Lake Whatcom Watershed

Total Phosphorus and Bacteria Total Maximum Daily Loads

Volume 2. Water Quality Improvement Report and Implementation Strategy

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Lake Whatcom Watershed
Total Phosphorus and Bacteria
Total Maximum Daily Loads

Volume 2. Water Quality Improvement Report and Implementation Strategy

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Executive Summary

In 1998, the Washington State Department of Ecology (Ecology) determined that Lake Whatcom did not have a natural level of dissolved oxygen and that several tributaries had excess bacteria. The Total Maximum Daily Load (TMDL) study demonstrated that low dissolved oxygen was caused by excess phosphorus in stormwater runoff related to development around the lake. This report (Volume 2) identifies how much phosphorus can be discharged to the lake and still meets the water quality criteria for dissolved oxygen. Water quality standards establish criteria that allow for only a minimal change from natural conditions.

This report also identifies how the previously-established bacteria load should be allocated between Whatcom County and the city of Bellingham to meet the water quality standard of support for *extraordinary primary contact recreation*.

The TMDL establishes phosphorus reduction targets that address the dissolved oxygen impairments, and also establishes "effective developed acre" targets that are directly linked to the phosphorus reduction targets. Either target, when implemented, will result in attainment of the dissolved oxygen standard.

During development of this TMDL, Ecology found that if runoff is reduced to match forested conditions in 87% of the current developed area, the remaining 13% of that developed area can continue to discharge stormwater as it does now. This does not mean that 87% of the developed area must be converted to forest. Rather, it means that the runoff from that land must be managed so that the effect on the lake is the same as if the runoff came from a forest. This can occur by improving the ground's ability to absorb and filter stormwater. Implementation options include (1) providing storage during storms so that infiltration can take place in-between storms, (2) rainwater harvest, (3) decreasing impervious surfaces, such as roofs, driveways, and roads, and (4) reducing concentration of phosphorus in stormwater through source control and treatment.

To address the bacteria impairments, the TMDL establishes allocations for reduced bacteria loading. In the course of the water quality study 11 tributary creeks to Lake Whatcom were sampled for nutrients and for fecal coliform bacteria. Sampling revealed that all of the tributaries have excessive fecal coliform bacteria in the dry season, and most tributaries have excessive bacteria in the wet season. To meet water quality standards, bacteria levels in the tributaries must be reduced by up to 96% in the most contaminated streams and by as little as 20% in the least contaminated streams.

Sources contributing to the high bacteria levels include human and animal sources. Sources of human waste may be from leaking sewer pipes or failed on-site-septic systems. On-site septic sources are addressed by the Whatcom County Health Department through inspections, as well as operation and maintenance requirements for homeowners. Leaking sewer pipes can be discovered by tracing contamination to the source. Any existing leaks should be identified and eliminated. The primary means of accomplishing the pollution reductions from animal sources will be people managing pet and livestock waste to prevent bacteria from entering flowing water.

Why did we develop a total maximum daily load (TMDL)?

The 303(d) list, which the federal Clean Water Act (Act) requires states to prepare, is a list of water bodies that do not meet state water quality standards. The Act requires that a TMDL be developed for each of the water bodies on the 303(d) list. Lake Whatcom is listed on the 303(d) list for both dissolved oxygen and fecal coliform bacteria. The TMDL study identifies pollution problems in the watershed, and then specifies how much pollution needs to be reduced or eliminated to achieve clean water. Then Ecology, with the assistance of local governments, agencies, and the community, develops a plan that describes actions to control the pollution, and a monitoring plan to assess the effectiveness of the water quality improvement activities. The water quality improvement report (WQIR) consists of the TMDL study and implementation strategy.

Watershed description

Lake Whatcom is a large natural lake in Whatcom County (Figure ES-1 vicinity map). The outlet of the lake is to Whatcom Creek at the northwest end, where it is regulated by a dam. During parts of the year when there is sufficient flow in the Middle Fork of the Nooksack River, water is diverted from the Middle Fork to Lake Whatcom by a tunnel and pipeline system. This diversion discharges to Mirror Lake, where heavier sediment is removed before the water enters Lake Whatcom at its southeast end through Anderson Creek.

Glacial sills divide Lake Whatcom into three main basins. Basin 1 to the northwest is closest to the city of Bellingham. It represents about 2% of the volume of the lake and about 10% of the lake area. The Geneva Sill, at a maximum depth of about 4 meters, separates Basin 1 and Basin 2. Basin 2 contains about 2% of the lake volume and about 8% of the area of the lake. There are no major tributaries into Basin 2. Strawberry Sill, at a maximum depth of about 12 meters, separates Basin 2 from Basin 3, which is the largest and deepest Lake Whatcom basin. Basin 3 to the southeast represents the remaining 82% of the area and 96% of the lake volume.

Lake Whatcom is the source of drinking water for nearly 100,000 people. Most of those people depend on the city of Bellingham's water treatment plant and distribution system. The city draws water from Basin 2 for treatment and distribution throughout the city as well as to some adjacent county residences. The next largest water provider is Lake Whatcom Water and Sewer District. The district draws water from Basin 3 north of the mouth of Austin Creek. There are also many individual homeowners adjacent to the lake that divert water from the lake for their personal domestic use.

Lake Whatcom supports important aquatic life. The Brannian Creek Hatchery, at the south end of the lake, supplies kokanee salmon eggs throughout the northwestern United States. It is one of the oldest self-sustaining kokanee hatcheries in the world. Lake Whatcom and its tributaries also support a native cutthroat trout population. Salmonid species (including trout) are highly sensitive to lake water quality changes in dissolved oxygen.

The goal of the dissolved oxygen TMDL is to limit phosphorous inputs to the lake to levels that will support near-natural dissolved oxygen levels. This will reduce the density of algae, restore the quality of the water as a source for drinking water, and improve aquatic habitat.

The goal of the fecal coliform TMDL is to limit fecal coliform to meet *extraordinary primary contact recreational* use. In addition to reducing the risk of exposure to pathogens for recreational users of the streams, the risk of pathogen exposure for households diverting water from the lake for their personal household use will also be lowered.

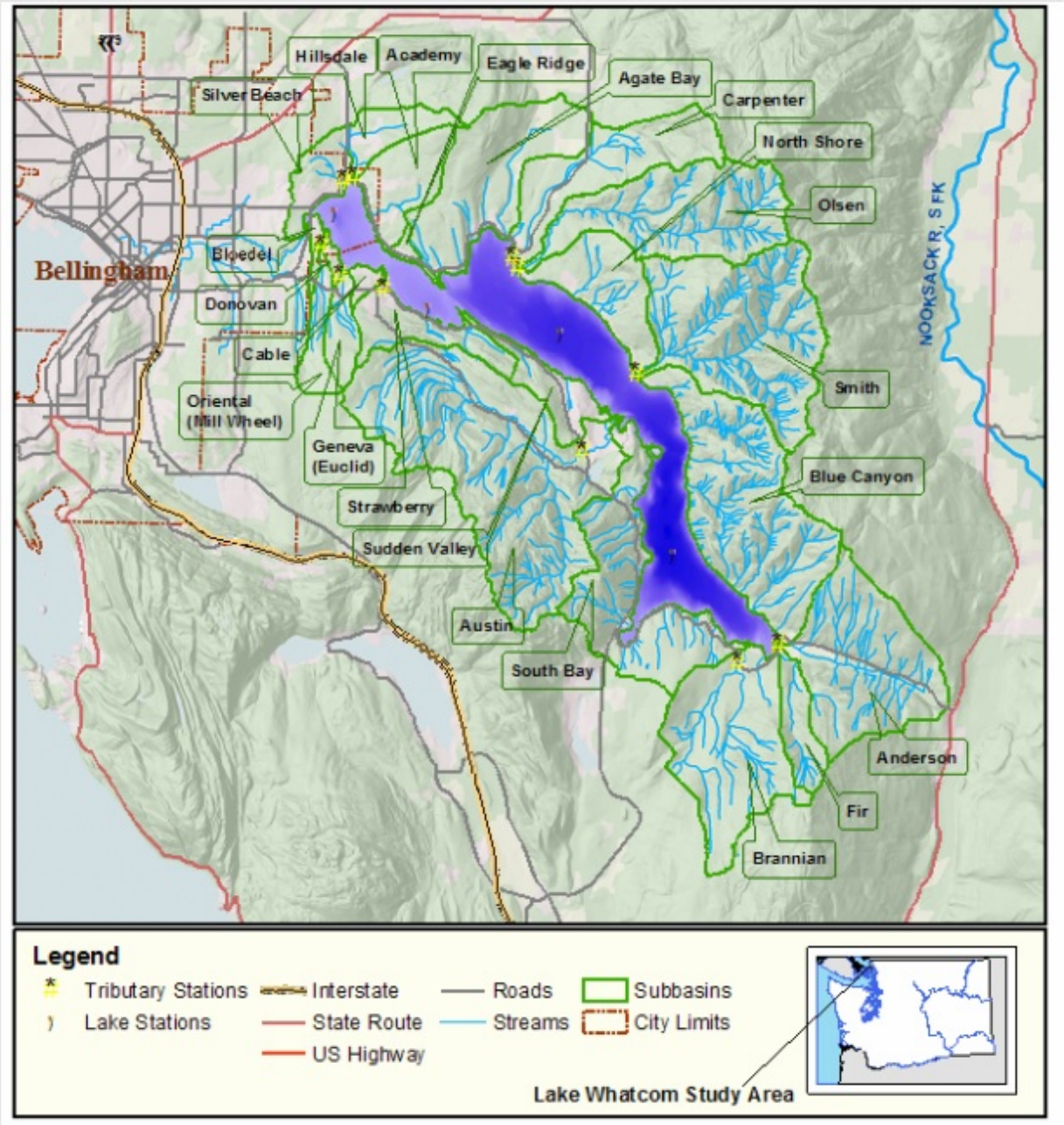


Figure ES-1. Lake Whatcom TMDL study area showing tributary watersheds and monitoring locations.

What needs to be done in this watershed?

Dissolved oxygen levels and phosphorus loading

Stormwater runoff needs to be treated so the phosphorus it carries to the lake is nearly the same as from a forested watershed. This is considered the "natural" loading level. Table ES-1 shows the estimated phosphorus loading that the lake can assimilate in a year with 2003 weather. As requested by the city of Bellingham and Whatcom County, Table ES-1 shows phosphorus loading from each jurisdiction within each tributary drainage, with the loading for the commercial forest land broken out separately.

Lake Whatcom can only accept slightly increased (beyond natural condition) levels of phosphorus and still meet water quality standards. Since natural phosphorus loading levels vary from year to year, primarily due to variable climatic conditions (temperature, wind, and precipitation), the *base condition* mass loading of phosphorous is expressed as the loading generated in 2003. This loading was calculated as a "normal" or "average" year prediction from a loading model of the watershed.

The mass loading in Table ES-1 is calculated by using a runoff model to estimate what the phosphorus loading would be if a percentage of the developed area in the watershed functioned like a forest. If 87% of the developed area around the lake, as estimated in 2010, stored water during rainstorms, filtered water through the soil, and transpired water back to the atmosphere as if it were covered by forest, the lake would have healthy levels of algae and dissolved oxygen.

Developed areas can function like a forest or native vegetation if there is sufficient storage to retain stormwater during storm events. Retaining the stormwater allows it to infiltrate during and after the storm event like it would do in forested conditions.

Stormwater treatment through filters can also be used to reduce phosphorus concentrations in polluted runoff. However, stormwater treatment using filters alone cannot achieve sufficient phosphorus reductions, and the installation and maintenance of the filters is tremendously expensive.

The simplest way to meet the phosphorus reduction goal is through full infiltration of runoff. If the impervious area on a parcel is limited to 10%, and 65% of the area remains as native vegetation, runoff from the developed area (up to 35%) can be absorbed by the native vegetation. As the proportion of developed area on a parcel increases, more substantial measures need to be taken in order to manage the water. The native vegetation will not have the capacity to absorb the increased runoff at the same level. Options include greater water storage and water reuse. Rain barrels and cisterns can replace lost storage from soil and leaves. Water reuse for dry-season irrigation or in-house use can extend the period of time available for infiltration and reduce phosphorus loading from runoff.

Table ES-1. Scenarios showing effective developed acres, total phosphorus, and fecal coliform loading by tributary.

Subbasin Name	Jurisdiction	Allocation Type	Existing Dev. Acres	87% Rollback Dev. Acres	Phosphorus		Wet Season		Dry Season	
					lb/2003 yr	lb/2003 dy	Fecal Coliform Target Geometric Mean	Fecal Coliform cfu/day	Fecal Coliform Target Geometric Mean	Fecal Coliform cfu/day
Academy	Bellingham	WLA	94.9	12.3	23.7	0.08	--	--	--	--
	Whatcom County	pWLA	173.2	22.5	76.8	0.28	--	--	--	--
	Whatcom County	WLA	22.9	3.0	6.9	0.02	--	--	--	--
Agate Bay	Whatcom County	pWLA	269.8	35.1	208.4	0.83	--	--	--	--
	Whatcom County	WLA	62.6	8.1	15.8	0.05	--	--	--	--
Anderson/Whatcom	Whatcom County	LA	120.8	15.7	401.9	0.99	--		--	
	Whatcom County	pWLA	133.7	17.4	117.0	0.29	50	2.87E+10	13	4.67E+09
Austin/Beaver	Whatcom County	LA	7.3	1.0	389.7	1.06				
	Whatcom County	pWLA	57.9	7.5	160.9	0.44	14	4.35E+09	17	2.58E+08
	Whatcom County	WLA	320.5	41.7	123.9	0.33	14	2.41E+10	17	1.43E+09

Subbasin Name	Jurisdiction	Allocation Type	Existing Dev. Acres	87% Rollback Dev. Acres	Phosphorus		Wet Season		Dry Season	
					lb/2003 yr	lb/2003 dy	Fecal Coliform Target Geometric Mean	Fecal Coliform cfu/day	Fecal Coliform Target Geometric Mean	Fecal Coliform cfu/day
Blodel	Bellingham	WLA	40.8	5.3	5.9	0.02	--	--	--	--
	Whatcom County	WLA	21.1	2.7	3.1	0.01	--	--	--	--
Blue Canyon	Whatcom County	LA	201.9	26.2	735.3	1.59	--	--	--	--
	Whatcom County	pWLA	51.0	6.6	94.7	0.21	--	--	--	--
Brannian	Whatcom County	LA	69.9	9.1	253.4	0.66				
	Whatcom County	pWLA	32.6	4.2	109.5	0.28	50	1.96E+09	31	2.08E+09
	Skagit County	LA	13.8	1.8	141.1	0.38	--	--	--	--
Cable	Whatcom County	WLA	100.2	13.0	11.6	0.04	4	--	3	--

Subbasin Name	Jurisdiction	Allocation Type	Existing Dev. Acres	87% Rollback Dev. Acres	Phosphorus		Wet Season		Dry Season	
					lb/2003 yr	lb/2003 dy	Fecal Coliform Target Geometric Mean	Fecal Coliform cfu/day	Fecal Coliform Target Geometric Mean	Fecal Coliform cfu/day
Carpenter	Whatcom County	LA	18.6	2.4	38.1	0.15	--	--	--	--
	Whatcom County	pWLA	183.2	23.8	128.7	0.47	12	2.91E+09	31	3.44E+08
	Whatcom County	WLA	38.0	4.9	10.3	0.03	12	6.03E+08	31	7.14E+07
Donavan	Bellingham	WLA	23.6	3.1	3.1	0.01	--	--	--	--
	Whatcom County	WLA	25.0	3.3	3.4	0.01	--	--	--	--
Eagle Ridge	Whatcom County	pWLA	16.8	2.2	7.3	0.03	--	--	--	--
	Whatcom County	WLA	30.5	4.0	7.2	0.02	--	--	--	--
Fir	Whatcom County	LA	2.5	0.3	103.4	0.21	--	--	--	--
	Whatcom County	pWLA	6.1	0.8	14.1	0.03	--	--	--	--
	Whatcom County	LA	0.0	0.0	10.0	0.02	--	--	--	--

