeric results for costs and values represent planning-level estimates for the conceptual action alternatives based on the information and data available at this stage of the project and include some data that reflect pre-COVID conditions. COVID-induced disruptions of typical economic conditions and patterns inject a limited level of uncertainty into the economic conclusions of DES's analysis.

DES's draft EIS identifies three Capitol Lake management alternatives to the present system of lake management: the estuary alternative, the managed lake alternative, and the hybrid alternative. The estuary alternative would restore Capitol Lake to its former estuarine condition and requires the removal of Capitol Lake Dam. It is to-date the only option identified by Ecology's modeling that is capable of meeting WQS, and is thus the management alternative supported by Ecology.

It is also the management solution identified by DES as the 'likely preferred alternative' to the present system of Capitol Lake management. The managed lake alternative would keep the current configuration of Capitol Lake and develop and adopt an adaptive management plan to improve water quality in the continued presence of the Dam. The hybrid alternative is similar to the estuary alternative, but calls for the installation of a retaining wall dividing part of Capitol Lake's North Basin to preserve the aesthetic qualities of Capitol Lake's reflecting pool while also restoring the estuarine characteristics of the Capitol Lake system.

The draft EIS's cost estimates for these three management scenarios are presented below. DES's project management website[27] contains more information. This table summarizes cost estimates associated with the DES draft EIS. The Estuary scenario, shown in bold, is DES's 'likely preferred alternative' and Ecology's recommended management solution.

Table 41. Estimated Costs for Capitol Lake Management Scenarios.

Management Alternative	Estimated Construction Costs ($M)	Estimated Maintenance and Dredging Costs ($M)	Total 30-Year Costs ($M)
No Action	$0	$18	$18
Estuary	**$131 - $235**	**$48 - $101**	**$179 - $336**
Managed Lake	$89 - $160	$248 - $447	$337 - $607
Hybrid	$177 - $319	$72 - $144	$249 - $463

[26] https://implan.com/

[27] https://capitollakedeschutesestuaryeis.org/alternatives

In their draft EIS, DES points out that project goals would not be realized under the No Action Alternative, which would lead to increased flood risk, increased costs for addressing water quality issues, lack of water access for recreation, and ongoing equity and social justice issues. They also indicate that all alternatives would generate enhancements to trails, habitat areas, and restored water-based recreation that would increase the value of recreation in the basin. For ecosystem services, benefits to habitats, visual aesthetics, and cultural, heritage, spiritual, and educational values would be most pronounced for the Estuary and Hybrid Alternatives.

Under the Managed Lake and No Action Alternatives, in contrast, tribal values would continue to be adversely impacted by the loss of connection to the natural environment and anthropogenic harm to the balance and functions of the Budd Inlet ecosystem. These conclusions support Ecology's present recommendation: to restore Capitol Lake to an estuarine system.

Riparian Actions

Based on the average cost of riparian restoration per acre, the total estimated cost to achieve 100-foot buffers in prioritized areas of the Budd Inlet and Deschutes TMDLs is approximately $5,205,000 dollars.

Riparian restoration cost estimates by Ecology's Water Quality Combined Funding Program indicate that the average cost to complete riparian restoration is approximately $15,500 per acre, based on 33 previously funded grant agreements across the state from State Fiscal Years 2016 to 2019. Adjusting for inflation[28] yields a price of $16,700 per acre in 2022 dollars. Cost per acre varies based on specific site conditions and project scale. Costs range from approximately $3,500 dollars to $35,000 dollars, depending on extent of invasive species control, ease of access, plant stock quality, and if maintenance is included in the budget. Typically, larger scale projects have a lower cost per acre. If 2,000 trees are planted on each acre, approximately 624,000 trees could be planted in 312 acres of prioritized riparian areas. These cost estimates represent the costs to implement riparian restoration projects using public funding. They do not include the cost of any necessary land acquisition, nor subsequent costs associated with necessary maintenance. If landowners choose to implement riparian restoration efforts on their own, costs may be significant lower depending on the costs of trees, site preparation, and any contracted labor.

Priority areas to address for Budd Inlet: East Bay Drive, West Bay Drive and Deschutes Parkway, tributaries draining directly to Budd Inlet, with extra emphasis on Schneider Creek, Ellis Creek, Mission Creek, and Moxlie Creek.

Priority areas identified in the Deschutes TMDL: Between RK 12 and 20; Henderson Blvd., Waldrick Rd., State Route 507, Old Camp Lane. Deschutes River between Rainier and Old Camp Lane, Thurston Creek at 3000 Rd.*, Johnson Creek at 3000 Rd.*, Huckleberry Creek at 3000 Rd.*, Mitchell Creek at 3000 Rd.*, Reichel Creek at Vail Loop Rd., Spring near Cowlitz Dr., Tempo Lake outflow at Stedman Rd., Spurgeon Creek at Rich Rd., Ayer Creek off Sienna Court; Percival Creek; and Black Lake Ditch.

