

Kitsap Lake Watershed Plan



Prepared by the City of Bremerton
Public Works and Utilities
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Introduction

Kitsap Lake is an important freshwater resource for residents of the City of Bremerton and Kitsap County. The lake provides significant beneficial uses to the public and is the largest lake in the Chico Creek watershed. Kitsap Lake is open for fishing year-round and provides anglers access to largemouth bass, bluegill, and is stocked with rainbow trout. The lake has a public beach and a boat ramp, and is a popular spot for swimming, kayaking, and other types of contact recreation. Kitsap Lake is also considered priority habitat for Chum, Steelhead, Coho, cutthroat trout, and Great Blue Heron by the Washington Department of Fish and Wildlife (WDFW PHS, 2023).

Kitsap Lake Park is a public city park and provides the only freshwater recreation resource in Bremerton. Free access to a clean, safe refuge from increasing instances of extreme heat is an equity issue for the overburdened communities within the city, as well as being a valuable resource for all local residents.

Past pollution has led to no-contact advisories and swimming beach closures due to high bacteria levels and frequent blooms of toxin producing cyanobacteria (KPHD, 2011). Bremerton has improved water quality greatly in recent years, and consistent and well-planned management will be crucial to the continued protection and improvement of Kitsap Lake water quality.

Purpose of the Watershed Plan

The Kitsap Lake watershed plan brings together stormwater infrastructure improvement, direct treatment of impairment issues, and lakeside resident and user education to restore and protect water quality, habitat, and recreation use for the benefit of people, wildlife, and fish.

The management measures described in this plan will work together to improve water quality for freshwater recreation, including reducing the number of water advisories due to toxic cyanobacteria during peak usage (summer) and elevated E-coli incidents. The completed plan will coordinate with the City of Bremerton's Stormwater Comprehensive plan.

Impairment, Causes and Concerns

The City of Bremerton has been working for many years with partner jurisdictions and other stakeholders and communities to study and collect data on water quality in Kitsap Lake. In 2018, Kitsap Lake water quality issues became a focal point of the Bremerton City Council, the Mayor, and the City's Stormwater program.

Water Quality Impairment

Kitsap Lake has been designated impaired for both fecal coliform (Category 4A) and total phosphorus (Category 2). For more information see the Department of Ecology Water Quality Atlas.

<https://apps.ecology.wa.gov/waterqualityatlas/wqa/map>

- Category 4A, an impaired water body that already has an EPA-approved TMDL in place and implemented, for Fecal Coliform
- Category 2, a water of concern, for Total Phosphorus

The Kitsap Lake basin is part of the Chico Creek watershed (figure 5), which drains Puget Sound via Dyes Inlet. Sinclair and Dyes inlets are currently on the EPA's 303(d) list of impaired waterways and have a Total Maximum Daily Load (TMDL) water quality improvement plan. A TMDL is the maximum amount of the pollutant allowed to enter a water body without exceeding water quality standards. TMDLs are

calculated and assigned by Ecology, with oversight from the EPA to waterbodies with known levels of pollution that exceed the water quality standards for the state. For more information regarding TMDLs please visit the Ecology website at: <https://ecology.wa.gov/water-shorelines/water-quality/water-improvement/total-maximum-daily-load-process> .

Bremerton's NPDES Phase II stormwater permit requires programs and practices to control polluted stormwater runoff. These practices address contamination through:

- Public education regarding responsible collection of pet waste,
- An illicit discharge detection and elimination, IDDE, program to locate and investigate and eliminate unusual sources of pollution,
- Low impact development (LID) principles followed at new and re-development sites,
- Maintenance practices to prevent flooding, which can wash pollutants into surface waters.

Fecal Coliform

The Sinclair and Dyes Inlet Fecal Coliform Water Quality Improvement Plan addresses Kitsap Lake water quality issues regarding fecal coliform but does not address phosphorus. Excess nitrogen and phosphorus have been identified as the main drivers of water quality degradation in the lake (KPHD, 2011)

Phosphorus

Prior studies have determined that phosphorous sources in Kitsap Lake include both internal recycling, as well as input from development within the watershed (KPHD 2011). Total phosphorous sources include runoff from bare soil and developed areas. Phosphorus occurs naturally, in human and animal waste and is added to some detergents and fertilizers. Roofs, driveways, and other impermeable surfaces interrupt the absorption and filtration provided by forests and soils, and instead send phosphorus-laden stormwater directly to the stormwater system and receiving waters.

On-Site Sewage Systems

Seventy-six percent of the residential properties in the Kitsap Lake watershed are served by City of Bremerton sanitary sewer. The remaining 24% have septic systems in place. Many of these on-site septic systems are more than 40 years old, with some likely in need of replacement. Many of the properties with OSS are outside of City limits and lack access to the City's sewer system.

Watershed Description

Kitsap Lake is in the western part of the City of Bremerton, on the west side of Puget Sound, west of Seattle, Washington. Average temperatures in Bremerton range from lows in the 30's (F) in December to highs in the 90's in August. Historically, average annual rainfall is 52 inches as measured by the City of Bremerton Public Works and Utilities. The rainy season is typically from October to April.

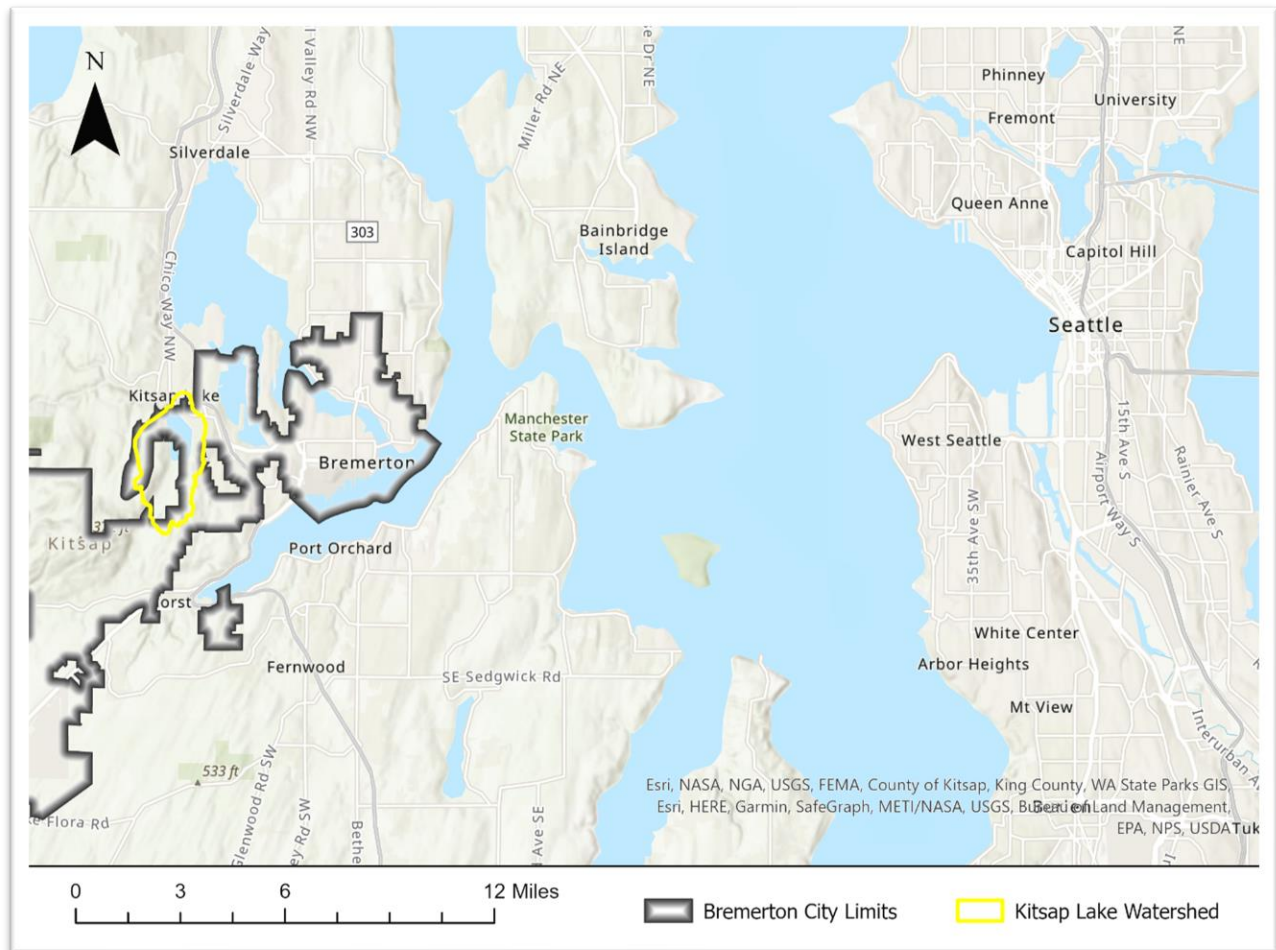


Figure 1 Kitsap Lake Location

The Kitsap Lake watershed covers 1,600 acres and is 65% within Bremerton city limits, with the remaining 35% in Kitsap County. The lake has a surface area of 238 acres, with an average depth of 18 feet and a maximum depth of 29 feet. The wetland at the southern end of the lake is approximately 35 acres.