Subbasin Name	Jurisdiction	Allocation Type	Existing Dev. Acres	87% Rollback Dev. Acres	Phosphorus		Wet Season		Dry Season	
					lb/2003 yr	lb/2003 dy	Fecal Coliform Target Geometric Mean	Fecal Coliform cfu/day	Fecal Coliform Target Geometric Mean	Fecal Coliform cfu/day
Geneva	Whatcom County	LA	0.0	0.0	1.6	0.00	--	--	--	--
	Whatcom County	pWLA	20.7	2.7	6.3	0.02	12	3.25E+08	22	1.94E+07
	Whatcom County	WLA	48.1	6.2	9.3	0.03	12	7.54E+08	22	4.51E+07
Hillsdale	Bellingham	WLA	16.8	2.2	3.3	0.01	17	1.21E+08	31	3.08E+07
	Whatcom County	pWLA	82.0	10.7	25.6	0.15	17	5.90E+08	31	1.50E+08
	Whatcom County	WLA	227.5	29.6	45.2	0.19	17	1.64E+09	31	4.17E+08
North Shore	Whatcom County	LA	42.8	5.6	90.8	0.37	--	--	--	--
	Whatcom County	pWLA	168.2	21.9	90.6	0.35	--	--	--	--
	Whatcom County	WLA	24.6	3.2	11.3	0.04	--	--	--	--

Subbasin Name	Jurisdiction	Allocation Type	Existing Dev. Acres	87% Rollback Dev. Acres	Phosphorus		Wet Season		Dry Season	
					lb/2003 yr	lb/2003 dy	Fecal Coliform Target Geometric Mean	Fecal Coliform cfu/day	Fecal Coliform Target Geometric Mean	Fecal Coliform cfu/day
Olsen	Whatcom County	LA	14.3	1.9	645.3	2.18	--	--	--	--
	Whatcom County	pWLA	10.6	1.4	44.9	0.15	50	1.94E+10	22	2.76E+09
	Whatcom County	WLA	2.6	0.3	3.7	0.01	50	4.81E+09	22	6.85E+08
Oriental	Bellingham	WLA	9.8	1.3	1.3	0.00	39	2.33E+08	42	3.31E+07
	Whatcom County	LA	0.0	0.0	7.6	0.02				
	Whatcom County	pWLA	0.1	0.0	8.1	0.02	39	2.57E+06	42	3.66E+05
	Whatcom County	WLA	86.3	11.2	14.2	0.04	39	2.06E+09	42	2.93E+08
Silver Beach	Bellingham	WLA	243.6	31.7	61.9	0.20	25	--	18	--
	Whatcom County	WLA	15.6	2.0	3.6	0.01	25	--	18	--
Smith/Whatcom	Whatcom County	LA	101.0	13.1	506.9	1.78				
	Whatcom County	pWLA	8.6	1.1	11.8	0.04	50	4.71E+09	31	2.86E+09

Subbasin Name	Jurisdiction	Allocation Type	Existing Dev. Acres	87% Rollback Dev. Acres	Phosphorus		Wet Season		Dry Season	
					lb/2003 yr	lb/2003 dy	Fecal Coliform Target Geometric Mean	Fecal Coliform cfu/day	Fecal Coliform Target Geometric Mean	Fecal Coliform cfu/day
South Bay	Whatcom County	LA	2.7	0.4	222.0	0.56	--	--	--	--
	Whatcom County	pWLA	263.5	34.2	259.8	0.62	--	--	--	--
	Whatcom County	WLA	74.2	9.6	62.6	0.15	--	--	--	--
Strawberry	Whatcom County	LA	0.0	0.0	0.4	0.00	--	--	--	--
	Whatcom County	pWLA	90.8	11.8	66.6	0.18	--	--	--	--
	Whatcom County	WLA	164.2	21.3	24.8	0.09	--	--	--	--
Sudden Valley	Whatcom County	pWLA	17.9	2.3	16.7	0.04	--	--	--	--
	Whatcom County	WLA	230.8	30.0	115.7	0.23	--	--	--	--
Totals			4106.2	533.8	5566.8					

WLA: Wasteload allocation.
LA: Load allocation.

Approach to permitting

A National Pollutant Discharge Elimination System (NPDES) general permit issued by Ecology under the Clean Water Act covers the discharge into Lake Whatcom of municipal stormwater from the stormwater conveyance systems of Whatcom County and the city of Bellingham. A separate NPDES permit issued by Ecology covers stormwater from construction activities that disturb more than one acre. A TMDL must identify the wasteload allocations associated with NPDES permits. The permit must also require that the wasteload allocations in the TMDL are met as a part of permit compliance (see NPDES Municipal Stormwater permit Appendix 2-TMDL). Permits for stormwater discharge may use mandatory activities as the means of meeting the wasteload allocations, instead of only requiring direct water quality monitoring measurements.

In developing the dissolved oxygen TMDL, Ecology found that total phosphorus loading levels are associated with developed land area. This TMDL introduces a surrogate called "effective developed acres". These are developed acres that have not been retrofitted to discharge forest level loads of phosphorus. Wasteload allocations have been developed for phosphorus loading and "effective developed acres," and are based on the fraction of the total allowable loading to the lake generated by the fraction of the developed area of the lake watershed that contributes to the stormwater discharge permit. However, the fraction of the area covered by permit will change over time as municipal stormwater systems are extended and as new areas are covered by construction stormwater permits. The permit defines a regulated area, but in fact the permit regulates discharges from the municipal storm sewer system (MS4). This TMDL considers all discharges from the regulated area as wasteload allocations. Discharges from the part of the watershed that is not yet regulated are identified as proposed wasteload allocations. Areas that are zoned for Commercial Forest are considered load allocations.

For distributed sources in a watershed a unit load, in terms of pollutant per acre, is equal to the total load in the watershed divided by the total area of the watershed. Therefore an area, whether covered by an NPDES permit or not, will have the same allocation in terms of unit load. The allocation is based on the allowable unit load per acre of the drainage where it is located. If the municipal stormwater system is extended to carry runoff from an area not previously served, the same allocation will apply to this new area included in the Municipal Stormwater Discharge Permit. However, because the boundary of land that drains to storm drainage systems is not mapped, we cannot accurately separate load allocations from wasteload allocations. In this situation, loading capacity has been listed as a wasteload allocation.

Similarly, areas that are not yet cleared are not subject to the Construction Stormwater General Permit. We cannot make an allocation for areas that have not yet applied for the Construction Stormwater General Permit. The wasteload allocation for the permit is the existing underlying allocation, calculated as the unit load, and multiplied by the area converted from nonpoint source to point source. The same wasteload allocation applies if the land is also covered by the Municipal Stormwater Permit or if it had been previously covered as a load allocation. That is, the allocations are not additive, but one allocation applies under all permits.

One of the requirements of the Municipal Stormwater Permit is to control runoff from new development. To meet that requirement, both the city of Bellingham and Whatcom County prohibit ground disturbance during the wet season in the Lake Whatcom watershed. For activities requiring a Construction Stormwater NPDES permit, compliance with both local government regulations, which prevent ground clearing in the wet season, and the general permit conditions will meet the wasteload allocations.

Land zoned for commercial forest was removed from the wasteload allocations and is listed separately as a load allocation. This land is typically in the headwaters and is categorically exempt from NPDES permits at this time. Whatcom County and the city of Bellingham will be applying the same Stormwater Management Program required under their permit to areas subject to the load allocation and the wasteload allocation. When the areas that drain directly to the lake can be mapped, an estimate of the load allocation will be made and deducted from the wasteload allocation.

Permit implementation

Measuring pollutant loading in stormwater is difficult. The variations from storm to storm make it difficult to evaluate the discharge of any storm against a standard. In this case, the standard is the discharge from an area contributing runoff to a point of discharge, in a year with weather like 2003. For this reason, the permit requirement to comply with the wasteload allocation will be expressed as actions that must be taken under the NPDES Phase II Municipal Stormwater Permit.

For municipal stormwater dischargers, compliance with the wasteload allocation will require development of an implementation plan that identifies the suite of actions necessary to comply with the limits of the wasteload. The actions considered are identified in the Implementation Strategy located in the last part of this document. How much of each activity is necessary and how long it will take to achieve all of the actions is not yet identified. Defining that the shortest timeframe for completing the implementation of the TMDL is required in the first permit cycle. A water quality implementation plan (WQIP) will be developed that provides that level of detail.

When complete, the plan will include development regulations to address new development and redeveloped properties, as well as incentives to retrofit existing development. The WQIP will require a retrofit program to address public infrastructure. As part of the WQIP, a schedule and budget are required.

As an intermediate step, in order to facilitate public input to decision makers such as the city of Bellingham and Whatcom County administration and councils, a plan with a fixed timeline (50 years to complete all actions) will be developed, and will include an estimated budget by activity. A second plan will be developed with a fixed budget (existing or reasonably forecast funding) and an estimate of the time needed for the complete implementation of all actions. Based on these two versions of an implementation plan, a final plan with budget and timeline will be developed.

Fecal coliform loading

The fecal coliform loads are divided among the jurisdictions based on the fraction of total land area within each jurisdiction. The target geometric mean remains constant, but the estimated total load of colony forming units is proportional to the contributing land area to each tributary. The primary means of reducing fecal coliform is by controlling bacteria sources and eliminating fecal-contaminated discharges. Both the city of Bellingham and Whatcom County have illicit discharge elimination programs that will need to ensure stormwater discharges are not contaminated with fecal coliform. Allocations are summarized in table ES-1.

Why this matters

Phosphorus

Phosphorus is the main cause of Lake Whatcom's low-oxygen problem. Phosphorus occurs naturally, but development increases phosphorus entering the lake in stormwater. Computer predictions show the lake would meet state standards for oxygen if there was 85.5% less development than existed in 2003. Since 2003, additional lots have been developed in the watershed, but development regulations required more forest to be preserved as a part of development. Based on current development, 87% percent of the developed area would need to function like a forest to meet water quality standards.

Sources

Sources include runoff from bare soil and developed areas. Phosphorus occurs naturally in soil, human and animal waste, and is added to some detergents and fertilizers.

Connection to algae and oxygen

Phosphorus feeds algae growth. Bacteria that consume dying algae deplete the oxygen that fish and other aquatic life need to survive. When oxygen levels are low, phosphorus is released from lake sediment and re-enters the water, perpetuating the cycle. The dissolved oxygen levels in Lake Whatcom fail to meet Washington State water quality standards, and these levels have the potential to get much worse, making the problem much more difficult to fix.

Treatment of drinking water

Excess phosphorus creates larger algae blooms, which require more treatment to make the water safe for drinking. Treatment may also create more trihalomethanes, a byproduct that some studies link to cancer.

Effect of development

Roofs, driveways, and other impermeable surfaces interrupt the absorption and filtration provided by forests and soils, and instead send phosphorus-laden stormwater rushing to the lake. Communities must modify existing and future development to create the same effect as removing development.

Fecal coliform

Fecal coliform bacteria originate in human and animal waste. Eleven tributaries feeding Lake Whatcom fail to meet state standards for fecal coliform bacteria. The bacteria create a health risk for people who work, use, or play in and around the water.

Sources

Runoff carries the bacteria from the ground and from failing septic systems into the lake. Sources of bacteria include leaking sewer lines, failing septic systems, pet waste, livestock and wildlife.

Water Quality Improvement Report

Introduction

The Washington State Department of Ecology (Ecology) published a total maximum daily load (TMDL) study in 2008. The study evaluated areas of the Lake Whatcom watershed with known or suspected water quality issues. These areas include Lake Whatcom, Anderson Creek, Austin Creek, Brannian Creek, Cable Street Drain, Carpenter Creek, Euclid Creek, Mill Wheel Creek, Olsen Creek, Park Place Drain, Silver Beach Creek, and Smith Creek. Key results of that study are presented in *Lake Whatcom Watershed Total Phosphorus and Bacteria Total Maximum Daily Loads: Volume 1. Water Quality Study Findings* (Pickett and Hood, 2008). (https://fortress.wa.gov/ecy/publications/summarypages/0803024.html).

What is a total maximum daily load (TMDL)?

A TMDL is a numerical value representing the highest pollutant load a surface water body can receive and still meet water quality standards. Pollution above the TMDL limit must be reduced or eliminated.

Federal Clean Water Act requirements

The Clean Water Act established a process to identify and clean up polluted waters. The Act requires each state to have its own water quality standards designed to protect, restore, and preserve water quality. Water quality standards consist of (1) designated uses for protection, such as cold water biota and drinking water supply, and (2) criteria, usually numeric criteria, to achieve those uses.

The Water Quality Assessment and the 303(d) List

Every two years, states are required to prepare a list of water bodies that do not meet water quality standards. This list is called the Clean Water Act 303(d) list. In Washington State, this list is part of the Water Quality Assessment (WQA) process.

To develop the WQA, Ecology compiles its own water quality data along with data from local, state, and federal governments, tribes, industries, and citizen monitoring groups. All data in this WQA are reviewed to ensure that they were collected using appropriate scientific methods before they are used to develop the assessment. The WQA divides water bodies into five categories. Those not meeting standards are given a Category 5 designation, which collectively becomes the 303(d) list.

Category 1 – Meets standards for parameter(s) for which it has been tested.

Category 2 – Waters of concern.

Category 3 – Waters with no data or insufficient data available.

Category 4 – Polluted waters that do not require a TMDL because they:

4a. – Have an approved TMDL being implemented.

4b. – Have a pollution control program in place that should solve the problem.

4c. – Are impaired by a non-pollutant such as low water flow, dams, or culverts.

Category 5 – Polluted waters that require a TMDL – the 303(d) list.

Further information is available at Ecology's Water Quality Assessment website (www.ecy.wa.gov/programs/wq/303d/).

The Clean Water Act requires that a total maximum daily load (TMDL) be developed for each of the water bodies on the 303(d) list.

Who should participate in this TMDL?

Nonpoint source pollutant load targets have been set in this TMDL. However, except for land zoned as "commercial forest," non-point loads cannot be clearly distinguished from the point sources. Therefore, loading from all nonpoint sources from land that allows uses other than forestry are addressed as part of the municipal stormwater allocation. If nonpoint sources are later mapped and segregated, we will still depend on successful control of stormwater. To avoid more stringent requirements being placed in NPDES permits, the Stormwater Management Program must provide reasonable assurance that load allocations will be met. Because nonpoint pollution comes from diffuse sources, all upstream watershed areas have the potential to affect downstream water quality. As such, all potential nonpoint sources in the watershed must use the appropriate best management practices to reduce impacts to water quality. The area subject to the TMDL is shown in Figure 1.

Similarly, all point source dischargers in the watershed must also comply with the requirements of their NPDES permits (which are required to be consistent with the assumptions and requirements of the TMDL). In this TMDL, the point source dischargers are similar to nonpoint sources: both have diffuse discharge locations. However, only point source dischargers are covered by an NPDES permit. The city of Bellingham and Whatcom County hold permits for the discharge of stormwater from their municipal stormwater system. As noted previously, the nonpoint source and point source boundaries have not been drawn with the exception of commercial forest zone land. Any area that discharges directly to the lake or one of its tributaries without passing through a municipal storm sewer system is a nonpoint source.

The goal of the storm sewer system is to apply a Stormwater Management program that prevents pollutants from entering the system. That program can be applied equally to nonpoint source and to point sources. So in this TMDL all allocations are expressed as wasteload allocations. When areas separate from the municipal storm sewer system can be mapped, the associated load allocation can be removed from the wasteload allocation as long as the same controls are applied to achieve both load allocations and wasteload allocations.