[28] https://www.bls.gov/data/inflation_calculator.htm. Other inflation adjustments also rely on this resource.

*These areas are subject to the Forest Practice Act rules for riparian buffer widths.

Septic Actions

Ecology estimates that the total cost needed to address noncompliant septic systems in prioritized subwatersheds falls between $28.6 – $70.2 million. There are 5,205 septic systems located in priority subwatersheds that drain directly to Budd Inlet. Assuming a 25% rate of noncompliance, we estimate the number of noncompliant systems to be approximately 1,300.

Thurston County estimates that annual maintenance costs fall between $200 and $500 per system (J. Mountjoy-Venning, personal communication, Feb. 7, 2022). Our estimate is based on the midpoint of this range. Inspection costs are assumed to be $160 per system, and inspections are assumed to take place every 3 years. Septic system replacement costs vary widely, with estimated ranges of $18,000 - $50,000 per system (J. Mountjoy-Venning, personal communication, Aug. 18, 2022) and $35,000 - >$50,000 per system (City of Olympia; see Appendix B) provided by Ecology's partners. The cost estimate assumes a 10-year planning window.

Table 42. Summary of cost estimates for septic system BMPs.

Implementation Activity	Description	Total Cost Estimate in 2022
Septic Systems	Estimated cost to address approximately 1300 noncompliant septic systems within priority subwatersheds that drain directly to Budd Inlet.	
Septic system inspection	Inspections on 1300 priority septic systems at a cost of $160 per system every three years, extended for 10 years.	$693,000
Septic system maintenance	Maintenance on 1300 priority septic systems at an average cost of $350 per year, extended for 10 years.	$4,550,000
Septic system replacements	Replacing 1300 priority septic systems at an estimated cost ranging between $18,000 and $50,000 per system.	$23,400,000 – 65,000,000
Septic system total	The total cost of inspecting, maintaining, and replacing priority septic systems.	$28,643,000 - 70,243,000

Stormwater Actions

Ecology estimates that the total cost needed to retrofit impervious surfaces in prioritized areas of this TMDL is between $2,817,200 and $10,971,800. According to the Puget Sound

Stormwater Retrofit Report Cost Estimate Appendix A[29], the average cost to retrofit impervious surfaces with water quality treatment facilities is $20,000 to $78,000 per acre. Adjusting for inflation since this study's publishing, these values increase to $25,600 to $99,700. This estimate is for water quality facilities that remove 80 percent of total suspended solids and does not consider the cost to remove other pollutants carried in stormwater, or the cost to acquire land to construct stormwater facilities.

This number also does not include costs for flow control. Depending on the water quality impairments, different suites of stormwater BMPs may be necessary, and costs can be much higher.

Ecology applied this per-acre estimate to the landcover database of prioritized areas in the Budd Inlet and Deschutes River watersheds. These prioritized areas contain 28 acres of high-density developed land with an average impervious coverage of 90%, 65.6 acres of medium-density developed land that averages to be 65% impervious, and 120.5 acres of low-density developed land that averages to be 35% impervious. These landcover descriptions can be found in Table 34.

The Puget Sound Stormwater Retrofit Report Cost Estimate Appendix A estimated that annual maintenance costs $300 to $3,200 dollars per acre. The estimated annual maintenance cost to maintain the impervious acreage within prioritized areas of this TMDL ranges from $33,000 to $352,000, depending on maintenance frequency and the total acres maintained, though this cost estimate focusing on implementation rather than subsequent maintenance costs.

Funding Opportunities

Funding is available from several agencies mentioned in this document. The most common funding sources used in our area are discussed below. There are many other funding sources, especially for projects that benefit both water quality and salmon. EPA's Funding Resources for Watershed Protection and Restoration[30] website provides additional funding source information including The Water Financial Clearing House[31], a searchable database of financial assistance sources (grants, loans, and cost-sharing) available to fund a variety of watershed protection projects. The following is a partial list of funding opportunities that are popular in western Washington.