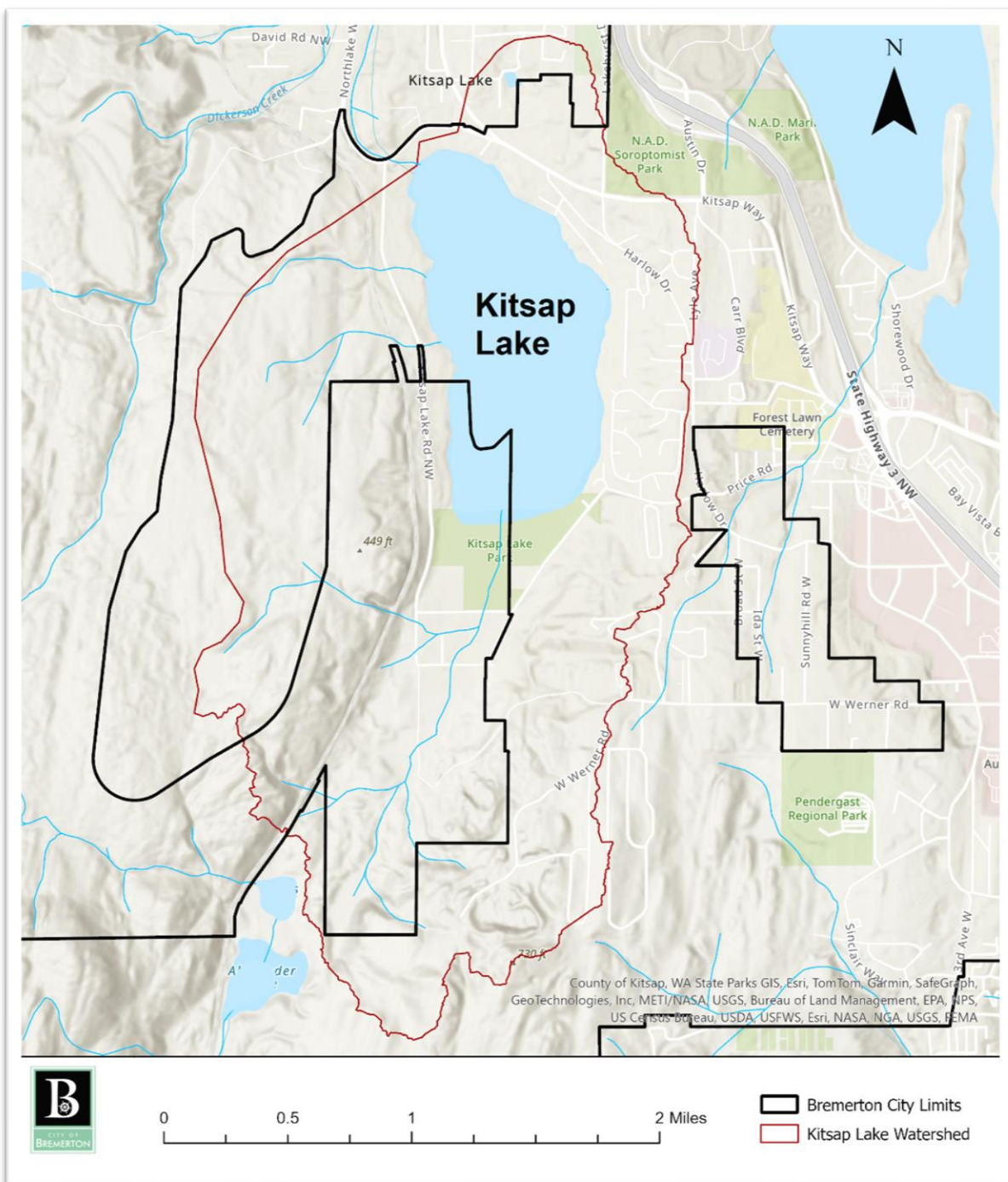


Figure 2 Kitsap Lake Watershed

The Kitsap Lake watershed is developed with a variety of impervious surfaces, especially along the lake front and in the eastern portion of the watershed. Kitsap Lake basin is 13% impervious surfaces within the City of Bremerton, and 10% impervious overall, including the Kitsap County portion.

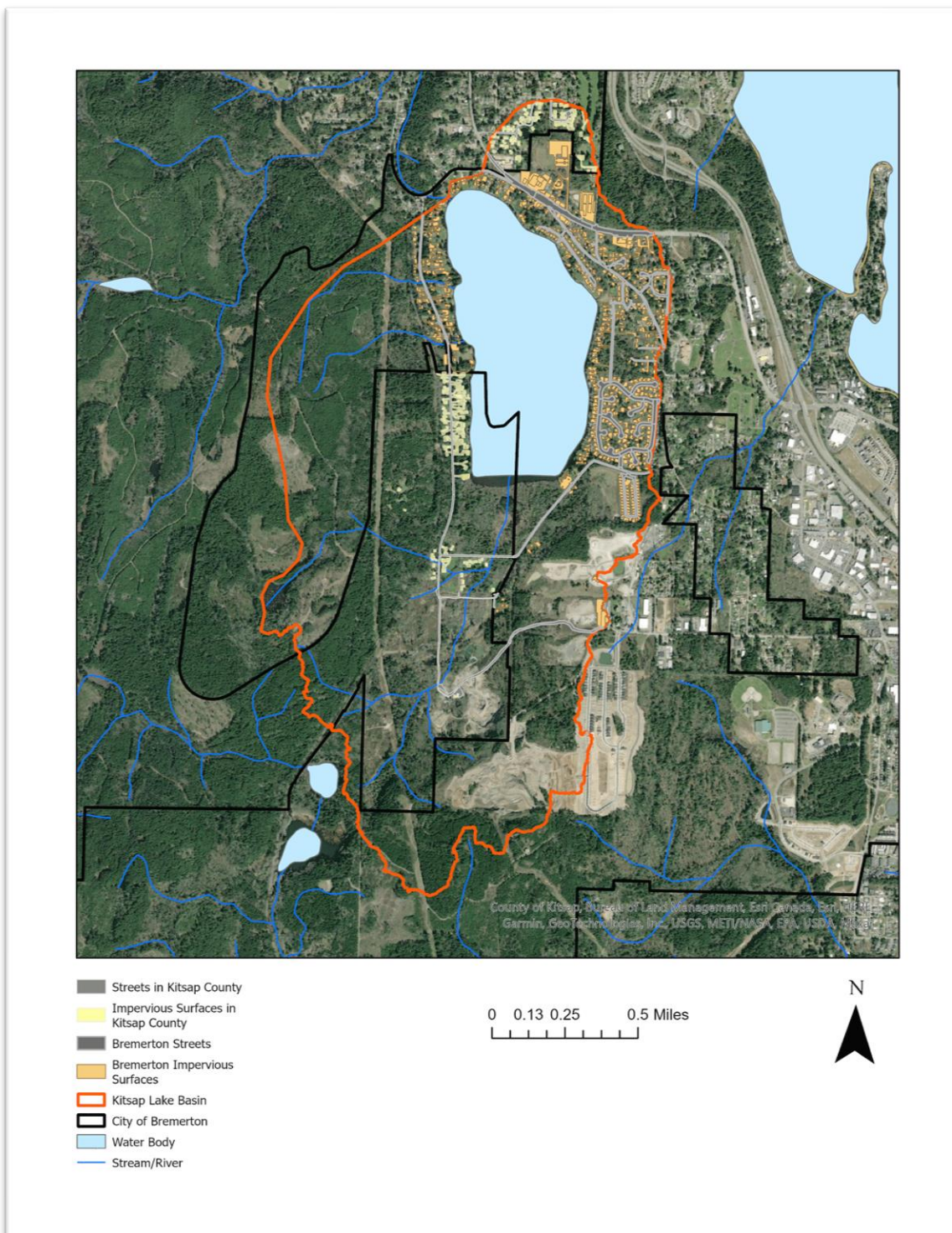


Figure 3 Impervious Surfaces in the Kitsap Lake Watershed

Of the portion of the watershed in the City of Bremerton, 64%, is zoned as low density residential, 23% zoned industrial, and 5% is zoned as commercial. The western and southern portion of the watershed includes forested area, largely undeveloped county land, wooded residential, and Kitsap Quarry, a basalt rock quarry.