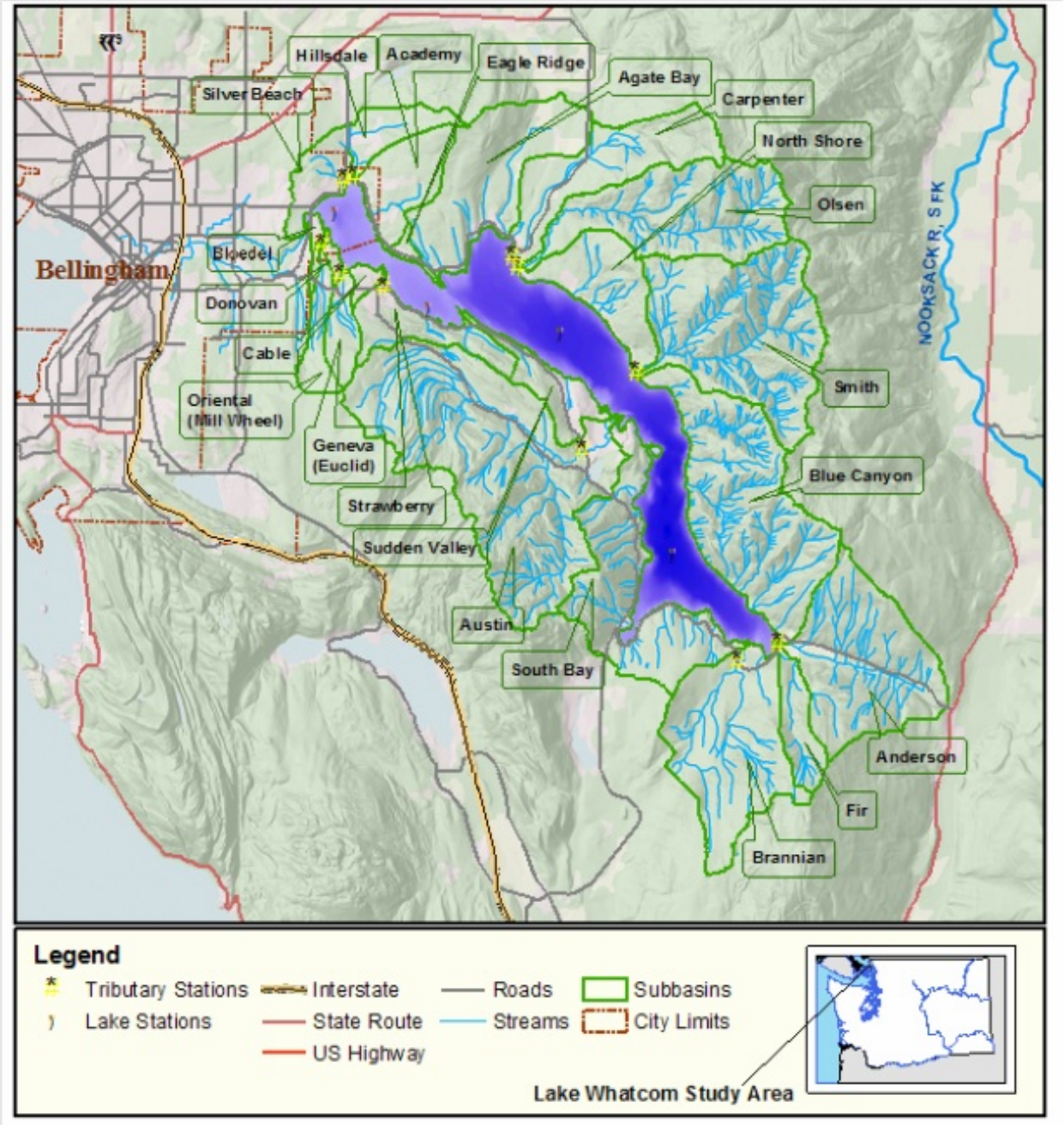


Figure 1. Lake Whatcom watershed showing tributary basins and monitoring sites

TMDL process overview

Ecology uses the 303(d) list to prioritize and initiate TMDL studies across the state. A TMDL study identifies pollution problems in the watershed and specifies how much pollution needs to be reduced or eliminated to achieve clean water. Ecology, with the assistance of local governments, tribes, agencies, and the community, then develops a strategy to control and reduce pollution sources as well as a monitoring plan to assess effectiveness of the water quality improvement activities. Together, the study, water cleanup targets, and implementation strategy comprise the Water Quality Improvement Report (WQIR).

Once the U.S. Environmental Protection Agency (EPA) approves the WQIR, a water quality implementation plan (WQIP) is developed a year later. The WQIP identifies specific tasks, responsible parties, and timelines for reducing or eliminating pollution sources and achieving clean water. In the Lake Whatcom case, because of significant investment of money and time, additional time for the development of the WQIP is anticipated.

Elements the Clean Water Act requires in a TMDL

Loading capacity, allocations, seasonal variation, margin of safety, and reserve capacity

A water-body's *loading capacity* is the amount of a given pollutant that a water body 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 source is a *wasteload* or *load* allocation. If the pollutant comes from a discrete (point) source subject to a NPDES permit, 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 diffuse (nonpoint) sources not subject to an NPDES permit, such as general urban, residential, or farm runoff, the cumulative share is called a *load allocation*.

If a TMDL makes a wasteload allocation, assuming a reduction in nonpoint sources of pollution, *reasonable assurances* that the reduction will be achieved must be provided. When there are not reasonable assurances the entire load reduction must be assigned to the point sources. This provides a strong incentive for the point sources to assist in developing programs that will provide reasonable assurances that the nonpoint reductions will be achieved. Often the reasonable assurances are in the form of an enforceable local ordinance or program.

The TMDL must also consider *seasonal variations* and include a *margin of safety,* which take into account any lack of knowledge about the causes of the water quality problem or its loading capacity. A *reserve capacity* for future pollutant sources is sometimes included as well. Therefore, a TMDL is the sum of the wasteload and load allocations, any margin of safety, and any reserve capacity. The TMDL must be equal to or less than the loading capacity.

Surrogate measures

When it is difficult to measure a pollutant allocation directly, a surrogate measure may be used to provide more meaningful and measurable pollutant loading targets. EPA regulations [40 CFR 130.2(i)] allow "other appropriate measures" in a TMDL. The Report of the Federal Advisory Committee on the Total Maximum Daily Load (TMDL) Program (EPA, 1998) includes the following guidance on the use of surrogate measures for TMDL development:

> *When the impairment is tied to a pollutant for which a numeric criterion is not possible, or where the impairment is identified but cannot be attributed to a single traditional "pollutant," the state should try to identify another (surrogate) environmental indicator that can be used to develop a quantified TMDL, using*

numeric analytical techniques where they are available, and best professional judgment (BPJ) where they are not.

The surrogate measure must be designed to meet water quality standards, including both numeric or narrative criteria and the water-body's designated uses. A surrogate measure can be assigned to a nonpoint source load allocation (for example, effective shade targets to reduce stream temperature) or to a point source wasteload allocation (for example, stormwater flow or percent impervious surface).

Ecology has established phosphorus allocations for stormwater discharges in this TMDL which, if achieved, are expected to result in the attainment of dissolved oxygen standards. Ecology has also established "effective developed acre" surrogate targets that, if implemented, are expected to result in the attainment of dissolved oxygen standards. Either target, when implemented, will result in attainment of the dissolved oxygen standard. The surrogate is provided as a more direct measure of the changes that need to be made to reduce pollution. The maximum daily load of phosphorus is calculated based on adjusting the effective developed acres target to meet water quality standards.

Why Ecology conducted a TMDL study in this watershed

Background

Ecology conducted a TMDL study in this watershed because Lake Whatcom was placed on the 303(d) list of impaired water bodies in 1998. This decision was made because the rate at which oxygen levels declined in the bottom of the lake in the summer had increased over time in the basin closest to Bellingham (Basin 1). This information indicated that oxygen levels were below natural levels.

Silver Beach Creek was also on the 1998 303(d) list of impaired water bodies for excess fecal coliform bacteria.

Lake Whatcom is in Water Resource Inventory Area 1 (WRIA 1), which includes the Nooksack Watershed and nearby watersheds that drain to the Salish Sea. In 2001, all of the potential TMDLs for WRIA 1 were evaluated to determine which projects should be initiated first. Because Lake Whatcom supports aquatic life, is vulnerable to additional degradation, and is a very important drinking water supply, it was determined that this project should be started first. The TMDL for bacteria was included because for minimal additional cost samples for bacteria could be collected when other samples were collected.

The purpose of this TMDL project is to identify the amount of pollution that can enter Lake Whatcom and its tributaries and still meet water quality standards. Meeting water quality standards requires meeting criteria, supporting beneficial uses, and satisfying antidegradation. Meeting the water quality criteria for oxygen levels in the lake will mean controlling algae growth by controlling the limiting nutrient (phosphorus) entering the lake from tributaries and

other sources in the watershed. Meeting standards for bacteria will mean reducing bacteria in the tributaries themselves.

The study area for this TMDL consists of Lake Whatcom and its tributary subbasins (Figure 1). The downstream point of the study area is the Electric Avenue Bridge near the lake's outlet. The diversion from the Middle Fork Nooksack River to Lake Whatcom is also included as a background source in this study. The diversion is operated under the city of Bellingham's water right and TMDLs cannot alter a water right, so we account for that source but do not make assumptions about how it will be changed.

WRIA 1 has been the focus of a watershed planning process since 1998 (www.ecy.wa.gov/programs/eap/wrias/Planning/01.html). For this study, the historical land use covers and a modification of the existing land use covers from the watershed planning process were used. The report also evaluates a modification of the existing land use to bring it up to 2009 development conditions.

Impairments addressed by this TMDL

The main uses intended to be protected by this TMDL are domestic water supply; aquatic life; salmon and trout spawning; core rearing and migration for salmonids; extraordinary primary contact recreation; and miscellaneous uses such as wildlife habitat, harvesting, commerce and navigation, boating, and aesthetics.

These uses will be protected by decreasing the loading of the phosphorus and fecal coliform bacteria into the water bodies. The water bodies on the 303(d) list of impaired waters is summarized in Table 1.

Table 1. Study area water bodies on the 2012 303(d) list for dissolved oxygen, total phosphorus, and fecal coliform addressed by this TMDL.

Water body	Parameter	Listing ID	NHD reachcode	Township	Range	Section
Whatcom Lake	Dissolved Oxygen	5846	17110004015288	Grid Cell: 48122H4G1		
Silver Beach Creek	Fecal Coliform	7120	17110004014799	38N	3E	22
Whatcom Lake	Total Phosphorus	8621	17110004015288	Grid Cell: 48122H3D3		
Anderson Creek	Fecal Coliform	39036	17110004014459	37N	4E	26
Smith Creek	Fecal Coliform	39145	17110004014650	37N	4E	05
Olsen Creek	Fecal Coliform	45589	17110004013681	38N	4E	30
Brannian Creek	Fecal Coliform	45603	17110004014737	37N	4E	27
Carpenter Creek	Fecal Coliform	45604	17110004014376	38N	4E	30
Austin Creek	Fecal Coliform	45617	17110004013567	37N	4E	08

Water body	Parameter	Listing ID	NHD reachcode	Township	Range	Section
Euclid Creek	Fecal Coliform	45618	17110004013599	38N	3E	27
Silver Beach Creek	Fecal Coliform	45633	17110004014792	38N	3E	22
Mill Wheel Creek	Fecal Coliform	45652	17110004014028	38N	3E	27

There are other parameters for which Lake Whatcom is impaired. Austin and Euclid Creek are also impaired for Dissolved Oxygen. The analysis for this TMDL did not provide enough information to determine if meeting the wasteload allocations and load allocations would be sufficient to attain water quality standards so those impairments are not listed in the Table 1.

The area covered by this TMDL

The area subject to this TMDL, also known as the TMDL *footprint*, is shown in Figure 1. The entire Lake Whatcom watershed is affected by this TMDL.

Applicable water quality standards

Lake Whatcom is a critical water supply source for nearly 100,000 Whatcom County residents, including those in the city of Bellingham and in the Lake Whatcom Water and Sewer District (formerly Water District No. 10). The city uses its water supply for industrial, commercial, and residential uses. The number of direct withdrawals by single family residences (SFR) is not known, but is estimated to be between 150 and 400 SFR (Buroker, 2007).

Lake Whatcom provides habitat to both warmwater and coldwater fish. The lake provides the brood stock for the Brannian Creek Hatchery, which is the state's source of kokanee for fish stocking throughout the state. Bass fishing tournaments in Lake Whatcom are popular and attract many fishers from throughout the state.

The lake provides source water for the Washington Department of Fish and Wildlife's Whatcom Falls Fish Hatchery, which raises cutthroat and rainbow trout for stocking lakes and ponds throughout northwest Washington. Lake Whatcom also provides instream flow for water quality purposes in Whatcom Creek during low-flow periods of late July to early September. That is the flow necessary to support aquatic life.

Lake Whatcom is a regional recreation destination for swimming and boating. Many homes have docks and water craft which residents use throughout the year.

Dissolved oxygen

Aquatic organisms are very sensitive to reductions in the level of dissolved oxygen in the water. The health of fish and other aquatic species depends on maintaining an adequate supply of oxygen dissolved in the water. Oxygen levels affect growth rates, swimming ability, susceptibility to disease, and the relative ability to endure other environmental stressors and

pollutants. While direct mortality due to inadequate oxygen can occur, the state designed the water quality criteria to maintain conditions that support healthy populations of fish and other aquatic life.

Oxygen levels can fluctuate over the day and night in response to changes in climatic conditions as well as the respiratory requirements of aquatic plants and algae. Since the health of aquatic species is tied predominantly to the pattern of daily minimum oxygen concentrations, the criteria are based on the lowest one-day minimum oxygen concentrations that occur in a water body.

In the summer, Lake Whatcom forms a warm surface layer and a cooler pool of water at the bottom, called the hypolimnion. The surface of the lake has the atmosphere and photosynthesis by algae to supply oxygen. Wind mixes the surface layer but does not mix the hypolimnion, so the atmosphere cannot provide oxygen to the lower pool. The depth of the surface layer (about 30 feet) limits the amount of photosynthesis in the lower pool. Because of this, the hypolimnion has no significant supply of oxygen beyond what is dissolved in the water when the layers form. A typical configuration is shown in Figure 2 by coloring in the grid representing the different layers. The figure is the grid used in the CE-QUAL-W2 model used to simulate the lake response to inputs.

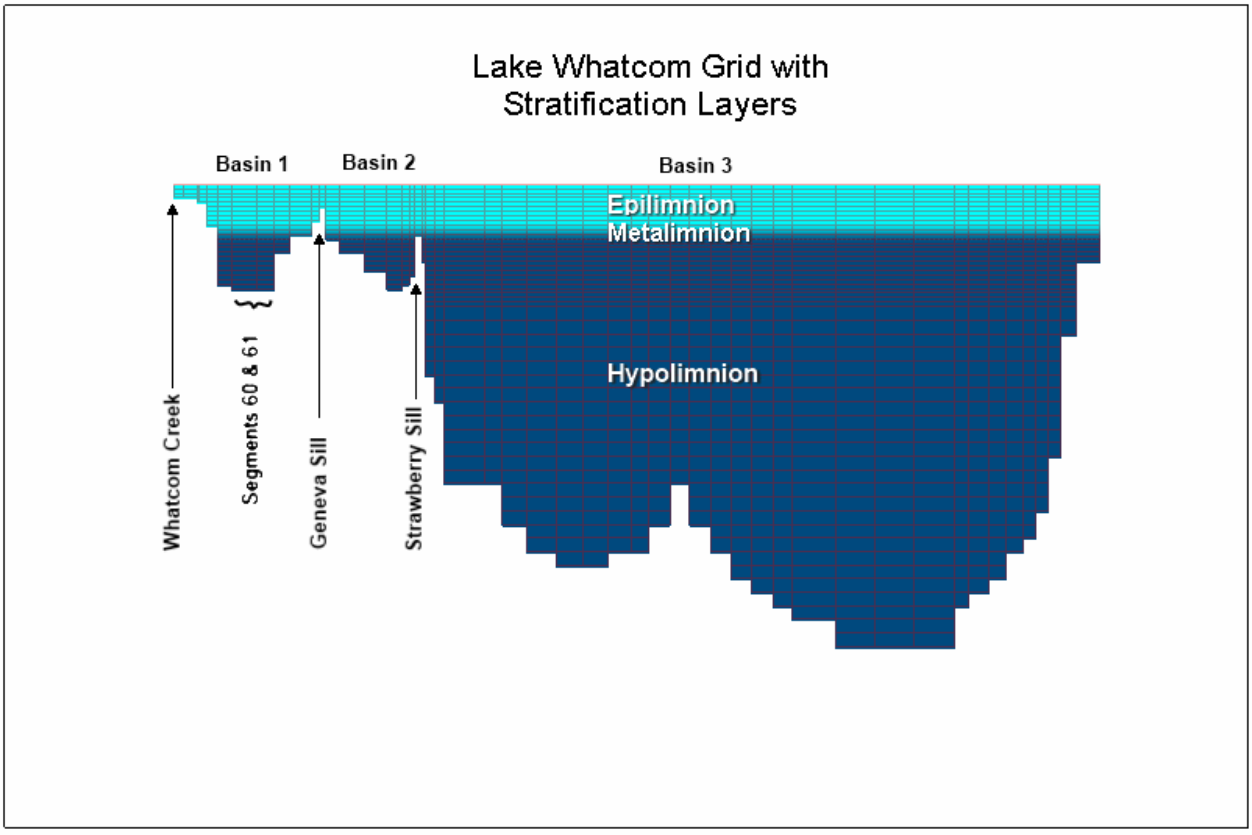


Figure 2. Cross-section of Lake Whatcom with vertical exaggeration to show stratified layers.