U.S. Environmental Protection Agency

National Estuary Program

EPA's National Estuary Program (NEP) was established by Congress in 1987 to improve the quality of estuaries of national importance. In the Puget Sound and surrounding watersheds, this includes protection of fish, shellfish, wildlife, and recreational activities and requires the control of point and nonpoint sources of pollution. Using a collaborative, consensus-building approach, the Management Conference (a collective of governments, organizations, businesses

[29] citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.443.5944&rep=rep1&type=pdf
[30] https://www.epa.gov/nps/funding-resources-watershed-protection-and-restoration
[31] https://ofmpub.epa.gov/apex/wfc/f?p=165:1

and individuals convened by the Puget Sound Partnership) engages in developing and implementing the Puget Sound Action Agenda. The EPA provides funding to Washington state agencies as Strategic Initiative Leads and to the Northwest Indian Fisheries Commission to implement the Puget Sound Action Agenda. Interested parties should reference the Puget Sound Partnership's NEP Solicitation and Grants[32] web page for specific information on how to apply for these funds.

Environmental Education Grants

Education institutions; state, local, and tribal environmental and educational public agencies; and nonprofit organizations described as 501(c)(3) of the Internal Revenue Code are eligible for this funding, which supports environmental education projects that promote environmental awareness and stewardship. These grants require non-federal matching funds for at least 25% of the total cost of the project. For more information visit EPA's Environmental Education[33] web page.

Washington State Department of Ecology

Water Quality Combined Financial Assistance Program

Ecology's Water Quality Program administers four main funding programs under an integrated annual funding cycle. Ecology awards grants and loans on a competitive basis to eligible public entities for high priority water quality projects throughout Washington State. Applicants use one integrated financial assistance application to apply for funds from the four funding sources simultaneously. Ecology typically kicks off its annual cycle in August with applicant training workshops.

- Centennial Clean Water Program: Centennial is a state funded program created by the Washington State Legislature in the mid-1980s. Under this program, grants are available to public entities for wastewater infrastructure (limited to hardship communities) and nonpoint source pollution control projects including but not limited to: on-the-ground restoration, agricultural BMPs, off-stream watering provisions, onsite septic repair and replacement, stormwater activities, and drinking water source protection.
- Clean Water Act Section 319 Nonpoint Source Grant Program (Section 319): The United States Congress established Section 319 as part of the Clean Water Act amendments of 1987 to address nonpoint sources of water pollution. Under this program, grants are available to public entities for projects including but not limited to: on-the-ground restoration, watershed planning, technical assistance, BMP implementation, off-stream watering provisions, water quality monitoring, and education and outreach.
- Clean Water State Revolving Fund (CWSRF): The United States Congress established the CWSRF as part of the Clean Water Act Amendments of 1987. Under this program, low-interest loans are available to public entities for projects including but not limited to: facilities, nonpoint source planning and implementation, local stormwater regulation

[32] https://www.psp.wa.gov/NEP-solicitation-and-grants.php
[33] https://www.epa.gov/education

review, low impact development planning and implementation, and education and outreach. Low interest loans have also been used as "pass through" to homeowners for projects such as onsite septic repair and replacement or agricultural BMP implementation. Loans may be used for a wider range of improvements on private property.

- Stormwater Financial Assistance Program (SFAP): The SFAP is designed to fund stormwater projects and activities that have been proven effective at reducing impacts from existing infrastructure and development and enhance existing stormwater programs. Grants are available to counties, cities, towns and port districts for retrofit projects including but not limited to: stormwater treatment facilities, detention facilities, infiltration systems, low impact development planning and BMP implementation, and a limited suite of stormwater activities.

Refer to Ecology's Find A Grant[34] or Loan web page and/or the Water Quality Combined Funding Program[35] web page for more information.

Coastal Protection Fund

Since July 1998, water quality penalties issued under Chapter 90.48 RCW have been deposited into a sub-account of the Coastal Protection Fund known as Terry Husseman Account. A portion of this fund is made available to regional Ecology offices to support on-the-ground environmental restoration and enhancement projects. Local governments, tribes, and state agencies must propose projects through Ecology staff. Visit the Coastal Protection Fund - Terry Husseman Account Grants[36] web page for more information.

Floodplains-By-Design

Ecology's Floodplain Management Program administers the Floodplains by Design grant program under a biennial funding cycle. Ecology awards grants on a competitive basis to eligible entities (e.g., local governments, tribes, diking and drainage districts, port districts, nonprofit agencies) for collaborative and innovative projects throughout Washington State that support the integration of flood hazard reduction with ecological preservation and restoration. Proposed projects may also address other community needs, such as preservation of agriculture, improvements in water quality, or increased recreational opportunities provided they are part of a larger strategy to restore ecological functions and reduce flood hazards. Visit the Floodplains by Design[37] web page for more information.