Urban Growth Area

The City's UGA is expanding approximately 230 acres within the Kitsap Lake watershed in 2025. This includes the property along the southwest waterfront. Per the Kitsap County 2024 Comprehensive Plan update, "it is expected that much of this UGA will become part of the City over the next 20 years." Bringing the entire lakefront of Kitsap Lake within the City of Bremerton's jurisdiction will simplify efforts to protect and improve water quality for all residents and lake users.

Benefits of inclusion in Bremerton's UGA include:

- **Wastewater Service** - Municipal wastewater service is not available to those properties located outside of a UGA in unincorporated areas of the County. Inclusion in the UGA will allow property owners to connect to existing wastewater infrastructure.
- **Lake Management** – The future consolidation of governance around Kitsap Lake will simplify and improve the City's stewardship of Kitsap Lake.
- **Utility Fees** - Inclusion in the UGA provides a path toward annexation, which would result in removal of the 50% water and wastewater rate surcharges for those customers that become City residents.
- **Kitsap Public Health District Support** - KPHD supports UGA expansion to protect environmentally sensitive resources and ensure property owners can access a municipal sewer if septic repairs are impractical or too expensive.

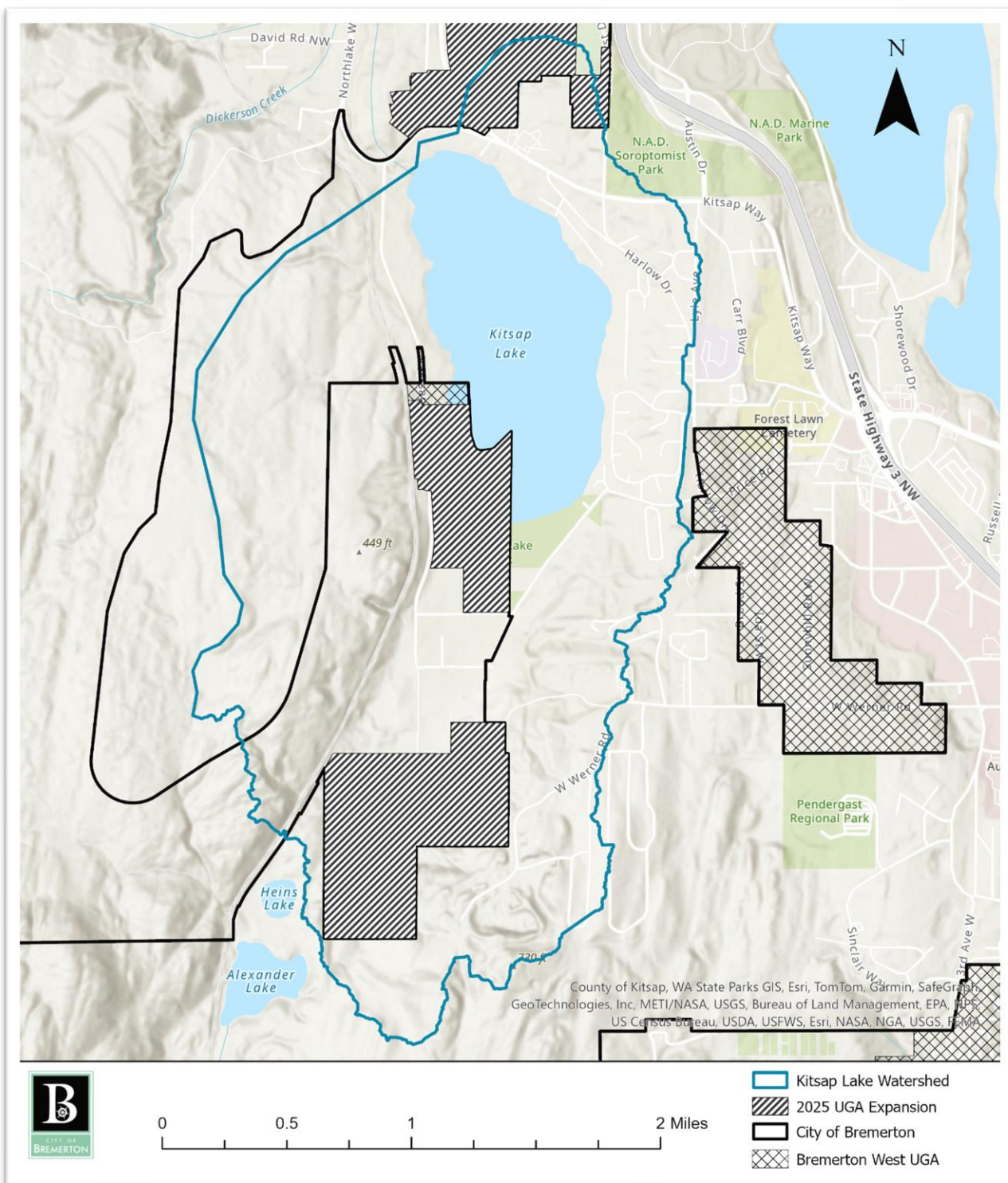


Figure 4 Urban Growth Area within the Kitsap Lake Watershed

Hydrology

Originally formed by glacial retreat, the lake is fed by springs, ephemeral streams, direct precipitation, stormwater runoff, and from the south by an unnamed creek commonly referred to as Kitsap Quarry Creek. There are nineteen stormwater outfalls to Kitsap Lake, fourteen within the City of Bremerton and five from Kitsap County.

There is a 35-acre wetland at the southern end (inlet) of the lake, between the WDFW public boat ramp on the southwest corner and Kitsap Lake Park on the southeast corner.

Kitsap Lake has a relatively high retention time, the water in the lake is not replaced often with new water from creeks, springs, or precipitation. High retention time means pollutants entering the lake are not quickly flushed out, putting higher importance on pollution prevention.

Discharge from the Lake to Kitsap Creek averaged between 4.7 to 11.0 CFS (cubic feet per second) from 2002 to 2018. (Kitsap PUD)

Kitsap Lake is one of two freshwater lakes within the Chico Creek watershed. Water leaves the lake at the outlet at the north end of the lake to create Kitsap Creek, which is a tributary to Chico Creek. Chico Creek flows north to Dyes Inlet and greater Puget Sound.