Of particular interest in this TMDL project is the connection between nutrients and the decline of oxygen in the hypolimnion. Phosphorus is the limiting nutrient for most of the lake and during most of the year (Matthews et al., 2002a). Excess phosphorus promotes additional algae growth.

Algae settling and decaying in the hypolimnion increases the consumption of oxygen in that lake layer. An analysis of the monitoring that led to the 303(d) listing showed that the rate of oxygen loss was increasing over time. As a result, low oxygen levels in the hypolimnion were beginning earlier in the year, developing more rapidly, and lasting for longer durations.

Since the health of aquatic species is tied predominantly to the pattern of daily minimum dissolved oxygen concentrations, the applicable criterion is typically expressed as the lowest one-day minimum dissolved oxygen concentration that occurs in a water body. However, stratified lakes need to be treated differently because seasonally dissolved oxygen reaches levels far below numeric criteria in many lakes under natural conditions.

In the Washington State water quality standards, freshwater aquatic life use categories are described using key species (salmonid versus warmwater) and life-stage conditions (spawning versus rearing). Minimum concentrations of dissolved oxygen are used as criteria to protect different categories of aquatic communities [WAC 173-201A-200; 2003 edition].

Lakes have specific standards for recognizing dissolved oxygen conditions. For all lakes, and for reservoirs with a mean annual retention time of greater than 15 days, human actions considered cumulatively may not decrease the one-day minimum oxygen concentration more than 0.2 mg/L below estimated natural conditions.

Stratified lakes may be very sensitive to small changes that affect the thermal differences between the bottom and the top of a lake. The thermal differences create stratified layers where water quality may vary widely throughout the water column. This dynamic quality of the lake and the method of modeling the lake create challenges for applying the standards to model results.

In the lake model (described later in this report), dissolved oxygen concentrations are available for each model cell at a specified time interval. To balance temporal resolution with output file size, three-hour intervals were chosen. The daily minimum is estimated using the lowest of the eight daily values.

Over most of the model, except the deepest areas of Basin 3, the model cells are one meter deep and several hundred meters long. The model resolution is such that small vertical differences are easily seen. Therefore, comparing different scenarios on a cell-by-cell or day-by-day basis may show differences that are indicative of physical changes but do not represent impairment of aquatic uses.

An alternative approach is to aggregate dissolved oxygen data from the model output over a volume of the lake representing critical segments and during months representing a critical time period. In other words, this alternative approach looks at a subsection of the length of the lake with the most severe decline in oxygen, during the season when that decline occurs, and evaluates how much water in that subsection has low oxygen levels. To meet water quality standards, the volume of water with low oxygen in the subsection should be the same as under natural conditions. Included is a 0.2 mg/l allowed decrease from natural conditions. For instance, if under natural conditions there are 1 million cubic meters of water with less than 2.2

mg/l of dissolved oxygen in the natural condition, the acceptable dissolved oxygen level would be 2.0 mg/L for the same volume of water.

In practice, this is done by identifying the spatial and temporal extents of interest. The total volume of the lake in the model cells for this space and time that have less than a particular dissolved oxygen level is added up. The cumulative volumes at each dissolved oxygen level in one scenario are compared to the dissolved oxygen levels for the same cumulative volumes from a scenario that estimates the natural dissolved oxygen levels. If, for a given aggregated volume of water, the oxygen level in the test scenario water is more than 0.2 mg/L below the oxygen level of the same volume of natural water, then the criterion is not met.

Aesthetic values and phosphorus

Aesthetic narrative criteria are defined in WAC 173-201A-160(2)(b) and apply to all existing and designated uses for fresh water. The standards state that: *Aesthetic values must not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch, or taste.* (See WAC 173-201A-230 for guidance on establishing lake nutrient standards to protect aesthetics.)

This TMDL is addressing a 303(d) listing for total phosphorus; however, there are no numeric criteria for phosphorus. The listing is based on the narrative criterion. Studies have identified Lake Whatcom as phosphorus-limited *except for* a small period of time in late fall in Basin 1 (Matthews et al., 2002a).

As identified previously under the discussion on dissolved oxygen, phosphorus has an effect on dissolved oxygen by stimulating algal growth. Excess algae not only contribute to dissolved oxygen depletion but can also affect aesthetic values. The phosphorus reductions necessary to meet dissolved oxygen criteria will control the algae that cause the aesthetic impairment. Therefore, this TMDL will use dissolved oxygen as the criterion to determine loading limits for total phosphorus, which will be linked back to land use practices, nutrient deposition and transport processes. The levels of total phosphorus necessary to meet the numeric dissolved oxygen criterion will be more than adequate to meet the narrative criterion.

Bacteria

Bacteria criteria are set to protect people who work and play in and on the water from waterborne illnesses. In the Washington State water quality standards, fecal coliform is used as the indicator bacteria for the state's freshwaters (e.g., lakes and streams) because it indicates the presence of waste from humans and other warm-blooded animals. Waste from warm-blooded animals is more likely to contain pathogens that will cause illness in humans than waste from cold-blooded animals. The fecal coliform criteria are set at levels that have been shown to maintain low rates of serious intestinal illness (gastroenteritis) in people.

The extraordinary primary contact use is intended for waters capable of "providing extraordinary protection against waterborne disease or that serve as tributaries to extraordinary quality shellfish harvesting areas." To protect this use category: "Fecal coliform organism levels must not exceed a geometric mean value of 50 colonies/100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating

the geometric mean value exceeding 100 colonies/100 mL" [WAC 173-201A-200(2)(b), 2003 edition].

Because of the variability of bacteria levels, compliance is based on meeting both the geometric mean criterion and the 10% of samples (or single sample if less than ten total samples) limit. These two measures used in combination ensure that bacterial pollution in a water body will be maintained at levels that will not cause a greater risk to human health than allowable. The water quality standards state:

> When averaging bacteria sample data for comparison to the geometric mean criterion, it is preferable to average by season and include five or more data collection events within each period. Averaging of data collected beyond a thirty-day period, or beyond a specific discharge event under investigation, is not permitted when such averaging would skew the data set so as to mask noncompliance periods.

The criteria for fecal coliform are based on allowing minimal risk of illness to humans who work or play in a water body. The criteria used in the state standards are designed to allow seven or fewer illnesses out of every 1,000 people swimming or bathing in the water. If the concentration of fecal coliform in the water rises above the numeric criterion, human sources need to be controlled to bring concentrations back into compliance with the standard.

The specific level of illness rates caused by bacteria from animal waste (versus human waste) cannot be calculated. However, warm-blooded animals are a common source of serious waterborne illness for humans, especially animals managed by humans and thus exposed to human-derived pathogens.

Ecology study methods

Data quality and collection

The previous report, *Lake Whatcom Watershed Total Phosphorus and Bacteria Total Maximum Daily Loads: Volume I. Water Quality Study Findings*, described data quality for model development and calibration (Pickett and Hood, 2008). Volume 1 also described data collection for model development and calibration. The only additional data included in this volume are addressed in the following section. The additional data come from sources outside of Ecology and were used to develop the new scenario representing existing conditions.

Information and data from sources outside of Ecology

Information on land cover was developed from data supplied by the city of Bellingham and Whatcom County. The county and the city provided a list of parcels permitted for the construction of homes between 2002 and 2008. Using GIS, parcels in the watershed that were developed from 2002 to 2008 were sampled to determine the percentage of each lot covered by impervious area and forested area. The remaining 2002-2008 developed area was classified as residential pervious.

Ecology used this information to create new land cover classes in the Lake Whatcom watershed. For each new land class, a fraction of the forest in the 2002 existing land cover was converted to residential impervious and to residential pervious, based on the comparison of the sampled parcels.

Whatcom County zoning

Calculation of percentages of impervious and forested land cover

Approximately 10% of Whatcom County parcels (not within the city of Bellingham) were sampled. Lot boundaries from Whatcom County parcel data were used with 2009 National Agriculture Imagery Program orthophotography to estimate areas. The large dispersion in data indicated a need to use stratification of the lots based on zoning. Some zones that were under-sampled and had high variation required additional sampling.

It was determined, based on review of the data and discussions with the Lake Whatcom Management Interjurisdictional Coordinating Team, to create the classes in the list that follows. In general, zoning classes defined by Whatcom County were used. However, if there was a great distinction between individual zones combined together in a single zoning class, the individual zones were broken out. The residential rural (RR) zoning class had a large variation of retained forest canopy. Since a significant number of lots in this class were developed at five acres and greater, with a substantial amount of forest canopy retained, the RR zoning was broken into large and small lots.

Whatcom County residential classes:

- UR: Urban Residential, Including UR, UR3, and URM12 zoning
- RES RURAL: Residential Rural, Including R2A, R5A, and R10A
- RR1: Residential Rural 1
- RR2: Residential Rural 2
- RF: Rural Forestry

City of Bellingham zoning

The city of Bellingham maintains data on the amount of impervious area and forest cover of each lot. Approximately 10% of the sites were examined using GIS to determine consistency with measurements from orthophotography, as performed on Whatcom County data. Consistency was confirmed; therefore, all of the data provided by the city of Bellingham were used. No significant difference between zones in Bellingham was evident, so all Bellingham data were pooled to create one residential class: City of Bellingham residential class.

The parcels identified as developed were compared to the existing conditions land cover from the WRIA 1 Watershed Management Project. The purpose was to confirm the assumption that lots developed between 2002 and 2008 were characterized as Forest in the Base Scenario (BAS) used in Volume 1 (Pickett and Hood, 2008) to represent the calibration conditions. With the exception of the urban residential class, this was confirmed.

Approximately 40% of the lots developed between 2002 and 2008 were already classified as developed in the existing land cover. This is because the 30-m resolution of the land coverage approaches the size of many of the lots in the urban residential class (10,000 sq ft), and because much of the development in that class is infill.

Conversion and apportionment to watershed basins

The city of Bellingham and Whatcom County parcels were combined. This created a single layer of new development, and each parcel was assigned a new residential class. These data were overlaid with layers defining reaches (or drainage areas) used to model runoff loading with the HSPF[1] model. That GIS evaluation determined the area in each residential land cover class for each reach used in the runoff loading model. Figure 3 shows the results.

The ratio for residential land cover classes was adjusted to assume 40% of each lot was already converted, reflecting the effects of small parcel size and infill. For each HSPF reach, a number of forested acres were converted to residential pervious and impervious cover based on the number of acres developed in each of the new residential land cover classes.

The HSPF input file was then adjusted by subtracting the appropriate number of acres of forest and adding the appropriate number of acres of both residential pervious and residential impervious area. These numbers were calculated based on the acres of each of the new land cover classes in each subbasin and the ratios in Table 2.

Table 2. New residential land classes with fraction dedicated to existing HSPF land covers.

New Residential Land Cover Classes	Zones Affected	Converted from Forest	Residential Pervious	Impervious
RES RURAL	R2A, R5A, R10A	60%	58%	2%
RF	RF	0%	0%	0%
RR1	RR1	90%	70%	20%
RR2	RR2	100%	60%	40%
UR	UR, UR3, URM12	60%	45%	15%
COB	All zones in city	88%	61%	27%

[1] Hydrological Simulation Program - Fortran

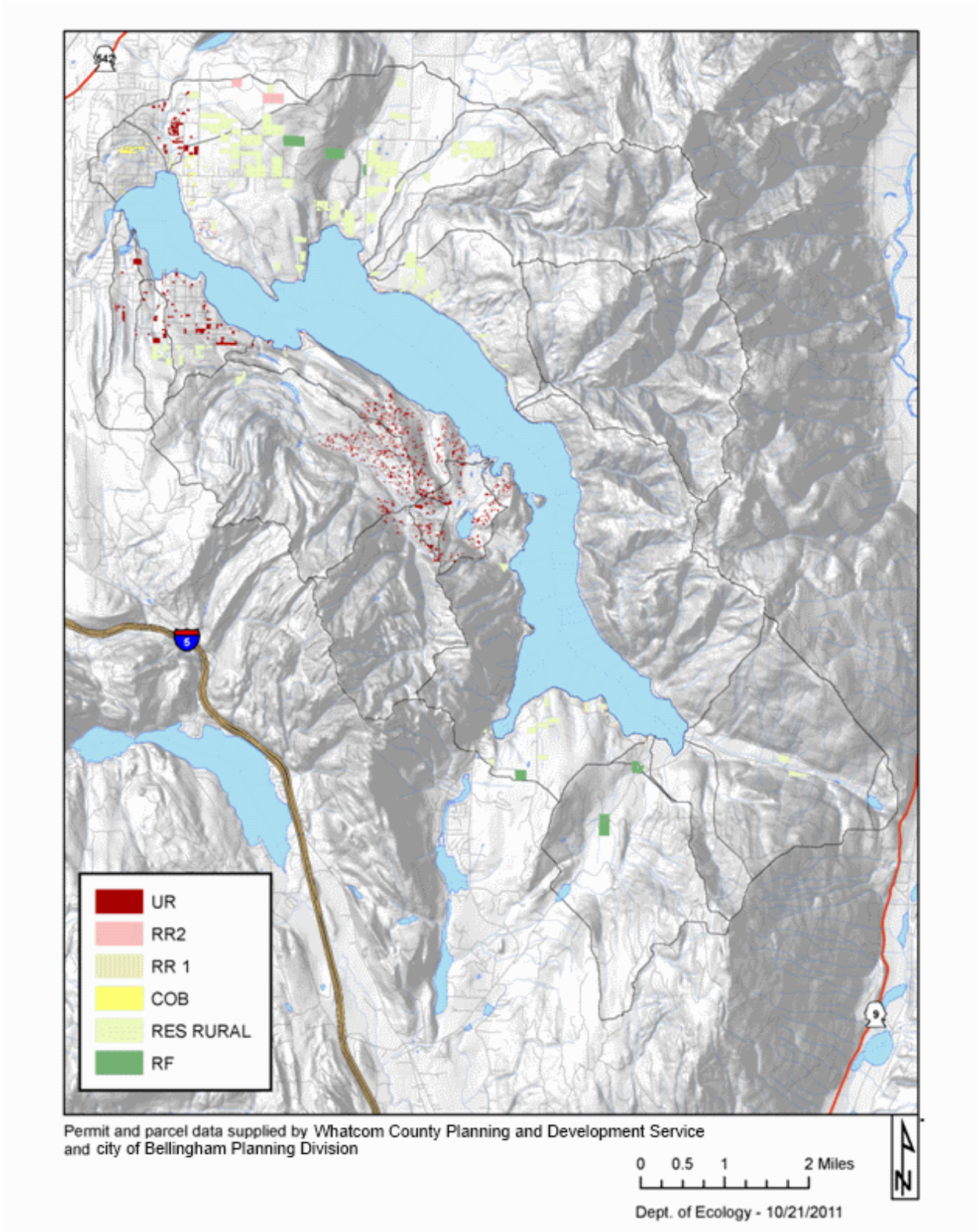


Figure 3. New development in Lake Whatcom watershed by new land cover classes.

Ecology Study Results and Discussion

Study approach

Volume 1 Study

Volume 1 of this report (Pickett and Hood, 2008) analyzed two scenarios: 1) "BAS" representing the Base Scenario – existing conditions in 2002/2003; and 2) "FBO" representing the Full Buildout as zoned in 2002. The two scenarios were intended to provide information to help local jurisdictions evaluate how much existing sources of pollution should be reduced to accommodate new development.