[34] https://ecology.wa.gov/About-us/How-we-operate/Grants-loans/Find-a-grant-or-loan
[35] https://ecology.wa.gov/About-us/How-we-operate/Grants-loans/Find-a-grant-or-loan/Water-Quality-Combined-Funding-Program
[36] https://ecology.wa.gov/About-us/How-we-operate/Grants-loans/Find-a-grant-or-loan/Coastal-protection-fund
[37] https://ecology.wa.gov/Water-Shorelines/Shoreline-coastal-management/Hazards/Floods-floodplain-planning/Floodplains-by-Design

Streamflow Restoration Implementation Grants

The 2018 Streamflow Restoration Act (ESSB 6091) provides for actions in watersheds to offset potential impacts to instream flows associated with permit exempt domestic water use and achieve net ecological benefit. The purpose of this Streamflow Restoration Grant program is to provide funding for those actions ("projects").

Ecology's Water Resources Program administers the Streamflow Restoration Grants program and awards grants on a competitive basis for projects throughout the state that improve streamflows and instream resources, as directed under the new law. Visit the Streamflow Restoration[38] web page for more information.

Washington State Recreation and Conservation Office and Washington Department of Fish and Wildlife

Aquatic Lands Enhancement (ALEA) Program

The Aquatic Lands Enhancement Account (ALEA) Grant Program provides grant-in-aid support for the purchase, improvement, or protection of aquatic lands for public purposes, and for providing and improving access to such lands. It is guided by concepts originally developed by DNR, including re-establishment of naturally self-sustaining ecological functions related to aquatic lands, providing or restoring public access to the water, and increasing public awareness of aquatic lands as a finite natural resource and irreplaceable public heritage. Local and state governments, as well as Native American Tribes, are eligible to apply if legally authorized to acquire and develop public open space, habitat, or recreation facilities. Federal agencies, nonprofit organizations, and private entities are not eligible, but are encouraged to seek a partnership with an eligible entity in order to pursue the public benefits the ALEA Grant Program supports. ALEA Grant Program funds may be used for the purchase, restoration, or improvement of aquatic lands for public purposes, and for providing and improving public access to aquatic lands and associated waters. All projects must be consistent with the local shoreline master program and must be located on lands adjoining a waterbody that meets the definition of "navigable." Projects intended primarily to protect or restore salmonid habitat must be consistent with the appropriate lead entity strategy or regional salmon recovery plan. Recipients must provide at least 50% match. For more information, view the WDFW's Aquatic Lands Enhancement Account Volunteer Cooperative Grant Program[39] and/or RCO's Aquatic Lands Enhancement Account[40] web pages.

Salmon Recovery Funding Board

This board was created in 1999 by the State Legislature to provide salmon recovery grants that protect existing high quality salmon habitat, restore degraded habitat, and assess the feasibility of future projects and other salmon-related activities. Part of the funding comes from the state

[38] https://ecology.wa.gov/Water-Shorelines/Water-supply/Streamflow-restoration

[39] https://wdfw.wa.gov/species-habitats/habitat-recovery/alea

[40] https://rco.wa.gov/grant/aquatic-lands-enhancement-account/

Puget Sound Acquisition and Restoration Fund, which supports projects in Puget Sound watersheds. Local and state governments, Native American Tribes, as well as special purpose districts, private landowners, nonprofit organizations and regional fisheries enhancement groups are all eligible to apply. View RCO's Salmon Recovery and Puget Sound Acquisition and Restoration[41] web page for more information. Visit RCO's grant programs[42] web page to learn about additional grant opportunities (including the two mentioned above).

US Department of Agriculture

Conservation Reserve Enhancement Program (CREP)

The Conservation Reserve Enhancement Program is a voluntary program designed to benefit both farms and fish. It is a partnership between the State and Federal governments that was created to restore and protect critical fish habitat. The program compensates farmers for growing riparian buffers in stream-side areas of their property. It is a great way to help landowners implement conservation practices on their property while also offsetting the burden of property taxes through land rental payments. In addition to providing habitat, the buffers improve water quality and increase stream stability.

Land enrolled in CREP is removed from production and grazing under 10-15 year contracts. In return, landowners receive annual rental, incentive, maintenance, and cost share payments. CREP is administered by Thurston Conservation District in cooperation with the USDA Farm Service Agency.

Conservation Reserve Program (CRP)

The CRP is a voluntary program that offers annual rental payments, incentive payments for certain activities, and cost-share assistance to establish approved cover on eligible cropland. Administered by the Thurston Conservation District, assistance is available in an amount equal to not more than 50% of the participant's costs in establishing approved practices; contract duration is between 10-15 years.