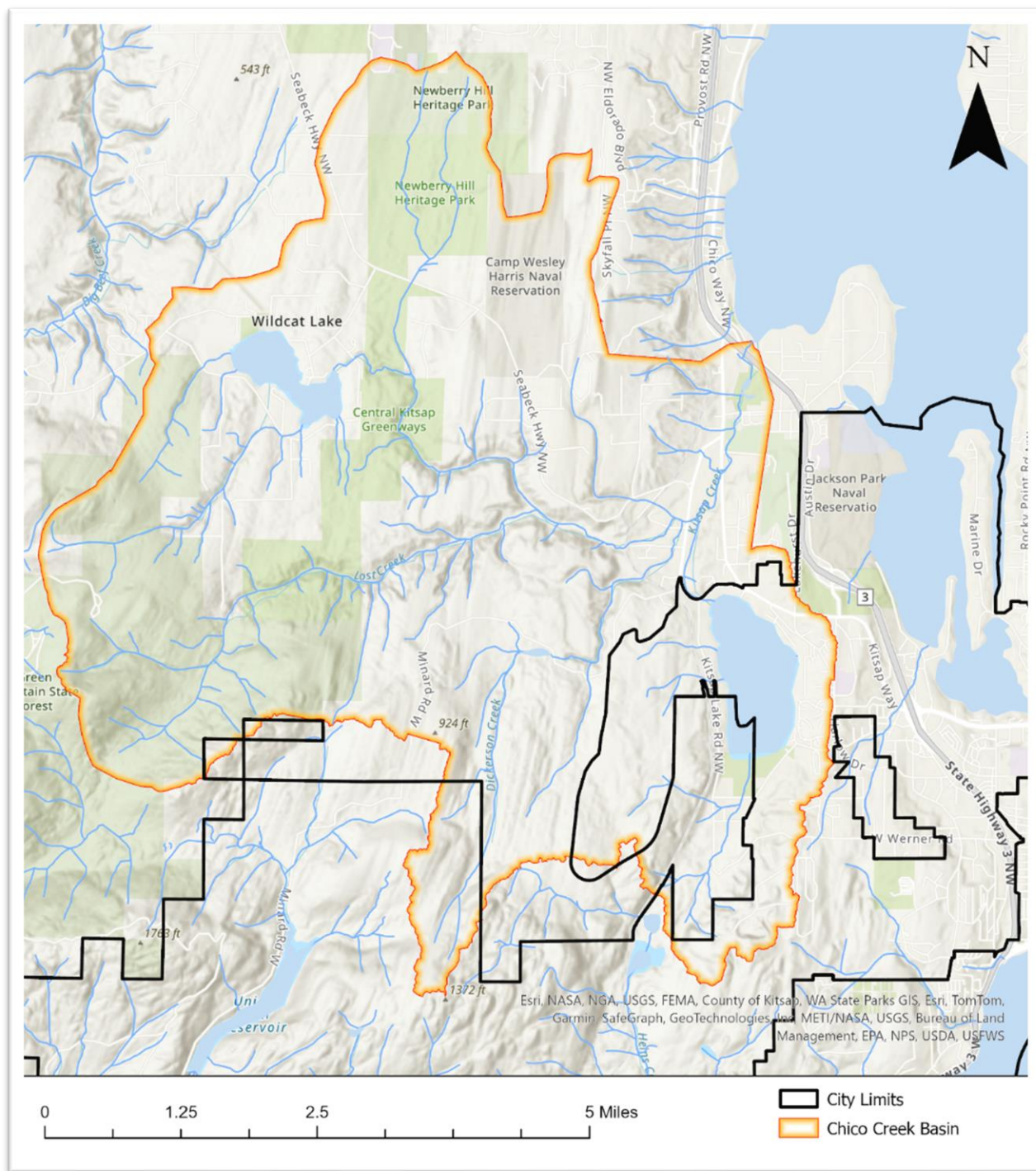


Figure 5 Chico Creek Watershed

Species of Interest

The Washington department of Fish and Wildlife list of Priority Habitat and Species for Kitsap Lake (<https://geodataservices.wdfw.wa.gov/hp/phs/>) includes the East Kitsap Demographically Independent Population of Steelhead.

Table 1 Priority Habitat and Species in the Kitsap Lake Watershed

PHS Species/Habitats Overview:

Occurrence Name	Federal Status
Winter Steelhead	N/A
Coho	N/A
Resident Coastal Cutthroat	N/A
Coho	Candidate
Steelhead	Threatened
Cutthroat	Not Warranted
Chum	Not Warranted
Rainbow Trout	N/A
Fall Chum	N/A
Great blue heron	N/A
Lake	N/A
Freshwater Emergent Wetland	N/A
Freshwater Forested/Shrub Wetland	N/A

Kitsap Lake has been recorded as a breeding area for great blue heron, a priority species. Both the lake and the freshwater emergent wetland are priority habitats. Non-salmonid fish species include sculpin, lamprey, bass, and non-native warm water fish introduced for recreational fishing.

The Chico Creek watershed is a significant habitat for native salmonid populations including chum, coho, steelhead, and cutthroat trout. The watershed contains areas of high-quality habitat that serve as salmonid refugia. Refugia are “habitats or environmental factors that provide spatial and temporal resistance and/or resilience to aquatic communities impacted by natural and anthropogenic disturbances”. (May, C.W. and G. Peterson 2003).

The 2020 Kitsap Lake Integrated Aquatic Vegetation Management Plan Update survey by AquaTechnex identified Japanese Knotweed, Purple Loosestrife, Fragrant Waterlily, and Curly Leaf Pondweed as invasive submerged aquatic species and yellow flag iris on the shoreline as noxious species. Eurasian Milfoil is also present in the lake which is an entanglement danger to swimmers and interferes with boating and fishing.

Stakeholders and Technical Assistance Partners

Lakefront property owners, residents who use the lake for recreation, the Suquamish Tribe, and residents of Kitsap County are stakeholders. As of 2022, the population of COB was 41,258 with 99% of residents in urban areas (United States Census Bureau, 2022).

The Suquamish Tribe is a sovereign nation, located on the Kitsap peninsula. The Tribe partners with local agencies on planning, and habitat protection and restoration.

Kitsap County Public Health District (KPHD) monitors water quality in Kitsap Lake, produces annual water quality monitoring reports and issues water contact advisories for Kitsap Lake when toxin producing blue green algae meet defined criteria and for elevated *E. coli*. KPHD collaborated with the Washington Department of Ecology, the City and Kitsap County Surface and Stormwater Management on the Kitsap Lake and Chico Bay Pollution Identification and Correction (PIC) Project in 2005. KPHD also has the authority to enforce rules adopted by the Washington state board of health, including rules to protect public drinking water sources and public health.

Kitsap County Surface and Stormwater Management maintains a water pollution hotline, conducts annual inspection of commercial properties to assess cleanliness, conducts street sweeping, screens outfalls for IDDE.

Kitsap Conservation District (KCD) is a non-regulatory subdivision of state government that administers programs to conserve natural resources. KCD offers technical assistance to landowners who have questions or concerns about flooding, stormwater pollution, or stormwater management.

Local Lake Restoration Efforts

Similar lake restoration efforts have taken place at other small lakes around Puget Sound in Washington. (Figure 5)

The City of Anacortes manages Heart Lake for both Eurasian milfoil and toxin producing Cyanobacteria blooms due to high phosphorus. Past treatments at Heart Lake include fluoridone application, hand pulling for milfoil, and alum treatment to immobilize lake sediment phosphorus.

Snohomish County has an ongoing treatment plan for Lake Ketchum, a 25-acre lake with legacy phosphorus issues from a former dairy farm. Their lake management plan includes an initial whole lake alum treatment, followed by annual alum treatment of the water column.

Kitsap County formed a Lake Management District (LMD) and treated Long Lake for invasive aquatic macrophytes (Brazilian Elodea and Eurasian Milfoil) and high levels of phosphorus. Alum was used to treat for phosphorus in Long Lake as needed and as funding was available. The LMD was disbanded in 2022.

Current and Continuing Efforts

Kitsap Lake Algae Control and Aquatic Vegetation Management

Kitsap Lake water quality and aquatic vegetation have been studied for the past two decades. The lake is fed by streams, springs, and stormwater runoff which carries nutrients into the lake. Lake water has a very limited exchange rate, so pollutants tend to persist in the lake and settle to the bottom. Accumulated lake sediment has high levels of nutrients that support aggressive aquatic vegetation growth and feed potentially toxic cyanobacteria algae blooms. Further, the lake attracts waterfowl whose waste contains *E. coli*. Historically, elevated bacteria levels and cyanobacteria algae blooms prompted closures or advisories to be posted at the lake's public access areas, restricting contact recreation.

The current management program began in 2019 and is ongoing. Without a dedicated funding source established to finance a remedy for the lake, city staff decided to pursue grant funding. The City applied for and received funding through the Department of Ecology's Water Quality Program, Aquatic Invasive Plants Management Grant Program in 2020. Using these funds, the City selected AquaTechnex to assist in updating the Integrated Aquatic Vegetation Management Plan (IAVMP) and define what was needed to reduce algae blooms and improve the health of Kitsap Lake.

AquaTechnex collected and tested water and sediment samples from the lake to determine baseline conditions that helped inform the current management program. Aquatic and shoreline vegetation were surveyed to determine quantities of invasive species and vegetation overgrowth. Bathymetry (underwater topography) measurements were conducted to calculate lake volume and identify the deeper regions of the lake that may experience anoxic conditions when the lake becomes stratified.