The results showed that even at 2002 levels of development the necessary reductions were very significant. The city of Bellingham subsequently adopted development regulations that do not allow new development to increase phosphorus loading above that contributed from the site when forested or in native vegetation. Whatcom County is in the process of developing and adopting regulations that will achieve the same goal.

Volume 2 Study

This volume (Volume 2) estimates existing loading from the development that took place from the development of the BAS land cover up through 2009. Reductions are calculated from the 2009 starting point without any allowance for additional sources of new development.

The same process as described in Volume 1 was used to estimate existing loads and to determine the reductions required to meet water quality standards. The Existing Conditions Scenario was developed to reflect the amount of forest that had been converted to pervious and impervious land cover as a result of development since 2002. The modeled developed areas were reduced using the same partial rollback methods described in Volume 1. An 87% rollback is required to meet water quality standards.

Both the city of Bellingham and Whatcom County revised their development regulations after 2002 to require more native vegetation be preserved. A survey of lots developed since 2002 demonstrated that on larger lots the new regulations preserved a significant portion of the property. While a significant area was developed, the effect it had on the lake was mitigated by not disturbing the entire parcel.

Conclusions and recommendations

Conclusions

If runoff is reduced to match forested conditions in 87% of the current developed area, Lake Whatcom will meet water quality standards for dissolved oxygen and phosphorus. This is a slight change from the results of the original study (Volume 1).

Currently, 12% of the Lake Whatcom watershed is developed. Achieving this reduction in phosphorous loading would allow the watershed to function as if only 2% of the watershed were developed. The total phosphorus loading from both forest and developed areas would be reduced from 3,958 kg/2003 year to 2,534 kg/2003 year.

Recommendations

The city of Bellingham and Whatcom County need to develop plans to retrofit existing development to remove 87% of the phosphorus that is being generated in excess of what forested lands would generate. The plans must address both private and public development. New development must have phosphorus loading that is no greater than the area would naturally generate when covered by forest or native vegetation. If the loading is greater, then the difference must be mitigated by concurrent reductions of existing development in excess of the 87% target.

The Lake Whatcom Management Program should continue to be the forum to coordinate the plans of the entities.

TMDL analysis

Dissolved oxygen-phosphorus

Analytical framework

Volume 1 of the Lake Whatcom Watershed Phosphorus and Bacteria TMDL described the analytical framework for the TMDL in great detail. This volume (Volume 2) provides analysis of the existing conditions of phosphorus loading and how the loading affects dissolved oxygen levels. In Volume 1 (Pickett and Hood, 2008), Tables 7 though 10 show the acres of land cover and percentages in each HSPF subbasin for the Base Scenario and Full Buildout Scenario. In this volume, Tables 3, 4 and 5 show the same data updated with the Existing Conditions Scenario.

Model calibration

No additional calibration work took place. Models described in Volume 1 (Pickett and Hood, 2008) were used with land cover areas adjusted to reflect existing conditions as identified previously, without further calibration.

Compliance with standards

The CE-QUAL-W2 model output from the Existing Conditions Scenario showed dissolved oxygen fails to meet water quality standards. Figure 4 shows the cumulative dissolved oxygen for the Existing Condition Scenario for the most sensitive segments of the lake, segments 60 and 61. The description of the basis for the cumulative volume is found on pages 64 and 65 of Volume 1. Similar to Volume 1, Figures 26 through 31, Figure 4 shows:

- The cumulative volume of water that has at least the specified concentration of dissolved oxygen is shown as a green line.
- The full rollback, representing natural conditions, is shown with a blue line.

- The dashed blue line represents the water quality criteria of no more than 0.2 mg/l less than natural conditions.
- Areas where the green line is to the left of the dashed line represent an oxygen deficit, a failure to meet water quality standards, and are shaded in red. The scale of the deficit is calculated as the area (mg/L * million cubic meters).

From Figure 4, we can see the impairment is in the water with the lowest dissolved oxygen levels. Because the water near the surface tends to have more oxygen than the water near the bottom it is easy to make the mistake of reading the dissolved oxygen level as a surrogate for depth. This is not precisely true. In early summer water at the bottom of the lake will have modest levels of dissolved oxygen (say 5 mg/L). Later in the summer the water at the bottom of the lake will have dissolved oxygen levels of 0 mg/L and water near to a 10 meter depth will have dissolved oxygen at about 5 mg/L. It is safe to say the very lowest levels of oxygen are only found at the base of the lake and the highest levels of oxygen are within 10 meters of the surface of the lake. Additional oxygen at levels around 10 mg/L in the developed scenario is a result of algal production from photosynthesis in the epilimnion (top layer). This does not offset the deficit in volume of water with less than 2 mg/L at the hypolimnion (lower layer).

Figure 5 shows the comparison of the 87% rollback from Existing Conditions Scenario compared to the Full Rollback and demonstrates compliance with standards.

Table 3. Total acres per reach by land use category – Existing Conditions Scenario.

HSPF Subbasin Name	Reach	HSPF Land Use Category								Total Acres of Subbasin
		Agriculture	Deciduous Forest	Developed	Evergreen Forest	Mixed Forest	Open	Water/ Wetlands	Developed–Impervious	
Mirror Lake	3001	-	54	-	8	33	25	13	-	134
Anderson Creek	3005	77	591	11	1,015	749	126	6	3	2,579
NE Lake Whatcom Inflow 1	3006	11	152	2	329	161	4	2	1	663
NE Lake Whatcom Inflow 2	3010	2	453	15	1,436	1,106	201	24	4	3,241
Smith Creek	3015	-	498	-	1,486	1,174	105	-	-	3,263
Smith Creek Outlet	3018	-	12	1	4	18	4	0	0	40
Olsen Creek	3020	-	375	16	1,220	817	16	0	5	2,448
Carpenter Creek	3025	4	147	65	186	308	37	1	19	766
N Lake Whatcom Inflow	3030	1	255	109	187	455	104	14	31	1,156
Silver Beach Creek	3035	0	104	222	88	209	27	-	63	712
NW Lake Whatcom Inflow	3040	114	1,355	695	224	991	116	24	199	3,718
Brannian Creek	3045	-	493	13	1,071	619	97	2	4	2,298
Brannian Creek Outflow	3050	-	17	12	11	25	2	1	4	70
S Lake Whatcom Inflow	3055	0	698	132	489	769	153	28	38	2,307
Upper Austin Creek	3060	1	100	8	1,306	336	5	-	3	1,759
Beaver Creek	3065	0	598	121	1,134	1,139	8	1	34	3,036
Austin Creek	3070	-	9	17	62	25	1	-	5	118
Austin Creek Outflow	3072	-	26	130	110	96	9	28	35	433
SW Lake Whatcom Inflow 2	3075	0	130	219	258	258	9	15	61	950
SW Lake Whatcom Inflow 1	3080	-	69	278	51	96	11	1	76	582
Euclid Creek	3085	-	55	79	66	116	2	-	22	340
Mill Wheel Creek	3090	-	75	126	104	227	3	4	34	574
Total		212	6,264	2,273	10,843	9,726	1,062	164	641	31,185
Percent		1%	20%	7%	35%	31%	3%	1%	2%	100%

Calculations based on several significant digits. Table values rounded to nearest acre or nearest percent.

Table 4. Percentages per reach by land use category – Existing Conditions Scenario..

HSPF Subbasin Name	Reach	HSPF Land Use Category								Total Acres of Subbasin
		Agriculture	Deciduous Forest	Developed	Evergreen Forest	Mixed Forest	Open	Water/ Wetlands	Developed–Impervious	
Mirror Lake		-	40.7%	-	5.8%	24.8%	18.9%	9.9%	-	0.4%
Anderson Creek	3001	3.0%	22.9%	0.4%	39.3%	29.0%	4.9%	0.2%	0.1%	8.3%
NE Lake Whatcom Inflow 1	3005	1.7%	23.0%	0.4%	49.6%	24.4%	0.6%	0.3%	0.1%	2.1%
NE Lake Whatcom Inflow 2	3006	0.1%	14.0%	0.5%	44.3%	34.1%	6.2%	0.7%	0.1%	10.4%
Smith Creek	3010	-	15.3%	-	45.6%	36.0%	3.2%	-	-	10.5%
Smith Creek Outlet	3015	-	30.7%	3.5%	9.2%	45.3%	10.1%	0.2%	1.0%	0.1%
Olsen Creek	3018	-	15.3%	0.7%	49.8%	33.4%	0.6%	0.0%	0.2%	7.9%
Carpenter Creek	3020	0.5%	19.2%	8.4%	24.2%	40.2%	4.8%	0.1%	2.5%	2.5%
N Lake Whatcom Inflow	3025	0.1%	22.0%	9.5%	16.2%	39.4%	9.0%	1.2%	2.7%	3.7%
Silver Beach Creek	3030	0.0%	14.6%	31.2%	12.3%	29.3%	3.7%	-	8.8%	2.3%
NW Lake Whatcom Inflow	3035	3.1%	36.4%	18.7%	6.0%	26.6%	3.1%	0.7%	5.3%	11.9%
Brannian Creek	3040	-	21.5%	0.6%	46.6%	26.9%	4.2%	0.1%	0.2%	7.4%
Brannian Creek Outflow	3045	-	24.0%	17.7%	15.1%	35.1%	2.3%	0.9%	5.0%	0.2%
S Lake Whatcom Inflow	3050	0.0%	30.2%	5.7%	21.2%	33.3%	6.6%	1.2%	1.6%	7.4%
Upper Austin Creek	3055	0.1%	5.7%	0.5%	74.2%	19.1%	0.3%	-	0.1%	5.6%
Beaver Creek	3060	0.0%	19.7%	4.0%	37.4%	37.5%	0.3%	0.0%	1.1%	9.7%
Austin Creek	3065	-	7.4%	14.8%	52.3%	20.9%	0.4%	-	4.2%	0.4%
Austin Creek Outflow	3070	-	6.0%	30.0%	25.4%	22.1%	2.0%	6.4%	8.2%	1.4%
SW Lake Whatcom Inflow 2	3072	0.0%	13.7%	23.0%	27.2%	27.1%	0.9%	1.6%	6.4%	3.0%
SW Lake Whatcom Inflow 1	3075	-	11.8%	47.7%	8.8%	16.4%	1.9%	0.2%	13.1%	1.9%
Euclid Creek	3080	-	16.0%	23.1%	19.5%	34.2%	0.7%	-	6.5%	1.1%
Mill Wheel Creek	3085	-	13.1%	22.0%	18.2%	39.6%	0.5%	0.7%	6.0%	1.8%
Mirror Lake		-	40.7%	-	5.8%	24.8%	18.9%	9.9%	-	0.4%
Anderson Creek	3001	3.0%	22.9%	0.4%	39.3%	29.0%	4.9%	0.2%	0.1%	8.3%

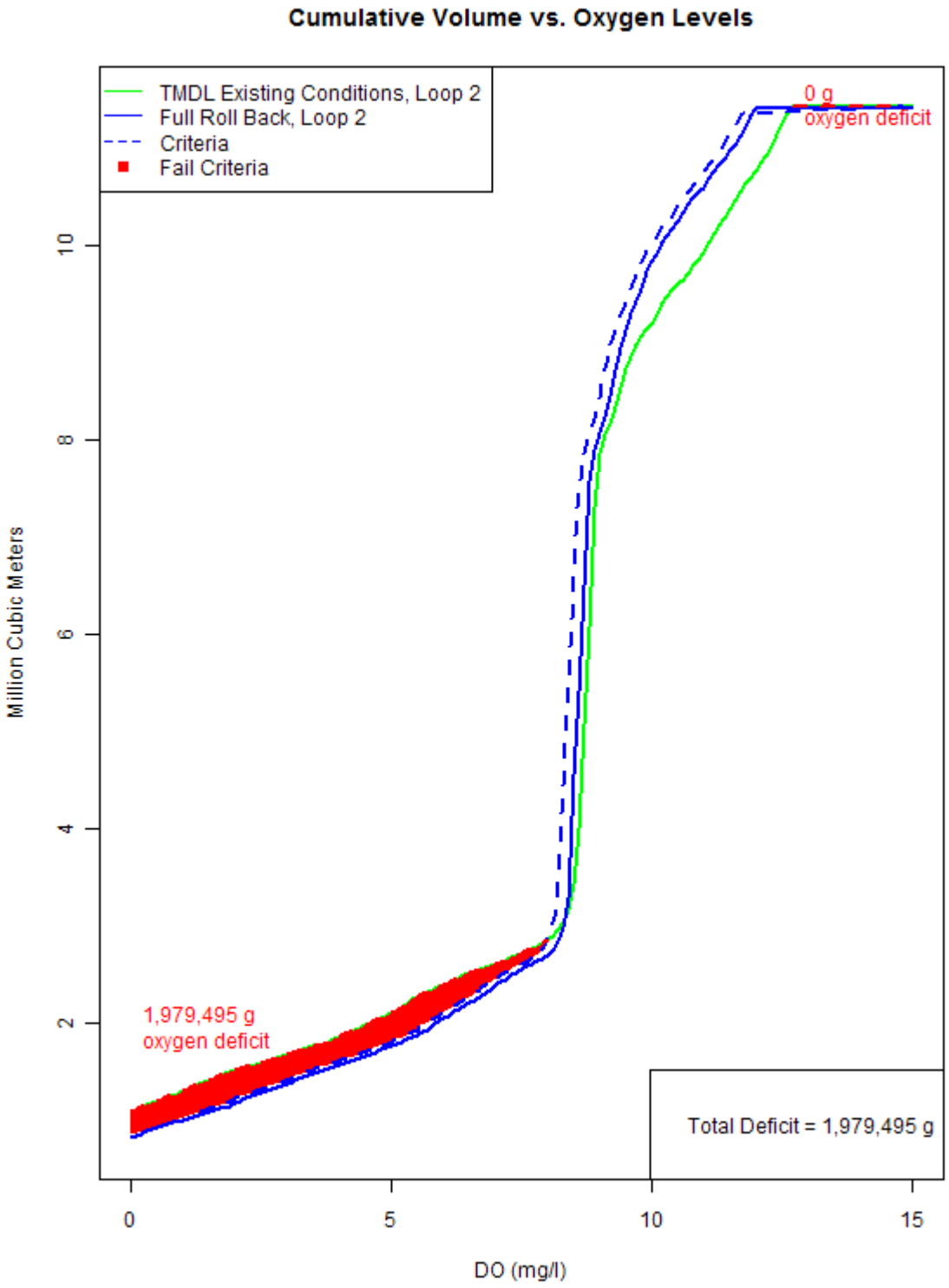


Figure 4. Comparison of Existing Conditions Scenario to Full Rollback Scenario *in terms of cumulative volumes of dissolved oxygen in Basin 1 (segments 60 and 61), June - October.*