Environmental Quality Incentives Program (EQIP)

This federally funded program is managed by the Natural Resources Conservation Service (NRCS). The EQIP program provides technical assistance, cost share payments and incentive payments to assist crop and livestock producers with environmental and conservation improvements on the farm.

Wetland Reserve Enhancement Partnership

Wetland Reserve Enhancement Partnership is a voluntary NRCS easement program, which is part of the Agricultural Conservation Easement Program, a Farm Bill Conservation Program. State agencies, county and local governments, non-governmental organizations and American Indian Tribes collaborate with NRCS through partnership agreements. These partners work

[41] https://rco.wa.gov/grant/salmon-recovery/
[42] https://rco.wa.gov/recreation-and-conservation-office-grants/find-a-grant/

directly with tribal and private landowners, who voluntarily enroll eligible land through the purchase of an NRCS Wetland Reserve Easement in order to protect, restore and enhance wetlands. With this funding, easements enable landowners to adopt conservation practices that improve wetland functions and conditions. Eligible lands (e.g. farmed or converted wetland habitat that can be restored), may be enrolled under permanent easements, 30-year easements, or 30-year contracts (for acreage owned by tribal landowners). Partners are required to contribute a financial or technical assistance match of at least 10 percent. Proposals that provide match greater than 10 percent receive higher consideration in the selection process.

There is no single source of funding that will solve the problem of low DO in Budd Inlet. Ecology TMDL and nonpoint staff will work with stakeholders to develop strategies for funding water quality improvement projects and prepare appropriate scopes of work that will help implement this implementation plan. Funding agencies should be evaluating the effectiveness of existing programs to meet the needs of this and other TMDLs and modifying their programs to ensure continued riparian improvements leading to the completion of TMDL goals.

This TMDL recommends creating funding opportunities to build and maintain incentive programs essential towards encouraging landowners to install BMPs on their property (e.g. riparian buffers, irrigation efficiencies, etc). In addition, this TMDL encourages the creation of incentive programs, not just for landowners, but also for developers in order to promote stormwater BMPs, LID and irrigation efficiency systems.

Outreach

Public Involvement in TMDL Development

Ecology convened an advisory group for the Deschutes River TMDL from 2009 to 2018. Key stakeholders invested considerable time and effort into the development of both the Deschutes and Budd Inlet TMDLs. Meeting attendees were encouraged to participate by providing information specific to their represented organizations, discussions and suggestions for meeting topics or additional technical work, or examples of activities or actions included in this report. Ecology appreciates the commitment, dedication, and input provided by this group. The advisory group later changed to the Deschutes Watershed Council, coordinated by Thurston Conservation District, in an attempt to focus more broadly on implementation actions while also keeping the public up to date on Budd Inlet TMDL development.

Since 2018 Ecology has been working to complete the Budd Inlet TMDL while maintaining consultation with a selection of stakeholders to hear feedback, answer questions, and discuss implementation actions. Ecology held public meetings to share contents of the draft TMDL in 2022 (see Appendix B). Ecology held a public comment period from June 8 to July 25, 2022. All public comments and Ecology's response to comments are included in Appendix B.

Targeted Outreach to Enhance Implementation

Outreach and education efforts will be crucial to ensure implementation actions occur and water quality standards are met in Budd Inlet. These efforts help raise general awareness, create stewardship opportunities, and effect behavior change to improve water quality.

It is important to educate residents and visitors in the Budd Inlet watershed, on how their individual and collective actions can help improve water quality. Targeted education and outreach efforts are needed to promote voluntary implementation of water quality BMPs.

Outreach and educations should focus on the following objectives:

1) **Enhance Awareness**
    - Provide education of water quality problems and causes to community members and landowners.
    - Demonstrate how BMPs address water quality problems.
    - Disseminate information on financial assistance programs through Ecology, TCD, and other sources.
2) **Shift Attitudes**
    - Build trust with communities, residents, and agricultural producers.
    - Acknowledge water quality impacts caused by land use and development.
    - Recognize individual responsibility to protect water quality.
    - Spread knowledge of BMPs that protect water quality, and their application(s).
    - Recognize that BMPs for water quality protection can support sustainable land use and development.
3) **Promote Behavior Change**
    - Provide technical assistance and planning and implementation support to communities and individual landowners.
    - Utilize available funding to assist in planning and implementation efforts.

Outreach and education should be targeted towards landowners with properties adjacent to surface waters, with an emphasis on any areas identified as a priority in this TMDL or other watershed plans addressing nutrients.

Some outreach techniques include:

- Social and mass media messaging.
- New and existing public events and educational opportunities.
- Public displays and signage.

- Partnerships with local schools, nonprofits, and other community groups.
- Neighborhood social events and project tours.