Since the management plan was implemented, there have been significant water quality improvement including significantly fewer beach closures, and no closures during the highest lake use summer months (Figure 6). Improved water quality has a significant positive impact on downstream water quality. By using safer products and processes to remove phosphorus from the water column and harvesting excess submerged vegetation the City is protecting the lake and habitat without damaging sensitive fish stocks or vegetation species. <https://www.bremertonwa.gov/1282/Kitsap-Lake-Algae-Control-and-Aquatic-Ve>

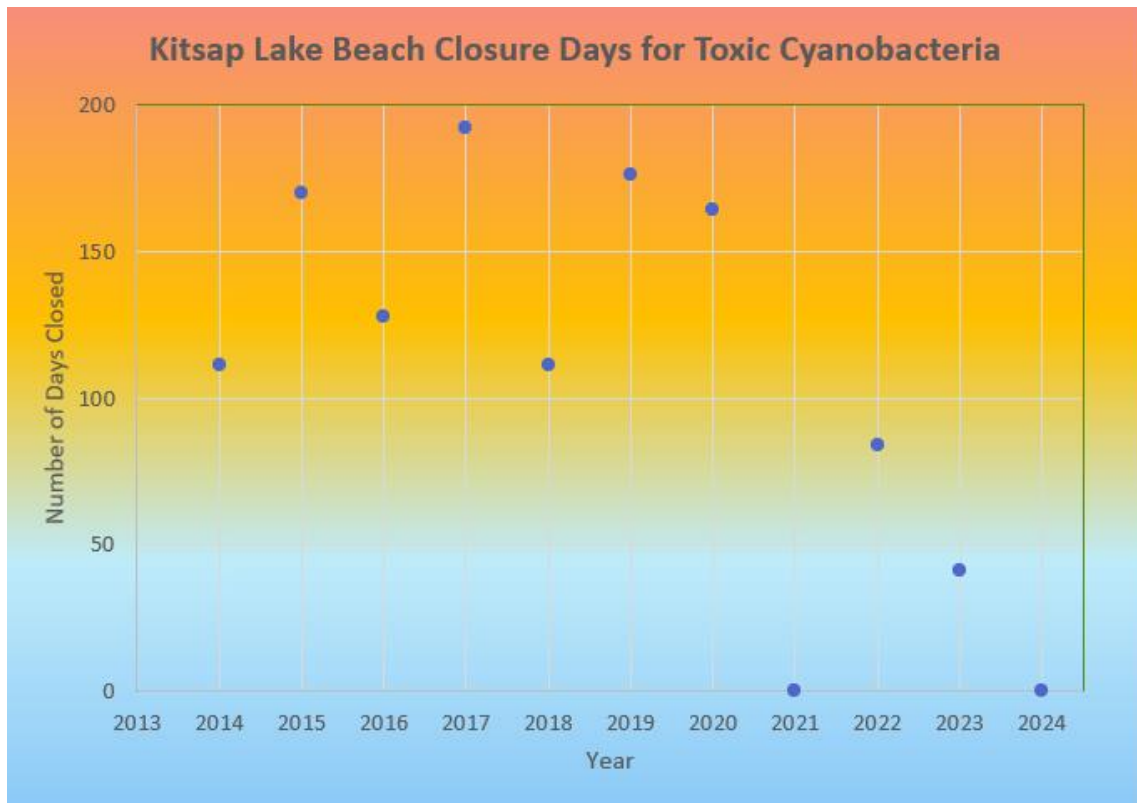


Figure 7 Number of Beach Closure Days From 2014 through 2024

Treatment includes two yearly Phosphorus sequestering treatments, annual harvest of excess vegetation, and herbicide application as needed. (Table 2) The phosphorus treatments sequester the excess phosphorus in the lake, making it unavailable to feed blooms of toxin producing cyanobacteria. (Figure 7) The aquatic vegetation harvest clears the lake of nuisance levels of vegetation and removes the plants before they can die back and decompose at the end of the growing season. (Figure 8) Vegetation removal from the system prevents excess nutrients from being released back into the water column.

Table 2 Phosphorus Treatment and Aquatic Vegetation Harvest Dates

Year	Phosphorus Treatment		Aquatic Vegetation Harvesting	Algaecide
	Dates	Treatment		Phycomycin SCP
2020	6/8-6/11	Phoslock	7/28-8/7	
	8/25-8/27			
2021	6/14-6/15	Phoslock	8/11-8/26	
	9/7-9/8			
2022	5/23-5/25	Phoslock	8/8-8/22	
	7/25-7/26			
2023	6/6	Eutrosorb	7/31-8/14	
	9/7			
2024	5/20	Eutrosorb	8/13-8/26	
				6/27/2024
	9/4	Eutrosorb		



Figure 8 Phosphorus Treatment Application



Figure 9 Harvester Removing Excess Aquatic Vegetation

[Kitsap Lake Park Stormwater Treatment](#)

In Fall 2024 construction began on the Kitsap Lake Park renovation project. As part of the improvements to the Kitsap Lake Park Facilities, the Stormwater Program partnered with the Parks Department to fund the installation of one BioPod stormwater treatment system to treat runoff from the parking lot prior to discharge into the lake. Bremerton's Stormwater Program provided \$100K to cover the cost of installing the outfall and BioPod treatment system to support the on-going effort to improve water quality in Kitsap Lake. The BioPod provides basic, enhanced, and phosphorus treatment, reduces 6PPD-Q, and will reduce fecal coliform in runoff from the parking lot, a pollution generating impervious surface. Construction will be complete and the park will reopen in May 2025.

[Kitsap Lake Stormwater Retrofit](#)

In the City's continuing effort to improve water quality for Kitsap Lake, this project will provide treatment at four outfall locations that are currently untreated. The treatment will consist of installation of Washington Department of Ecology approved systems above four sites, three in Osprey Circle and

one on the north side of the intersection of Kitsap Way and Chico Way. Treatment will be for suspended solids (TSS), dissolved copper, dissolved zinc, and total phosphorus.

The treatment systems will treat runoff from:

A total of 37.12 acres of area in the Dockside Community.

- 11.38 acres of Road/sidewalk/driveways
- 8.96 acres of Roof area
- 14.07 acres of Grass
- 2.71 acres of Forest

A total of 40.31 acres of area from the area north of the intersection of Kitsap Way and Chico Way.

- 6.18 acres of Road/sidewalk/driveways
- 4.10 acres of Roof area
- 13.89 acres of Grass
- 15.48 acres of Forest

Northlake Way Culvert Replacement

The culvert crossing on Kitsap Creek at Northlake Way, just downstream from Kitsap Lake, has been classified as a fish passage barrier by the Washington Department of Fish and Wildlife. The stream is confined at the crossing to a narrow culvert with a long, steep pitch. Remediation of this culvert is recommended in the Suquamish Tribe's 2014 *Chico Creek Watershed Assessment for the Identification of Protection and Restoration Actions*. Preliminary Design for a new crossing was completed in 2021 with the help of a grant from the Washington Recreation and Conservation Office. The goal of this project is to improve fish passage for chinook, coho, chum, steelhead, and cutthroat trout. Bremerton engineering staff have applied for final design and construction funding through NOAA's current funding opportunity *NOAA's Restoring Fish Passage through Barrier Removal Grants under BIL and IRA*. It is anticipated that final design would occur in 2024-2026 and construction would occur in 2027.

Stormwater Management Action Planning (SMAP)

Beginning in 2019, Phase II municipalities in the state of Washington (including the City of Bremerton) began a new stormwater planning effort under the direction of the Washington Department of Ecology. A receiving waters assessment and basin prioritization were conducted to identify priority stormwater basins to receive treatment retrofits, targeted land management strategies, and enhanced maintenance programs. The environmental disparities experienced by overburdened communities were also considered in this ranking process. Kitsap Lake was identified as the highest priority basin for enhanced stormwater management and an action plan was developed which includes targeted stormwater pollution management and stormwater treatment retrofits at four sites.