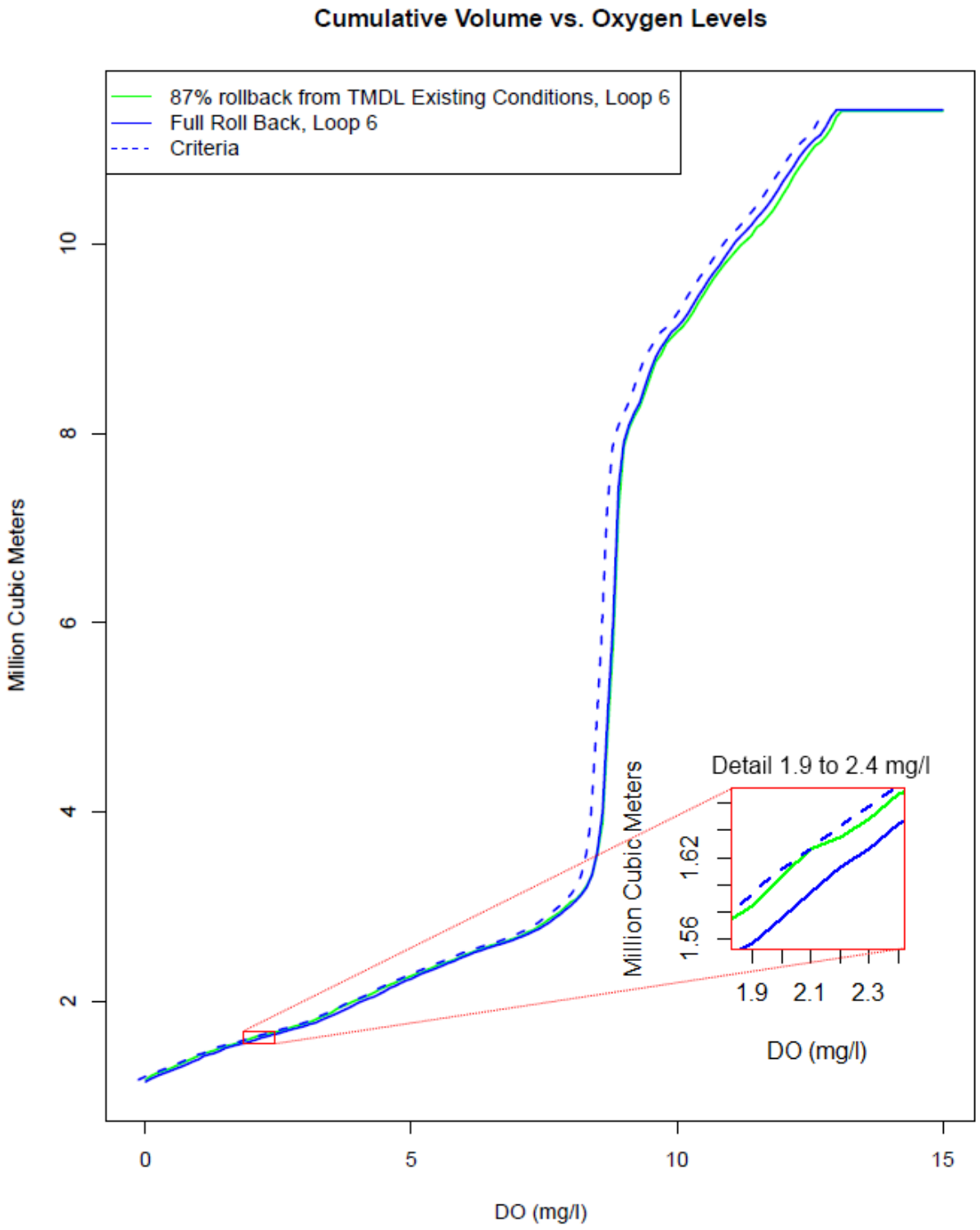


Figure 5. Comparison of Existing Conditions Scenario with 87% reduction in development to Full Rollback Scenario *in terms of cumulative volumes of dissolved oxygen in Basin I (segments 60 and 61), June - October.*

Loading capacity

Phosphorus

When 87% of the developed land within each subbasin is modeled as forest land, the lake meets the water quality standards. Across the entire watershed 3,539.6 of the 4,080.2 effective developed acres were modeled as forest land.

The cumulative oxygen distribution is shown in Figure 5. This figure is similar to Figures 29 and 30 from the *Lake Whatcom Watershed Total Phosphorus and Bacteria Total Maximum Daily Loads: Volume 1. Water Quality Study Findings (Pickett and Hood, 2008).* The green line, representing the cumulative dissolved oxygen at 87% rollback from the Existing Conditions Scenario, is about 0.2 mg/L lower in oxygen than a comparable volume of water under the Full Rollback Scenario.

There is also a slight enrichment of dissolved oxygen for the volumes of water with greater than 9 mg/l. However, this does not offset the lack of oxygen elsewhere. Algal photosynthesis in the epilimnion results in oxygen enrichment and decomposition in the hypolimnion generates oxygen deficits. In Figure 5, the oxygen deficits are no greater than 0.2 mg/L compared to the Full Rollback Scenario.

Loading capacity for this TMDL is expressed as mass of phosphorus per unit of time, and was estimated by modeling the effect of phosphorus from stormwater runoff on dissolved oxygen in Lake Whatcom. The existing watershed was modified to find the lowest fraction of development that had to function like a forest and meet water quality criteria for dissolved oxygen. Because inputs of phosphorus vary widely from day to day, season to season, and year to year, annual loading is the most representative way of expressing the allowable loading. However, maximum daily loading is included in this TMDL as well (see Table 5). A calendar year was used in the model because the lake is well mixed at the start of the calendar year (January 1), but is in a state of decaying stratification at the beginning of the water year (October 1). Variations in annual rainfall drive the variations in annual phosphorus loading. In this TMDL, the annual loading from the base condition (calendar year 2003) is reduced by modeling 87% of the developed area as forest land to estimate the phosphorus loading that would meet water quality standards. The developed acres that were not modeled as forest in calculating the maximum daily load are presented as a surrogate measure and called *effective developed acres*. In practice, we may find that all development needs some modification; nor can all sites be altered to the same degree. The phosphorus target and the "effective developed acres" targets are functionally equivalent; either target, when implemented, will result in attainment of the dissolved oxygen standard.

In order to partition allocations to individual jurisdictions and to estimate loading for each WRIA 1 Watershed Management Project drainage, estimated areal loading (pounds per acre) was calculated from the HSPF results of the Existing Conditions Scenario and the 87% rollback from the Existing Scenario. The estimates are based on the solution to the following equations:

$A*x + B*y = C$

$D*x + E*y = F$

$D = 0.1325*A$

$E = B + 0.8675*A$

Where:

x = areal loading rate for effective developed acres

y = areal loading rate for undeveloped acres

A = number of effective developed acres in Existing Conditions Scenario

B = number of forested/wetland acres in Existing Conditions Scenario

C = mass loading of phosphorus under Existing Conditions Scenario

D = number of effective developed acres in Rollback Scenario

E = number of forested/wetland acres in Rollback Scenario

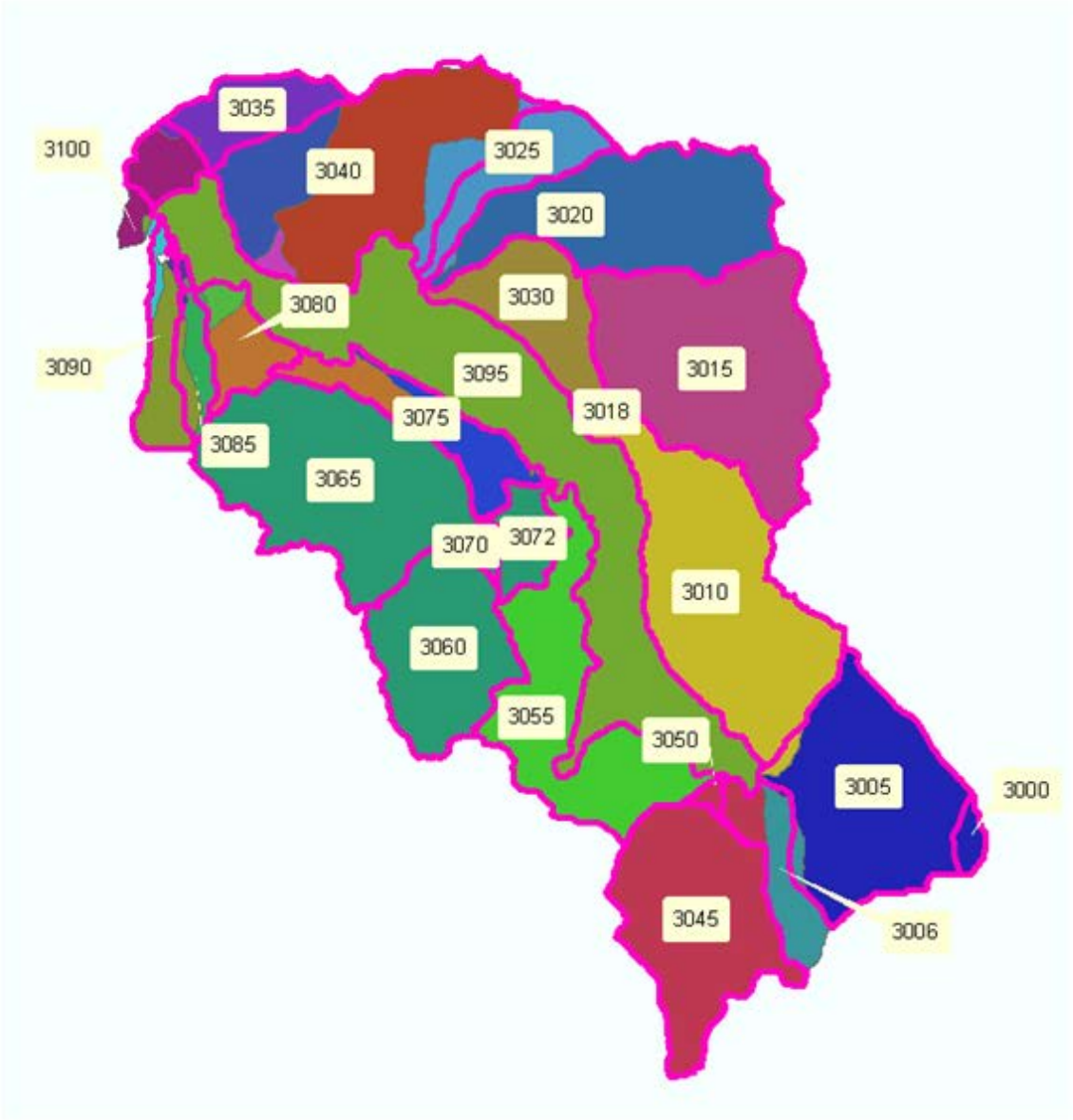
F = mass loading of phosphorus under Rollback Scenario

Each HSPF reach has a unique x and y areal loading rate based on the number of developed and forested areas and the mass loading. Those values are shown in Table 5. Average Annual loading is based on the calculated total loading for the 2003 calendar year. Maximum daily loading is based on the day in 2003 with the highest calculated loading. These values can be used to calculate the degree to which treatment has achieved the equivalent of reduction in effective area or the equivalency of any water quality offsets or water quality trades that may be adopted in the future.

Table 5. Areal loading by HSPF reach number for forest and developed areas.

HSPF Reach number	Existing Scenario Forest Acres[1]	Existing Scenario Effective Developed Acres[1]	Annual Average Forest Areal loading (lbs/ac)	Annual Average Developed Areal loading (lbs/ac)	Maximum Daily Forest Areal Loading (lbs/ac)	Maximum Daily Developed Areal Loading (lbs/ac)
3000			0.195905	0.477665	0.00048	0.001306
3005	2459	258	0.195905	0.477665	0.00048	0.001306
3006	643	20	0.239492	1.049443	0.000475	0.001956
3010	3000	244	0.250005	0.501469	0.000543	0.000968
3015	3197	111	0.156695	0.271141	0.000549	0.001003
3018	2420	33	0.156695	0.271141	0.000549	0.001003
3020	647	119	0.28468	1.540808	0.000965	0.002709
3025	922	235	0.135773	1.421995	0.000538	0.003735
3030	403	310	0.13903	1.150454	0.000581	0.003483
3035	2646	1063	0.036591	1.124954	0.000289	0.003563
3040	643	20	0.081903	1.242897	0.000357	0.003166
3045			0.191579	0.811042	0.000516	0.001577
3050	2256	112	0.191579	0.811042	0.000516	0.001577
3055	1971	338	0.216046	1.281554	0.000547	0.002082
3060			0.118073	0.961492	0.00032	0.002481
3065			0.118073	0.961492	0.00032	0.002481
3070			0.118073	0.961492	0.00032	0.002481
3072	4966	385	0.118073	0.961492	0.00032	0.002481
3075	662	284	0.154677	1.402637	0.000347	0.002279
3080	235	345	0.041936	0.577551	0.000197	0.002005
3085	244	96	0.0601	0.495982	0.000153	0.001615
3090	408	155	0.034174	0.806292	6.58E-05	0.003178

[1] Blanks indicate the Reach is tributary to the next reach with an area entered.



Numbers represent HSPF Reaches. Colors represent WRIA 1 Wastershed Planning Basins

Figure 6. Overlay of HSPF reach number with WRIA 1 Watershed Management Program Basins.

The original redistribution of developed area from HSPF reaches to WRIA 1 Watershed Management Plan-defined drainages proved problematic to particular jurisdictions. The lake response model is not particularly sensitive to the location of the inputs, so larger basins are satisfactory for making predictions on lake response. However, divisions between jurisdictions are more sensitive. For instance, the average developed area of the HSPF reach 3040 is about 30%. That reach includes the Silver Beach drainage, as well as the watersheds around Academy Creek and Agate Bay. However, the average developed area in Silver Beach drainage is 79%.

To address this issue, the following process was followed:

- GIS was used to combine the new land classes with the WRIA 1 Watershed Management Plan land cover (used in the Volume 1 BAS Scenario).
- A union was formed to distinguish the HSPF reach, WRIA 1 Watershed Management Plan drainage, jurisdiction, and in the case of commercial forest, the zoning of each polygon. The overlay of the HSPF reaches over the WRIA 1 Watershed Management Project drainages is shown in Figure 6. In the text of this document HSPF reaches are referred to by Reach Number and WRIA 1 Watershed Management Project basins are referred to by a basin name.
- For each WRIA 1 Watershed Management Project drainage, the area developed and forested within each jurisdiction and within each HSPF reach was totaled.
- The areal loading rates previously referred to were used to calculate the existing and allowable loading in pounds per year. These values were converted to kg/year for consistency with previous reports.

The subtotal by drainage area is shown in Table 6. Also shown is a calculation of the maximum daily loading for the drainage in pounds per acre. This is calculated based on the day with the highest load from the HSPF output for 2003.

Table 6. Scenarios showing effective developed acres, undeveloped (forest and wetland) acres, and total phosphorus loading by tributary.

Tributary Subbasin Name	Full Rollback Scenario		Existing Conditions Scenario			87% rollback from Existing Conditions Scenario			
	Forest & wetland acres	Annual mass TP (kg / 2003 yr)	Effective Developed acres	Forest & wetland acres	Annual mass TP (kg / 2003 yr)	Effective developed acres	Forest & wetland acres	Annual mass TP (kg / 2003 yr)	Maximum Daily mass TP (kg / 2003 yr)
Academy	780	36.3	291.0	487.3	181.9	37.8	740.5	48.8	0.17
Agate	2135.5	99.6	332.4	1798.5	254.0	43.2	2087.7	101.9	0.40
Anderson	2591.5	262	254.5	2347.3	265.7	33.1	2568.8	235.9	0.58
Austin	5331.6	300.8	385.8	4974.1	435.2	50.2	5309.7	306.6	0.83
Bloedel	82.7	1.3	61.9	20.3	22.9	8.0	74.1	4.1	0.01
Blue Canyon	3381.1	373	252.9	3055.6	402.4	32.9	3275.6	377.2	0.82
Brannian	2439.9	232.1	116.3	2425.8	258.1	15.1	2527.0	229.1	0.60
Cable	111	2.1	100.2	10.4	26.3	13.0	97.6	5.3	0.02
Carpenter	1149.6	68.2	239.9	908.9	196.4	31.2	1117.6	80.5	0.30
Donovan	61.8	1.2	48.6	13.0	14.7	6.3	55.2	2.9	0.01
Eagle Ridge	90.1	4.2	47.3	42.6	28.2	6.2	83.7	6.6	0.02
Fir	545.1	58.3	8.6	534.1	60.2	1.1	541.6	58.0	0.12

Tributary Subbasin Name	Full Rollback Scenario		Existing Conditions Scenario			87% rollback from Existing Conditions Scenario			
	Forest & wetland acres	Annual mass TP (kg / 2003 yr)	Effective Developed acres	Forest & wetland acres	Annual mass TP (kg / 2003 yr)	Effective developed acres	Forest & wetland acres	Annual mass TP (kg / 2003 yr)	Maximum Daily mass TP (kg / 2003 yr)
Geneva (Euclid Ck)	224.9	6	68.8	156.7	19.8	8.9	216.5	7.8	0.02
Hillsdale (Silver Beach Ck)	729.3	13.1	326.3	404.2	174.4	42.4	688.0	33.7	0.16
North Shore	1195.6	72.9	235.6	926.8	181.6	30.6	1131.8	87.6	0.35
Olsen	2423.7	313.3	27.5	2400.8	329.0	3.6	2424.8	315.4	1.06
Oriental (Mill Wheel Ck)	583.5	10.3	96.1	477.1	40.6	12.5	560.7	14.2	0.04
Silver Beach	328.2	15.1	259.2	68.4	148.2	33.7	293.9	29.8	0.10
Smith	3192.5	227.5	109.6	3194.1	240.8	14.2	3289.4	235.8	0.83
South Bay	2426.8	233.8	340.3	1968.7	390.0	44.2	2264.8	247.4	0.60
Strawberry	774	33.2	255.0	516.3	105.3	33.1	738.1	41.7	0.12
Sudden Valley	605.6	44	248.7	348.8	182.6	32.3	565.2	60.2	0.12
Total	31184	2408.3	4106.2	27079.8	3958.5	533.8	30652.2	2530.4	7.28
Other Sources									
MFN Diversion		293.1			293.1			293.1	
Groundwater		2203.4			2203.4			2203.4	
Precipitation		162.6			162.6			162.6	
Total		**5067.4**			**6617.6**			**5189.5**	

Bacteria

Loading capacity for bacteria is based on meeting the two-part criterion. One part of the criterion requires meeting the geometric mean, and one part of the criterion is based on the 90th percentile of the samples. Most often, the 90th percentile is the most restrictive limit. The loading capacity was calculated and reported in Volume 1 of this report. That report had a public review, comment and response to comment. Nothing in that review changed the loading capacity.