Tracking Progress

Ecology will build off outreach work done in completion of the Deschutes River TMDL, leveraging these partnerships and reconvening meetings of a stakeholder advisory committee to review and track water quality and implementation actions completed. This stakeholder coordination will begin in 2023 and continue as needed until the water quality goals for this project are reached by 2040. The purpose of these recurring meetings is to share information on water quality conditions in Budd Inlet and its tributaries.
Key discussion items will include the status of implementation actions, water quality data, regulatory changes, new and innovative ideas, and potential funding sources. Ecology will work cooperatively with stakeholders to help direct or redirect the adaptive management of this water cleanup plan.

Ecology will continue to offer grant funding through its annual grant and loan application process for water quality studies, stream restoration projects, BMP implementation, and for the development, continuation, and implementation of monitoring programs. To comply with this TMDL, all BMPs must be in place to address DO, pH, fine sediments, and temperature by the end of 2040, with prioritized areas addressed by 2035. The success of this TMDL project will be assessed using monitoring data from Budd Inlet, and Table 45 identifies measurable milestones to track TMDL implementation.

Table 43. Interim measurable milestones for tracking implementation.

Action	Target	Comments
The CLDE long-term management project must continue as scheduled.	The Capitol Lake EIS is scheduled to be completed by DES in October 2022; the design and permitting of the identified management solution is scheduled to begin by 2026; and the implementation of the management solution is scheduled to be complete by 2035.	The long-term management of Capitol Lake is the single most impactful implementation action recommended within this TMDL. Leading stakeholders: DES
The Puget Sound Nutrient Source Reduction Project will address the Budd Inlet bubble allocation.	This plan is scheduled to be completed by 2024.	The assigned reduction targets will allow the Budd Inlet bubble allocation to be met; and the Budd Inlet TMDL will limit the exchange of nutrients into the Sound.

Action	Target	Comments
		Leading stakeholders: Ecology
Increase septic conversions from the current average rate.	Thurston County should prioritize county resources to increase septic conversion rates.	An emphasis will be placed on septic conversions in prioritized areas that drain directly to Budd Inlet. Leading stakeholders: Thurston County PHSS
Expand septic system analysis to include all areas draining directly to Budd Inlet.	This expanded analysis should be completed by 2025.	This analysis will give Ecology and partners a clearer and more complete understanding of septic pollution within the watershed. Leading stakeholders: Thurston County PHSS
Increase riparian buffer implementation, with an emphasis on prioritized areas.	Riparian buffer implementation should continue in prioritized areas, with targets of 50% (78 acres) by 2030, 75% (156 acres) by 2033, and 100% by 2035.	There are 312 acres identified as priority riparian restoration areas in this TMDL. Leading stakeholders: Ecology, Thurston County, Thurston CD
DO monitoring in Budd Inlet shall continue, with the intent to measure progress toward DO goals	The frequency of noncompliance-days must be reduced 25% by 2030, 50% by 2035, and 100% by 2040.	DO monitoring is the most direct way that Ecology can measure progress toward TMDL goals. Leading stakeholders: Ecology
An effectiveness monitoring plan will be designed by Ecology and project partners to maximize the effectiveness of TMDL implementation and inform adaptive management strategies	Partner outreach informing the design of this plan will begin upon the approval of this TMDL.	The effectiveness monitoring plan will be used to determine progress toward achieving TMDL goals, and to provide a flexible framework for to accommodate future adaptive management. Leading stakeholders: Ecology

A monitoring program for evaluating progress is an important component of any implementation plan. Monitoring is needed to keep track of what activities have been done, measure the success or failure of actions, and evaluate if water quality standards are achieved. Monitoring should continue after attaining the water quality standards to ensure implementation measures are effective, remain in place, and the water bodies continue to meet the water quality standards. Monitoring is required midway through the implementation process to see if interim goals are being met.

In addition to existing monitoring programs, Ecology will examine the need for supplemental interim monitoring as implementation actions are completed. Ecology will monitor the progress of implementation through planned meetings with stakeholders. Ecology will use information gathered through monitoring to keep Budd Inlet on track to meet DO standards by 2040. Ecology and other partners who conduct monitoring (e.g., permittees, WADOT, etc). will share data and monitoring results frequently and openly to ensure that progress is achieved.

Adaptive Management

Natural systems are complex and dynamic. The way a system will respond to human management activities is often unknown and can only be described in probabilities. Ecology recognizes that models are inherent simplifications of these complex processes and, as such, are unlikely to exactly reproduce how waterbodies will respond to the application of various management strategies. Therefore, TMDLs have a varying level of uncertainty depending on factors, such as data availability, model resolution, and how well the natural processes are understood. Adaptive management involves testing, monitoring, evaluating applied strategies, and incorporating new knowledge into management approaches that are based on scientific findings.