Francis Drive Outfall Stormwater Retrofit

This project will improve water quality of stormwater discharging to Kitsap Lake and mitigate conveyance capacity issues. The SMAP identified projects in the Kitsap Lake Basin that treat stormwater runoff by using treatment BMPs approved by the Washington State Department of Ecology (Ecology) and upgrade stormwater conveyance by installing a new outfall. The original design for the Francis Street project that was identified in the SMAP included a new outfall to Kitsap Lake, but after further analysis, the planned new outfall was omitted and replaced with a conveyance retrofit design that balances the downstream stormwater flow between the two existing outfalls. In the existing condition, most of the stormwater flow drains to the southern outfall, and adding a connecting pipe will route more water to the northern outfall.

The retrofitted treatment system will treat 77.4 acres of urban land to the northwest of Kitsap Lake with an underground vault facility. The facility would provide Basic and phosphorous treatment and would discharge to an existing outfall to Kitsap Lake. The facility is expected to cost approximately \$1.58M, including final design, permits, construction, construction administration and contingency. Final design and construction of the Francis Street facility is anticipated in the 2025-26 period, contingent on obtaining grant funding.

For more information on SMAP and retrofit opportunities for Kitsap Lake see the City's SMAP Storymap here: <https://arcg.is/1qryrP>.



Figure 10 Francis Drive Outfall Stormwater Retrofit Project Area

Public Outreach and Education

Kitsap Lake Property Owners Group

Regular meetings are held with City staff and an association of Kitsap Lake property owners to discuss City management plans and any concerns the public may have.

West Sound Stormwater Outreach Group (WSSOG)

The City of Bremerton is a member of WSSOG, a multi-jurisdictional coordination group which develops and implements stormwater education to targeted audiences. WSSOG has been conducting a Natural Yard Care behavior change campaign for several years, which has a particular focus on preventing both pesticides and excess nutrients from washing off residential lawns into local waterways.

Pet Waste Program

Along with the IDDE program, the City's municipal stormwater permit also sets a TMDL for waterways designated as impaired. Dyes Inlet, of which Oyster and Ostrich Bays are a part, has a TMDL for fecal coliform bacteria. The City of Bremerton meets the TMDL requirements by using best management practices to prevent excess pollutants from entering the waterways, including the successful Pet Waste program.

Bremerton has installed and maintained pet waste education and collection stations at municipal parks and other Bremerton-owned and operated lands adjacent to stream and marine shorelines. There are 50 City owned and maintained pet waste stations, four of which are within city limits in the Oyster and Ostrich Bay watershed. Estimated pet waste bag use has grown to over 200,000 bags per year. Using an estimation of 1/3 lbs. of waste collected per bag, this program helps prevent up to 82,667 lbs. of bacteria and nutrient laden pet waste from washing into the City's streams, lakes, and Puget Sound each year.

Table 3 Annual Pet Waste Program Summary

Year	Pet Waste Bags Provided	Estimated Waste Collected (lbs)
2014	80,000	26,667
2015	136,000	45,333
2016	168,000	56,000
2017	192,000	64,000
2018	174,000	58,000
2019	170,000	56,667
2020	174,000	58,000
2021	178,000	59,333
2022	248,000	82,667
2023	204,000	68,000
2024	238,000	79,333

In addition to the City owned and maintained stations, Bremerton also sponsors privately maintained pet waste stations for Homeowner's Associations, businesses, and private residents through the Kitsap County "Apply for a Mutt Mitt Station" program. https://www.kitsap.gov/pw/Pages/muttmitt_app.aspx

Outreach Events

City staff participate in outreach events to answer questions from the public and share information and tips for preventing pollution, saving water, natural yard care, and more. Regularly attended events include:

- Kitsap Water Festival
- Sinclair Inlet Cleanup
- Kitsap Peninsula Home and Garden Expo
- Kitsap Fair and Stampede
- Kitsap Salmon Tours
- Kid's Fishing Day

Lake Friendly Yard Care

In addition to WSSOG's Natural Yard Care campaign, the city has a webpage with helpful information and a downloadable brochure. <https://www.bremertonwa.gov/1004/Natural-Yard-Care>

For residents within the Kitsap Lake watershed, Bremerton mailed letter with information and advice about lake friendly landscaping and yard care techniques and principles to every address in the Kitsap Lake watershed.

Kitsap Conservation District LID and Rain Garden Program

Bremerton has an interlocal agreement with Kitsap Conservation District to partner on rain gardens, low impact development education, technical assistance, and installation of stormwater Best Management Practices, BMPs. <https://kitsapcd.org/programs/raingarden-lid>

Classroom Visits

City staff visit a 4th and 5th grade highly capable classroom at Kitsap Lake elementary school each year to present information and answer student questions on the school's stormwater drainage, the City's stormwater system, pollution, ecology and more.

Costs and Financial Assistance

Kitsap Lake Stormwater Retrofit Project

In the City's continuing effort to improve water quality for Kitsap Lake, this project will provide treatment at four outfall locations that are currently untreated. The treatment will consist of installation of TAPE GULD approved systems above four sites, three in Osprey Circle and one on the north side of the intersection of Kitsap Way and Northlake Way. Treatment will be for suspended solids (TSS), dissolved copper, dissolved zinc, and total phosphorus.

- The project will be completed using a Department of Ecology grant. The grant will pay for 75% of the total cost to complete the design and construction. The Stormwater Utility will match the grant for the remaining 25% needed. The current construction estimate for the project is \$2.6 million.

Kitsap Lake Algae Control and Aquatic Vegetation Management

The goal of the project is to improve water quality of the lake and provide a safe environment for all lake users including people, fish, wildlife, and pets. Improved water quality has a significant positive impact on downstream users including shellfish at the Chico Creek outlet in Dyes Inlet. By using lake safe products and processes to remove phosphorus and excess submerged vegetation the City is protecting the lake and habitat without damaging sensitive fish stocks, or vegetation species.

- Funding is provided by an allocation of funds from the City of Bremerton General Fund and the Stormwater Utility.

Kitsap Lake Park Stormwater Treatment

As part of the improvements to the Kitsap Lake Park Facilities, the Stormwater Program is partnering with Parks to fund the installation of a Biopod stormwater filtration system to treat runoff from the parking lot prior to discharge into the lake. Biopods provide basic, enhanced, and phosphorus treatment, and will reduce fecal coliform in runoff from the parking lot, a pollution generating impervious surface.

- Bremerton's Stormwater Program provided \$100K to cover the cost of installing the outfall and BioPod treatment system to support the on-going effort to improve water quality in Kitsap Lake.

Kitsap Lake Stormwater Retrofit

An Ecology grant, and matching Stormwater Utility funds, were used to complete the design of four stormwater treatment systems that will provide improved stormwater water quality for runoff discharged into Kitsap Lake. These sites were selected based on water quality data collected from all inflow locations around the lake that identified where improvements would be most beneficial. Three sites are in the Dockside community, and one is on Kitsap Way at the intersection of Chico Way.

- Bremerton applied for a follow up construction grant from Ecology's Stormwater Financial Assistance Program (SFAP) and was selected to receive \$2,422,500 in grant funds, with \$427,500 in matching funds for a total "grant" of \$2.85 million. The City will use the funds to complete the final design / bid package, with project completion in 2025.

Francis Drive Outfall Stormwater Retrofit

The Francis Street Outfall Improvements project will correct a known capacity issue with the existing stormwater outfall as well as provide stormwater treatment meeting Ecology requirements.

PW engineering staff propose to apply for construction funding through Ecology's Stormwater Financial Assistance Program (SFAP) for FY 2025. It is anticipated that construction would occur in summer 2025. Construction funds are included in the 2023-2028 CIP. This grant requires a 15% match, which is funded by the utility. Project budgets are summarized below.

- Total project cost = \$1,452,000
- City portion (15%) = \$217,800
- Ecology grant portion = \$1,234,200

Northlake Way Culvert Replacement

The culvert crossing on Kitsap Creek at Northlake Way NW has been classified as a fish passage barrier by the Washington Department of Fish and Wildlife (WDFW). The stream crossing is a problem because the stream is confined within a narrow culvert with a long, steep pitch. Remediation of this culvert is recommended in the Suquamish Tribe's 2014 *Chico Creek Watershed Assessment for the Identification of Protection and Restoration Actions* (page 124). The goal of this project is to improve fish passage for chinook, coho, chum, steelhead, and cutthroat trout.

Bremerton received a grant for preliminary design in 2018 from the Washington Recreation and Conservation Office. Preliminary Design was completed in 2021.