Load and wasteload allocations

Wasteload allocations

Table 7 shows the wasteload allocation for phosphorus expressed as "effective developed acres." These are the acres that would not need to be retrofitted to address phosphorus if all other development were retrofitted to function like a forest. Table 7 also expresses the wasteload allocation in terms of pounds per 2003 year, as the city of Bellingham has elected to express limits in the ordinance regulating development in terms of pounds of phosphorus. Whatcom County is contemplating similar limits. This reflects the mass of phosphorus the lake can assimilate when the meteorology matches the meteorology of 2003. It is the total of the forest loading and the loading from developed areas after an 87% reduction in effective developed area within the area covered by the NPDES permit.

The city of Bellingham and Whatcom County have stormwater systems that are regulated by the Western Washington Phase II Municipal Stormwater Permit. The permit regulates the entire jurisdiction of the city of Bellingham and the urbanized areas and urban growth areas of Whatcom County. The initial permit expired February 15, 2012; however, a one-year permit was in effect until July 31, 2013.

A new Municipal Stormwater Permit effective August 1, 2013 and expiring July 31, 2018 has already been issued. Whatcom County and city of Bellingham TMDL requirements may be included through an administrative order, permit modification or at the next permit issuance after approval of the TMDL by EPA. In any subsequent permit modification, the actions included in the Administrative Order will be incorporated into Appendix 2 of the Municipal Stormwater Permit.

As identified in the Reasonable Assurance section, the Stormwater Management Plan required by the permit is the primary means of regulating all stormwater. The program will be applied across the watershed and be used to control both discharges into the municipal stormwater system and discharges direct to receiving waters.

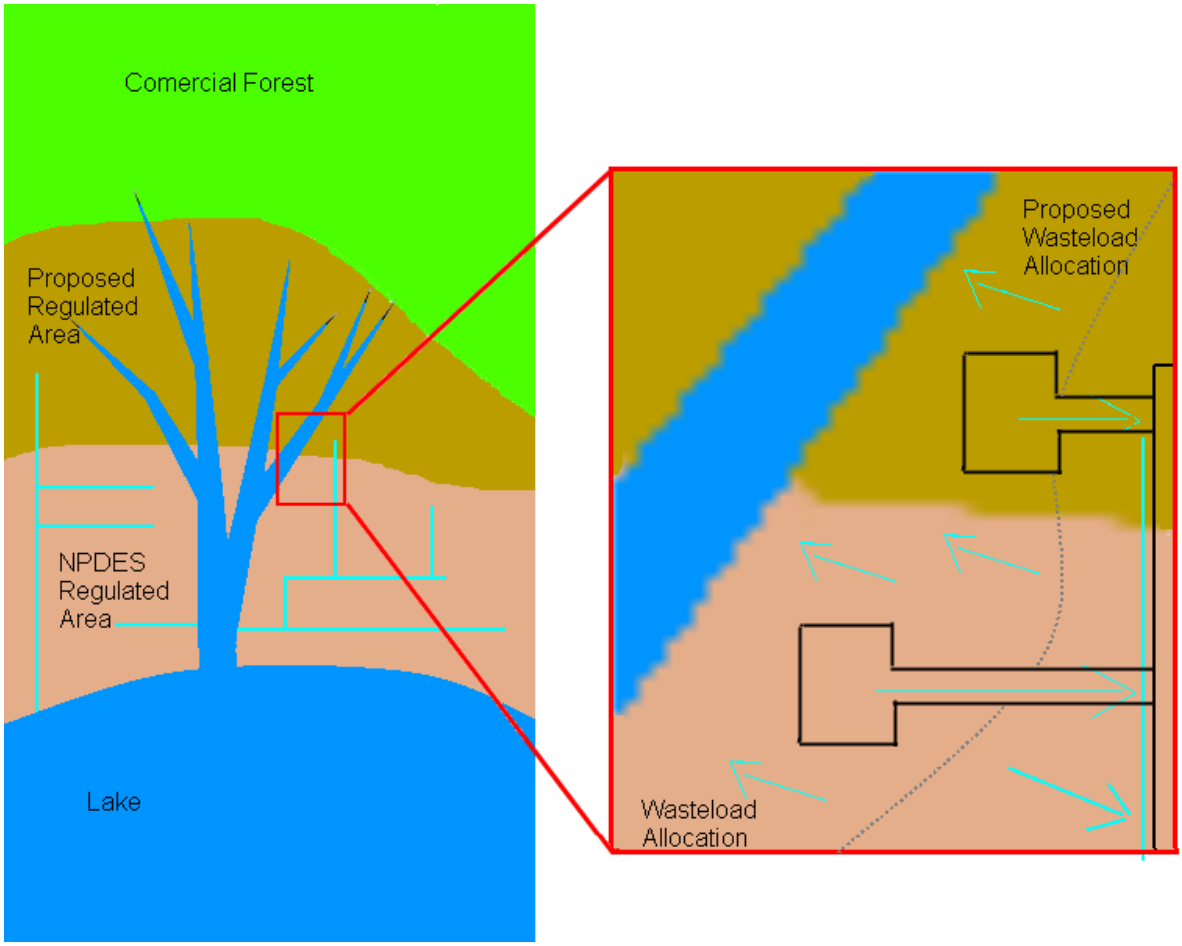


Figure 7. Differentiation between flows to MS4 and flows to receiving water.

For each jurisdiction, wasteload allocations for phosphorus and "effective developed acres" are included in Table 7. Allocations for phosphorus and "effective developed acres" are functionally equivalent, and either allocation, if implemented, will result in the attainment of standards. This wasteload is based on the area covered in the existing permit. For Whatcom County there is also a proposed wasteload allocation. The proposed wasteload is based on the area not covered by the existing permit and not zoned for commercial forestry.

Not all runoff from the area regulated by the permit enters a municipal stormdrain. Some areas drain directly to streams or to the lake. Consider Figure 7. The inset shows conceptual drainage patterns where the house and driveway and front yards drain to stormdrain and the back yards drain directly to the creek. The dashed line separating flow directions has not been mapped. So for now all of the water that runs off of the NPDES regulated area is identified as a wasteload allocation. All of the runoff from the proposed regulated area is identified as a proposed wasteload allocation. All of the runoff from the commercial forest area is identified as a load allocation.

When mapping identifies areas not regulated by the permit, the load allocation can be separated based on a pro rata share of the allocation based on land area. But only if reasonable assurance is provided so that those areas will remain controlled at the same level as the areas subject to the wasteload allocation.

The entire loading capacity for each drainage area not zoned Commercial Forest has been allocated either as a wasteload allocation or as a proposed wasteload allocation to either the city of Bellingham or Whatcom County. Figure 8 shows areas covered by a wasteload allocation (WLA) based on existing permit definitions and the area proposed for inclusion as a WLA. The division of the wasteload allocations is based on the fraction of the drainage area and includes both developed area and forest and wetland area.

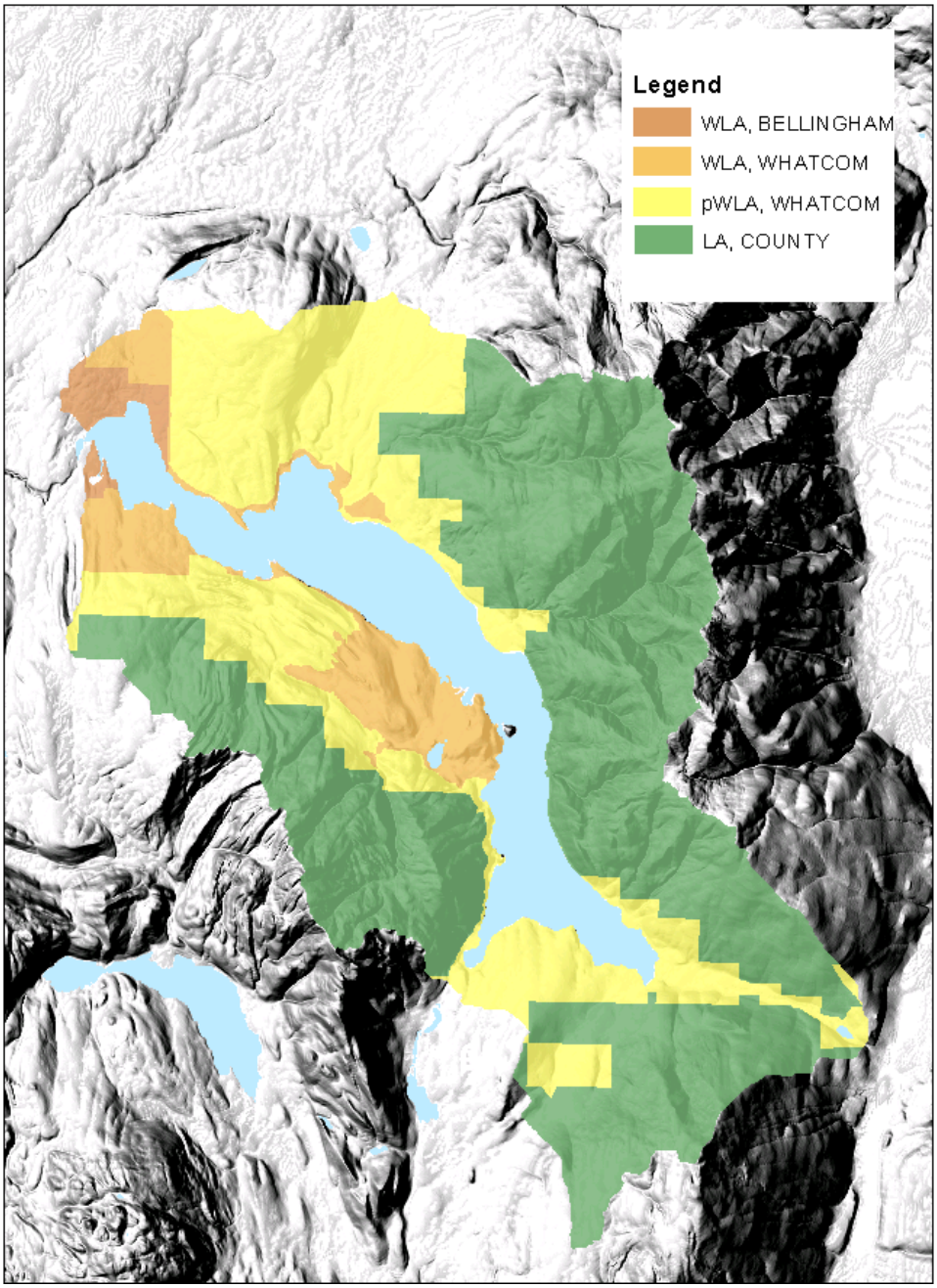


Figure 8. Mapped Areas of WLA, proposed WLA and LA.

The wasteload allocation for fecal coliform is expressed in terms of a Target Geometric Mean, which is the geometric mean calculated to be necessary for no more than 10% of the samples to exceed 100. The fecal coliform wasteload allocation is also expressed as the number of colony forming units per day, based on typical/maximum flows. Only the fraction running off from area regulated by the Municipal Stormwater Permit or proposed for regulation are included in the wasteload allocations and proposed wasteload allocations.

Table 7. Wasteload Allocations and Proposed Wasteload Allocations for municipal stormwater dischargers in the watershed covered by NPDES permits.

Drainage Name	Permittee Name	Effective developed acres	Annual Phosphorus Wasteload Allocation (lb/2003 yr)	Maximum Daily Phosphorus Wasteload Allocation (lb/2003 yr)	Fecal Coliform Wasteload Allocation Wet Season / Dry Season (Target GM as cfu/100mL)	Fecal Coliform Wasteload Allocation Wet Season / Dry Season (cfu/day)
Academy	Bellingham	12.3	23.7	0.08	N/A	N/A
	Proposed Whatcom Co.	22.5	76.8	0.3	N/A	N/A
	Whatcom Co.	3.0	6.9	0.0	N/A	N/A
Agate Bay	Proposed Whatcom Co.	35.1	208.4	0.8	N/A	N/A
	Whatcom Co.	8.1	15.8	0.1	N/A	N/A
Anderson/ Whatcom	Proposed Whatcom Co.	17.4	117.0	0.3	50/13	2.9E+10 / 4.7E+09
Austin/Beaver	Proposed Whatcom Co.	7.5	160.9	0.4	14/17	4.4E+09 / 2.6E+08
	Whatcom Co.	41.7	123.9	0.3	14/17	2.4E+10 / 1.4E+09
Blodel	Bellingham	5.3	5.9	0.0	N/A	N/A
	Whatcom Co.	2.7	3.1	0.0	N/A	N/A
Blue Canyon	Proposed Whatcom Co.	6.6	94.7	0.2	N/A	N/A
Brannian	Proposed Whatcom Co.	4.2	109.5	0.3	50/31	2.0E+09 / 2.1E+09
Cable	Whatcom Co.	13.0	11.6	0.0	4/3	*
Carpenter	Proposed Whatcom Co.	23.8	128.7	0.5	12/31	2.9E+09 / 3.4E+08
	Whatcom Co.	4.9	10.3	0.0	12/31	6.0E+08 / 7.1E+07
Donavan	Bellingham	3.1	3.1	0.0	N/A	N/A
	Whatcom Co.	3.3	3.4	0.0	N/A	N/A
Eagle Ridge	Proposed Whatcom Co.	2.2	7.3	0.0	N/A	N/A
	Whatcom Co.	4.0	7.2	0.0	N/A	N/A
Fir	Proposed Whatcom Co.	0.8	14.1	0.0	N/A	N/A
Geneva	Proposed Whatcom Co.	2.7	6.3	0.0	12/22	3.2E+08 / 1.9E+07
	Whatcom Co.	6.2	9.3	0.0	12/22	7.5E+08 / 4.5E+07

Drainage Name	Permittee Name	Effective developed acres	Annual Phosphorus Wasteload Allocation (lb/2003 yr)	Maximum Daily Phosphorus Wasteload Allocation (lb/2003 yr)	Fecal Coliform Wasteload Allocation Wet Season / Dry Season (Target GM as cfu/100mL)	Fecal Coliform Wasteload Allocation Wet Season / Dry Season (cfu/day)
Hillsdale	Bellingham	2.2	3.3	0.0	17/31	1.2E+08 / 3.1E+07
	Proposed Whatcom Co.	10.7	25.6	0.1	17/31	5.9E+08 / 1.5E+08
	Whatcom Co.	29.6	45.2	0.2	17/31	1.6E+09 / 4.2E+08
North Shore	Proposed Whatcom Co.	21.9	90.6	0.3	N/A	N/A
	Whatcom Co.	3.2	11.3	0.0	N/A	N/A
Olsen	Proposed Whatcom Co.	1.4	44.9	0.1	50/22	1.9E+10 / 2.8E+09
	Whatcom Co.	0.3	3.7	0.0	50/22	4.8E+09 / 6.9E+08
Oriental	Bellingham	1.3	1.3	0.0	39/42	2.3E+08 / 3.3E+07
	Proposed Whatcom Co.	0.0	8.1	0.0	39/42	2.6E+06 / 3.7E+05
	Whatcom Co.	11.2	14.2	0.0	39/42	2.1E+09 / 2.9E+08
Silver Beach	Bellingham	31.7	61.9	0.2	25/18	N/A
	Whatcom Co.	2.0	3.6	0.0	25/18	N/A
Smith/Whatcom	Proposed Whatcom Co.	1.1	11.8	0.0	50/31	4.7E+09 / 2.9E+09
South Bay	Proposed Whatcom Co.	34.2	259.8	0.6	N/A	N/A
	Whatcom Co.	9.6	62.6	0.1	N/A	N/A
Strawberry	Proposed Whatcom Co.	11.8	66.6	0.2	N/A	N/A
Sudden Valley Sudden Valley	Whatcom Co.	21.3	24.8	0.1	N/A	N/A
	Proposed Whatcom Co.	2.3	16.7	0.0	N/A	N/A

* There was insufficient information to calculate a load so the WLA is requires meeting water quality criteria. The target geometric mean is predicted to be necessary to meet the 90th percentile part of the water quality criteria.