In the case of TMDLs, Ecology uses adaptive management to assess whether the actions identified as necessary to solve the pollution problems are correct, and whether they are working. Ecology recognizes that the relationship between management strategies, implementation actions, and pollution load reductions cannot always be precisely quantified, increasing the importance of specific interim objectives and ongoing environmental monitoring. As we implement these actions, the system will respond and change. Adaptive management allows us to fine-tune our actions to make them more effective, to track environmental change, and to try new strategies if we have evidence that a new approach could help us to achieve compliance.

TMDL reductions should be achieved by 2040. Partners will work together to monitor progress towards these goals, evaluate successes, obstacles, and changing needs, and make adjustments to the implementation strategy as needed. Ecology will use adaptive management when water monitoring data show that the TMDL targets are not being met or implementation activities are not producing the desired result. If water quality standards are achieved, but wasteload and load allocations are not, the TMDL will be considered satisfied.

Ecology will use adaptive management when water monitoring data show that the TMDL targets are not being met or implementation activities are not producing the desired result. A feedback loop (Figure 9) consisting of the following steps will be implemented:

Step 1. The activities in the water quality implementation plan are put into practice.

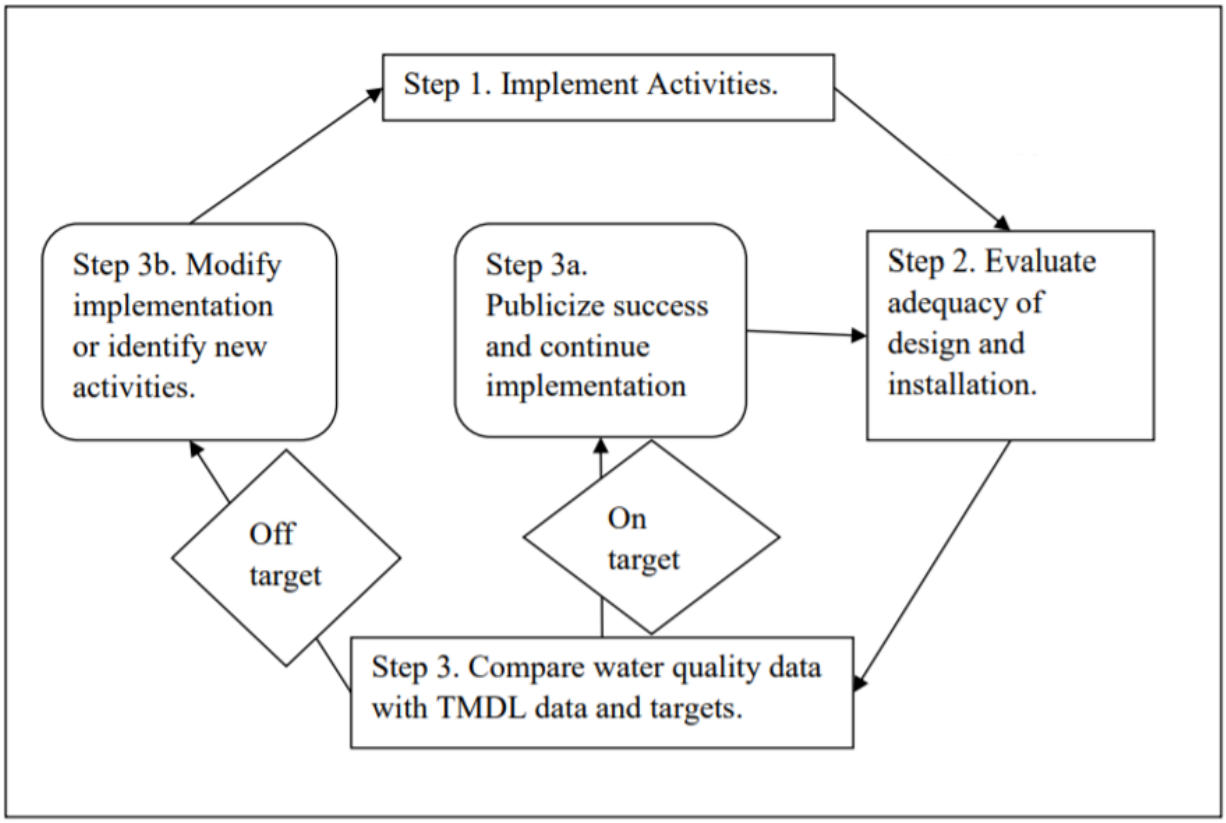
Step 2. Programs and (best management practices) BMPs are evaluated for technical adequacy of design and installation.