Monitoring

Illicit Discharge Detection and Elimination (IDDE)

Bremerton's IDDE program includes stormwater outfall screening, pollution reporting and response procedures, and a training program instructing city staff to recognize illicit discharges during their regular duties throughout the city.

City of Bremerton Water Quality Monitoring Program

Lake water sampling is performed regularly to establish baseline conditions and to evaluate the effectiveness of management activities in the lake or in the watershed.

City staff visit the lake to collect water samples and take measurements twice a month from spring to fall. Beginning in November of 2023 monthly winter sampling was added to the protocol.

- Temperature, dissolved oxygen, and pH are collected at the deepest part of the lake, near the end of Francis Drive, at five-foot increments from the lake surface to 25 feet.
- Secchi depth is collected at the Francis site.
- A fluorometer is used to record chlorophyll and phycocyanin levels from the water surface at Francis, the lake outlet, and the park.
- Water samples are collected at depths of five and twenty feet at Francis and at five feet at the park. These samples are sent to SePRO labs for total and free reactive phosphorus levels, and algae amount and speciation.

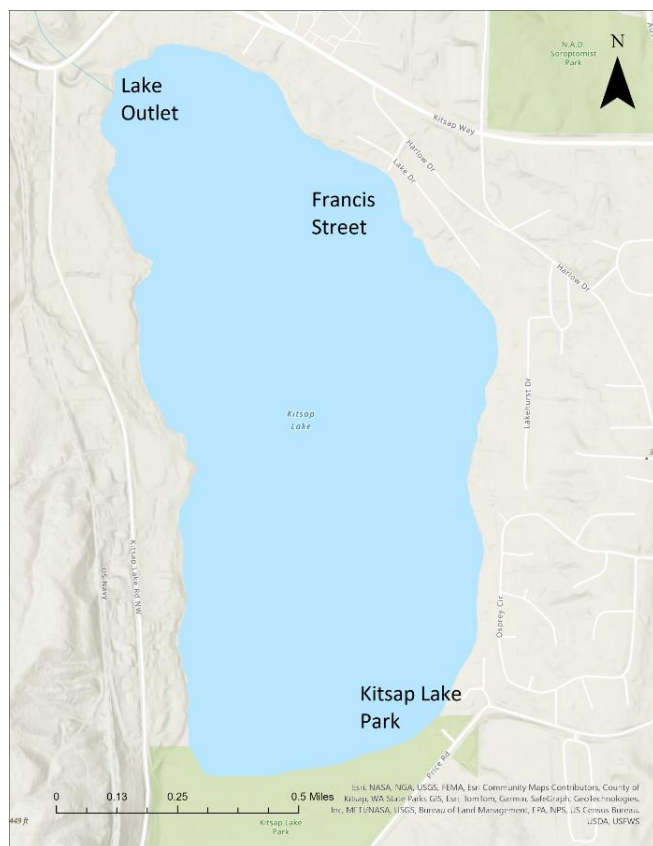


Figure 11 Kitsap Lake Sample Sites

Temperature and Dissolved Oxygen

Kitsap Lake is well mixed and uniform in temperature and dissolved oxygen during the cold months, with a thermal stratification setting up during the summer. The thermal barrier begins at approximately 15 feet of depth, with dissolved oxygen dropping sharply below that level during the summer.

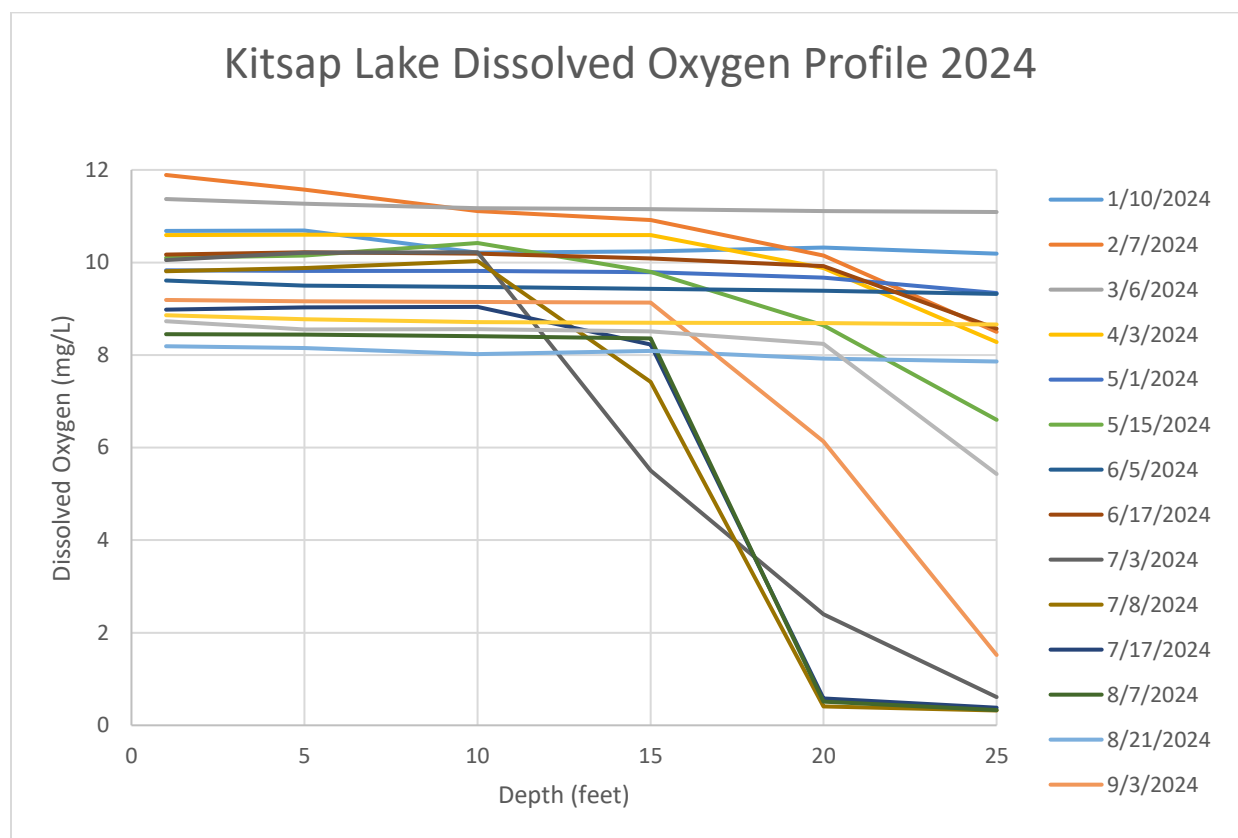


Figure 12 Kitsap Lake Dissolved Oxygen Profile, 2024

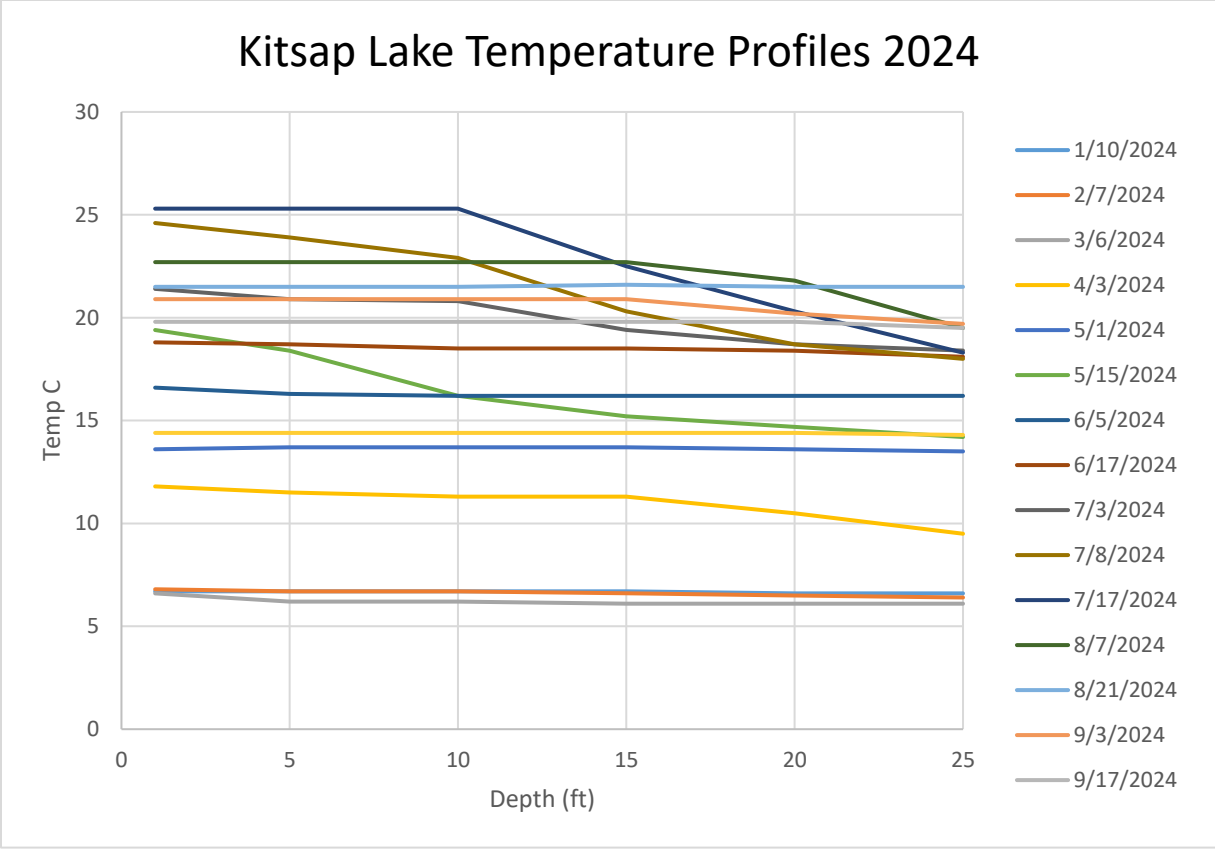


Figure 13 Kitsap Lake Temperature Profile, 2024

Phosphorus

Per the Washington Administrative Code section 173-201A-230, Establishing Lake Nutrient Criteria, the threshold level of Total Phosphorus is 20 $\mu\text{g/L}$, shown in the figure below as a dotted line. TP levels ranged from less than 5 to 50 $\mu\text{g/L}$ in Kitsap Lake in 2024.

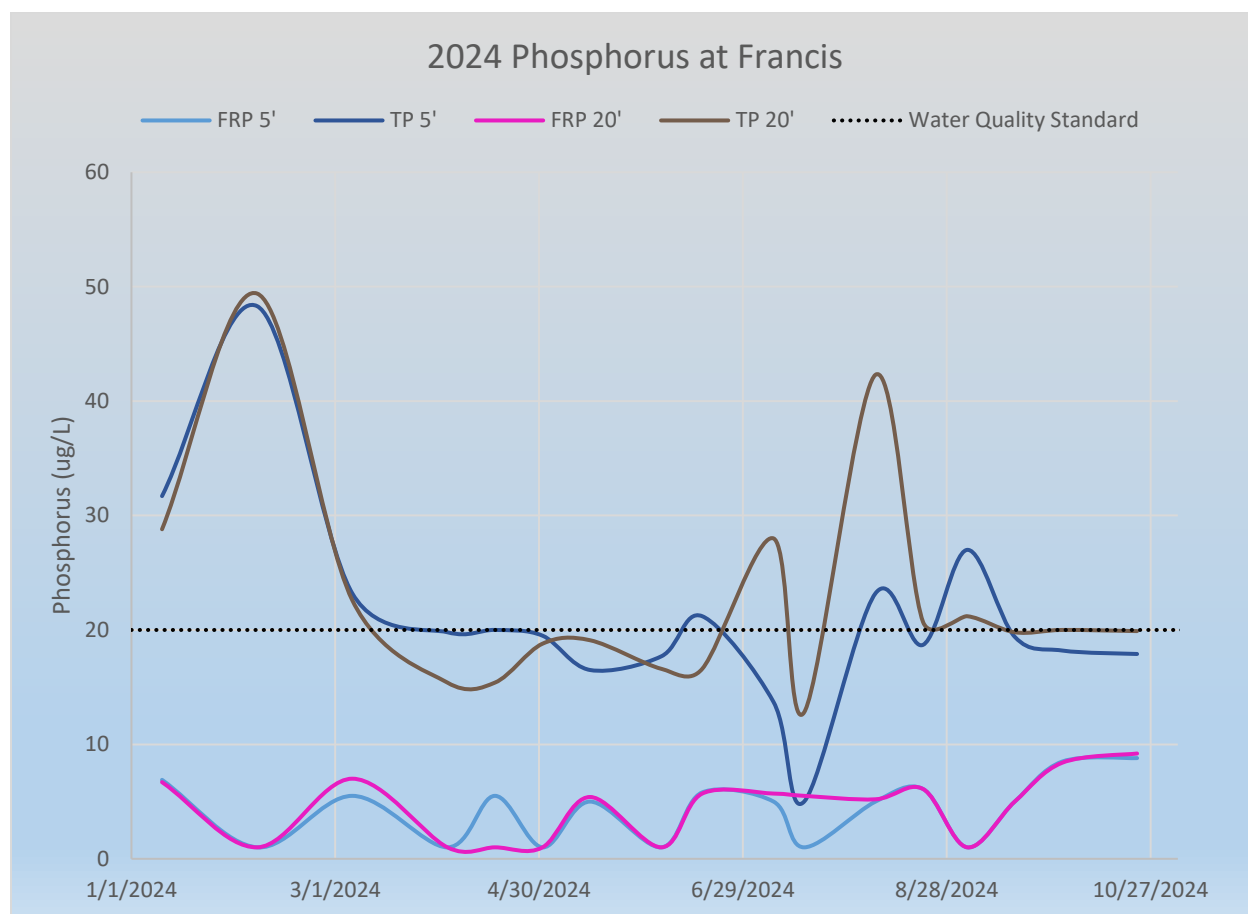


Figure 14 Kitsap Lake Phosphorus, 2024

Algae and Cyanobacteria

Cyanobacteria blooms have been well controlled since the City's treatment program began. The two critical times for treatment to prevent blooms are in the spring and fall of each year.

Kitsap Public Health Water Quality Monitoring

The Kitsap Public Health District's Water Pollution Identification and Correction Program includes monitoring and regular sampling of swimming beaches, including Kitsap Lake Park.

https://kitsappublichealth.org/environment/swimming_beach_advisories.php

Kitsap Public Health District releases an annual report comparing and quantifying water quality in Kitsap County, available here https://kitsappublichealth.org/environment/water_reports.php.

Adaptive Management

Adaptive management is the systematic use of information to improve operations, especially in the face of uncertainty. The adaptive management process can be applied at any scale, from budget processes to individual projects to overall stormwater management programs. This systematic process identifies uncertainties, monitors results, and informs actions. A formalized program that clearly articulates the uncertainties and monitors results reduces the risk of errors and allows programs to move forward in the face of uncertainty.

The Watershed Management Plan is comprised of program activities and individual projects that have been identified through prior data collection and system evaluations regarding water quality, flow control and habitat. These programmatic activities and projects are typically reviewed annually as part of capital project planning and budgeting. Data collection also occurs annually as part of routine monitoring, and as part of special time-limited projects. Combining annual programmatic planning with annual data review provides an opportunity to apply the adaptive management approach. More detailed program analysis, financial assessment and capital project planning occurs on a 6 to 7-year cycle as part of comprehensive planning and provides an additional opportunity for adaptive management measures.

Conclusions and Recommendations

The City of Bremerton will continue to protect and improve water quality in Kitsap Lake by following the guidelines and requirements of the NPDES stormwater permit, following the principles of low impact development for new and re-development projects in the Kitsap Lake watershed, and continuing current efforts on illicit discharge detection and elimination. Comprehensive data collection will continue with the City's lake sampling program.

Stormwater Management Action Planning will continue to be used to identify and prioritize projects in the City which present the most effective management actions to protect and restore water quality, including in the Kitsap Lake watershed. New projects by the City of Bremerton will address management of the high level of phosphorus in the lake, which feeds aquatic vegetation overgrowth and blooms of toxin producing blue green algae.

The City of Bremerton may wish to propose a lake management district for Kitsap Lake properties. If ongoing phosphorus treatments and other management methods are selected as the best way to address the cyanobacteria problems caused by high level of phosphorus, the annual cost of treatment may be significant.

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