Step 3. The effectiveness of the activities is evaluated by assessing new monitoring data and comparing it to the data used to set the TMDL targets.

> **Step 3a.** If the goals and objectives are achieved, the implementation efforts are adequate as designed, installed, and maintained. Project success and accomplishments should be publicized and reported to continue project implementation and increase public support.
>
> **Step 3b.** If not, then BMPs and the implementation plan will be modified or new actions identified. The new or modified activities are then applied as in Step 1.

Additional monitoring may be necessary to better isolate the pollutant sources so that new BMPs can be designed and implemented to address all sources of DO deficit. It is ultimately Ecology's responsibility to assure that implementation is being actively pursued and water quality standards are achieved.

Figure 9. Feedback loop for determining need for adaptive management.



Reasonable Assurance

Ecology estimates that in order to meet the wasteload allocations shown above, reductions of 65-70% will be needed from 1997 levels, When establishing a TMDL, reductions of a particular pollutant are allocated among the pollutant sources (both point and nonpoint sources) in the waterbody.

TMDLs must show "reasonable assurance" that these sources will be reduced to their allocated amount. If there is no reasonable assurance, EPA guidance indicates that the load reductions must be transferred to point sources. Ecology believes that the activities identified in this chapter already support this TMDL and add to the assurance that DO in Budd Inlet will meet criteria in the Washington State water quality standards. This assumes that the identified activities are continued and maintained.

Ecology is authorized under Chapter 90.48 RCW to impose strict requirements or issue enforcement actions to achieve compliance with state water quality standards. Before resorting to enforcement actions, however, Ecology first strives to achieve clean water by collaborating with partners in a cooperative fasion to institute implementation actions voluntarily.

There are several ongoing efforts currently underway that provide additional assurance that the objectives in this TMDL will be met. These projects have their own funding, project teams, and stakeholders. The project goals of the Long Term Management of Capitol Lake – Deschutes Estuary and the Puget Sound Nutrient Source Reduction Project overlap with the goals of the Budd Inlet TMDL. All of these projects must move forward and result in implementation actions in order for Budd Inlet to meet water quality standards.

The monitoring and adaptive management process described in the Tracking Progress section of this report is designed to provide information in a feedback loop (Figure 9) to encourage more landowner participation in BMP implementation and restoration projects. If the monitoring results indicate that the approaches being used are not working, the organizations involved in monitoring and implementation will re-convene to determine whether different approaches should be used.

Education, outreach, technical and financial assistance, and enforcement all will be used to ensure that the goals of this Water Quality Improvement Report are met. Ecology will seek funding resources to increase the number of compliance staff to investigate water use and develop appropriate compliance actions.

A list of ongoing or planned efforts, with accompanying descriptions, that add to the reasonable assurance that pollution reductions will be met is as follows:

- DES's Capitol Lake – Deschutes Estuary Long-Term Management Project is finalizing an environmental impact statement (EIS) that will recommend future management actions for Capitol Lake. The draft EIS was released in March 2022, and it identified the removal of the Capitol Lake Dam as the 'likely preferred alternative' strategy of managing Capitol Lake in the future. Further, DES "expect[s] that the likely preferred alternative will be confirmed as the preferred alternative in the Final EIS" to be issued in Fall 2022.

Capitol Lake and its dam are the largest source of DO-depletion within Budd Inlet, and DES's conclusion, while not yet final, gives ECY more assurance that this critical action is closer to being achieved.

- While there is not universal agreement, many key stakeholders in the community have expressed support for the removal of Capitol Lake Dam, either in their public comments on this TMDL (eg., LOTT, Deschutes Estuary Restoration Team, Washington Department of Fish and Wildlife; see Appendix B) or in other settings (eg,. Squaxin Island Tribe). While we acknowledge the existence of differing opinions, Ecology is encouraged by these remarks, which assure us that other actors in the community will remain engaged during the planning and implementation of restoration actions recommended by this TMDL, including the removal of Capitol Lake Dam. This engagement will help catalyze the reinstitution of workgroups and planning groups – which had met during the planning stages of this effort – as this plan moves into its implementation phase.

- This TMDL is closely integrated with the larger Puget Sound Nutrient Source Reduction Project, a Department of Ecology project designed to address nutrient pollution within the greater Puget Sound. The PSNSRP is closely adhering to the Nine Minimum Elements of Successful Watershed Plans[43], described within EPA's section 319 CWA guidelines.

[43] https://cfpub.epa.gov/watertrain/moduleFrame.cfm?parent_object_id=2868

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