At the time of this (Volume 2) publication, there are six sites covered by the Construction Stormwater General Permit (Construction Stormwater permit) in the Lake Whatcom watershed. Wasteload allocations, shown in Table 8, were calculated based on the total area listed in each respective permit. The phosphorus wasteload allocation is based on the areal forest loading

calculated in Table 6 for forest area. It is a calculation of the discharge that would occur from the site over an entire year exposed to 2003 weather conditions. That is, the site should not discharge more phosphorus during construction than a forested site would discharge. The wasteload allocation for the Construction Stormwater permit and the wasteload for the Municipal Stormwater Permit are not additive.

The wasteload allocation for the Construction Stormwater permit reflects the fraction of the Municipal Stormwater Permit wasteload allocation generated at that site. The Construction Stormwater permittee is responsible to Ecology to ensure they will not exceed the wasteload allocation that is passed from their site. The same limit is required for discharges directly into a receiving water or into a Municipal Stormwater system.

Only one site subject to the Construction Stormwater General permit is in an area covered by a fecal coliform TMDL. The wasteload allocation is expressed as the target geometric mean.

Table 8. Wasteload Allocations for construction stormwater dischargers in the watershed covered by NPDES permits.

Permittee Name and ID	Permit Number	Drainage Name	HSPF Reach Number	Acres	Phosphorus Wasteload Allocation (kg/2003 yr)	Fecal Coliform Wasteload Allocation Wet Season / Dry Season (Target GM as cfu/100mL)
Pollys Short Plat	WAR010659	Bloedel	3090	8.33	0.28	N/A
Savanah Park We	WAR125125	Hillsdale	3035	20.38	0.753	17/31
Squalicum Ridge Road	WAR125382	Agate	3040	517.27	42.36	N/A
Blodel Donovan Park Improvements	WAR 302274	Bloedel	3090	1.6	0.05	N/A

Load allocations

Silvicultural activities are not currently subject to NPDES permitting. Neither the city nor the county has jurisdiction over silvicultural activities, so the land that is zoned Commercial Forest has been broken out from the wasteload allocations. Table 9 shows the maximum annual phosphorus load allocations calculated using the forest areal loading rates in Table 6 and the areas within each drainage from each HSPF reach. The loading from commercial forest land has been calculated and is separated from the wasteload allocations shown in Table 9.

Table 9. Lake Whatcom tributaries phosphorus load allocations.

Drainage Basin	Load Allocation (lbs/2003 year)
Anderson	401.9
Austin	389.7

Drainage Basin	Load Allocation (lbs/2003 year)
Blue Canyon	735.3
Brannian	394.5
Carpenter	38.1
Fir	113.4
Geneva (Euclid Ck)	1.6
North Shore	90.8
Olsen	645.3
Oriental (Mill Wheel Ck)	7.6
Smith/Whatcom	506.9
South Bay	222.0
Strawberry	0.4
Middle Fork Diversion	646.2
Ground Water	4857.7
Precipitation	358.5

All of the loading capacity for fecal coliform has been made as a wasteload allocation or proposed wasteload allocation to the Municipal Stormwater permit holders. The loading capacity has been designated as either Wasteload or Proposed Wasteload in Table 10. In the future, areas that drain directly to a receiving water may be separated. Then the associated wasteload or proposed wasteload can be re-categorized as a load allocation, provided the level of control regulated by a permit remains in place.

Table 10. Lake Whatcom tributaries fecal coliform wasteload allocations.

Tributary	Geometric Mean (cfu/100 mL)	Highest Tenth % (cfu/100 mL)	Wasteload or Proposed	Allocation (cfu/day)	Reduction (%)
	Wet Season Targets (November-April)				
Anderson Creek	50	100	Proposed	2.9E+10	0%
Austin Creek	14	100	Wasteloa	2.8E+10	-51%
Brannian Creek	50	100	Proposed	2.0E+09	0%
Cable Street Drain	4	100	Wasteloa	--[1]	-60%
Carpenter Creek	12	100	Proposed	3.5E+09	-20%
Euclid Creek	12	100	Wasteloa	1.1E+09	-77%
Mill Wheel Creek	39	100	Wasteloa	2.3E+09	-74%
Olsen Creek	50	100	Proposed	2.4E+10	0%
Park Place Drain	25	100	Wasteloa	--[1]	-92%
Silver Beach	17	100	Wasteloa	2.3E+09	-88%
Smith Creek	50	100	Proposed	4.7E+09	0%
	Dry Season Targets (May-October)				
Anderson Creek	13	100	Proposed	4.7E+09	-75%
Austin Creek	17	100	Wasteloa	1.7E+09	-85%

Tributary	Geometric Mean (cfu/100 mL)	Highest Tenth % (cfu/100 mL)	Wasteload or Proposed	Allocation (cfu/day)	Reduction (%)
Brannian Creek	31	100	Proposed	2.1E+09	-37%
Cable Street Drain	3	100	Wasteloa	--[1]	-90%
Carpenter Creek	31	100	Proposed	4.2E+08	-55%
Euclid Creek	22	100	Wasteloa	6.5E+07	-50%
Mill Wheel Creek	42	100	Wasteloa	3.3E+08	-92%
Olsen Creek	22	100	Proposed	3.4E+09	-53%
Park Place Drain	18	100	Wasteloa	--[1]	-92%
Silver Beach	31	100	Wasteloa	6.0E+08	-96%
Smith Creek	31	100	Proposed	2.9E+09	-39%

[1] *No flows available for calculating loads.*

Seasonal variation

Implementation of the phosphorus TMDL is likely to have seasonal components, depending on the phosphorus loading source and control strategy.

Separate fecal coliform allocations are made for wet season and dry season. This reflects differences between sources and transport mechanisms.

For a more information about the seasonal variation for this watershed, see the *Lake Whatcom Watershed Total Phosphorus and Bacteria Total Maximum Daily Loads: Volume 1. Water Quality Study Findings (Pickett and Hood, 2008).*

Margin of safety

Phosphorus TMDL

The models did not provide an implicit margin of safety, and all estimates are as close to accurate as possible; therefore an explicit margin of safety is provided. The calculated minimum reduction in effective developed acres is 86.75%. By rounding this number up to 87%, 10.3 effective developed acres are not allocated and represent a margin of safety. In addition, the phosphorus allocations are expected to reduce oxygen levels by 0.1978941 mg/l, which is slightly less than the allowable 0.2 mg/l.

The continuous improvement process will minimize the need for a margin of safety. The improved knowledge and adaptive management reduces uncertainty. The risk of over-control is low because the implementation of the TMDL will take decades. Implementation actions in the near-term (10 to 20 years) are certain to be necessary regardless of adjustments to overall reduction targets.

While near-term implementation is taking place, additional knowledge will be gained on processes that are now sources of uncertainty. In subsequent cycles of the NPDES Phase II

Municipal Stormwater Permit, the city of Bellingham and Whatcom County will shift focus from refining the implementation plan to refining the models.

In that manner, while implementation begins on actions that must take place, refinements to the models can be made. If future modeling indicates a need for additional reductions, the implementation schedule can be adjusted. Changes can be made to either increase the time needed to complete implementation or to increase the rate of implementation. Likewise, if the improved models indicate that the previous models were overly protective, the most expensive and least effective implementation actions can be eliminated.

The focus on the most sensitive portion of the lake also provides a margin of safety for the rest of the lake. The TMDL is geared to meet the water quality criteria in the most sensitive 16% of Basin 1. This is just 0.4% of the lake volume. The other 99.6% of the lake will not approach the minimum allowable dissolved oxygen levels.

Bacteria TMDL

The margin of safety for the bacteria TMDL is based on the conservative assumptions provided by the statistical rollback method used to establish the loading capacity. It assumes that the coefficient of variation will remain constant. That is, we expect that the geometric mean will remain a fixed percentage of the 90th percentile. The reduction necessary to prevent more than 10% of the samples exceeding 100 cfu/100 mL will result in an expected geometric mean of less than 50 cfu/100 mL.

Reasonable assurance

When establishing a TMDL, reductions of a particular pollutant are allocated among the pollutant sources (both point and nonpoint) in the water body. For the Lake Whatcom Watershed Phosphorus and Bacteria TMDL, both point and nonpoint sources exist. TMDLs (and related implementation plans) must show "reasonable assurance" that the nonpoint sources will be reduced to their allocated amount.

Education, outreach, technical and financial assistance, permit administration, and enforcement will all be used to ensure that the goals of this TMDL project are met. Ecology is authorized under Chapter 90.48 RCW to impose strict requirements or issue enforcement actions to achieve compliance with state water quality standards. However, it is the goal of all participants in the Lake Whatcom Watershed TMDL process to achieve clean water through cooperative efforts.

The goal of the *Lake Whatcom Watershed Water Quality Improvement Report* for phosphorus and fecal coliform is to establish parameters and activities to bring the waters of the basin into compliance with the state's water quality standards. Ecology believes the following activities, if continued and maintained, support this TMDL and will help meet the necessary pollutant reductions. This rationale helps provide reasonable assurance that the Lake Whatcom watershed nonpoint source TMDL goals will be met.

The point source dischargers in the TMDL are the city of Bellingham and Whatcom County. Both are covered by the Western Washington Phase II Municipal Stormwater Permit. However, only a portion of the watershed within the county's jurisdiction is currently covered by the permit. Coverage of the entire Lake Whatcom watershed may be accomplished through an agreed order or an administrative order after the TMDL has been approved by EPA. At that time, the permit may be expanded to cover all non-forest stormwater discharges within the Lake Whatcom watershed.

Pollutant reductions in the Phase II Municipal Stormwater Permit are met by implementing a Stormwater Management Program. This program combines development standards, ordinances, inspections, and good housekeeping practices across the landscape. All sources in the watershed, both in permitted and unpermitted areas, are controlled by the Stormwater Management Program. In other words, sources that do not discharge into the municipal stormwater system are regulated in the same way as sources that do discharge into the municipal stormwater system. This assures that both point and nonpoint sources will achieve the necessary reductions.

The Lake Whatcom Management Team provides a forum for the city of Bellingham, Whatcom County, and the Lake Whatcom Water and Sewer District to harmonize their efforts to protect Lake Whatcom. The team jointly adopts five-year plans. The latest version is attached as Appendix D. This plan contains a list of all of the activities to be pursued during the next five-year permit cycle, including:

- Activities to reduce pollution runoff from existing development through infiltration, treatment, and source reduction.
- Public education.
- Funding to provide incentives to improve private property and improvements to public infrastructure.

All of these activities can help to reduce pollutants entering the waterways in the Lake Whatcom watershed, and help meet water quality standards. The current five-year plan does not identify how much of each action will be necessary to complete restoration, what funding will be required to complete all actions, or how long it will take to complete all actions.

The city of Bellingham and Whatcom County each need to identify what activities they will employ to restore their respective portion of the watershed. This requirement will be included in the next version of their respective Municipal Stormwater Permits as a translation of their wasteload allocations. Additional requirements to comply with specific TMDL wasteload allocations are typically included in an appendix to the Municipal Stormwater Permit. In each permit cycle, the requirements for the five years covered by the permit will be identified.

Adaptive management/continuous improvement

As described in the discussion regarding margin of safety, adaptive management will be an integral part of TMDL implementation. TMDL wasteload allocations may be translated into best management practices (BMPs) in municipal stormwater permits. In this case, the wasteload allocation for the Lake Whatcom TMDL will be translated into BMPs. The most important BMP

will be the continuous improvement strategy detailed in the Implementation Section under "What needs to be done?"

The fundamental concept is that five years are spent (1) developing a long-range plan and budget to meet TMDL reductions and (2) establishing short-term milestones for the next ten years that demonstrate that the plan is on schedule. The five years end with a list of the studies necessary to reduce uncertainty in the model estimates of loading capacity.

In the next five-year period, the identified studies are executed, the models are refined to reduce uncertainty, and improved loading capacity is estimated. During this period, the first of the five-year milestones are met, demonstrating that implementation is proceeding on schedule. Then the implementation plan is revised to meet the improved estimate of loading capacity, and new milestones are established. The third five-year period will focus on improving estimates of loading capacity.

In this way, lessons learned during each decade of implementation can be reflected in the implementation plan, and new information can be incorporated to improve the models.

Table 11 shows significant years for the cycles of the continuous improvement strategy.

Table 11. Identification of significant years for continuous improvement strategy.

Year	Accomplishment
Within 6 months of TMDL approval	Two preliminary Implementation Plans
2016	Submit final Implementation Plan
2017	Submit annual milestones for next 10 years
2018	Submit areas for model refinement
2018-2028	Meet annual milestones set in 2017
2023	New estimate of Loading Capacity
Years ending in 6	Revised Implementation Plan, if necessary
Years ending in 7	New annual milestones for next 10 years
Years ending in 8	Proposed study areas for model refinement
Years ending in 3	New estimate of Loading Capacity.

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Implementation Strategy

Introduction

This implementation strategy describes what will be done to improve water quality. It explains the roles and authorities of cleanup partners (those organizations with jurisdiction, authority, or direct responsibility for cleanup). It will also describe programs or other means through which the cleanup partners will address water quality issues.

After the EPA approves this TMDL, interested and responsible parties will work together to develop a detailed water quality implementation plan (WQIP). The plan describes and prioritizes specific actions planned to improve water quality and achieve water quality standards. Whatcom County and the city of Bellingham have one permit cycle to complete the plan.

What needs to be done?

The Lake Whatcom Reservoir Management 2010-2014 Work Plan is an exhaustive list of the known tools available for restoring the lake. The list of activities is long and detailed and thus not repeated here. Appendix D contains the entire work plan, last updated in 2010. The work plan contains (1) strategies for stormwater management of new and redeveloped properties and (2) monitoring, education, and outreach strategies. It does not contain how much of each activity is necessary to restore the watershed.

The public comment on this TMDL reflected concern that jurisdictions have not uniformly enforced ordinances that were designed to protect Lake Whatcom. Within one year of approval each jurisdiction shall add to their Stormwater Management Program a written enforcement process.

The city of Bellingham and Whatcom County both are covered by NPDES Phase II Municipal Stormwater Permits for the discharge of stormwater. When Ecology issues permits, the agency must require meeting the wasteload allocation of any TMDLs established for the receiving waters.

Stormwater is discharged from many outlets, with highly variable flow quantities and concentrations. Therefore, it is not practical to monitor for compliance with the wasteload allocation by representative sampling at each outfall. Ecology can instead prescribe BMPs that, when implemented, will result in meeting the wasteload allocation. The TMDL expresses the phosphorus loading in two ways. Either or both may be used to measure progress toward meeting the wasteload allocation for phosphorus.

- One metric is the rolled back effective developed acres. This metric is most useful when evaluating a project focused on applying dispersed stormwater management to existing infrastructure. The number represents an estimate of the existing developed area that can contribute additional phosphorus. A project is retrofitted when it is modified to store stormwater and increase the infiltration of stormwater. When the hydrology matches the

runoff from a forested area, it is considered 0% effective developed area. But if there is a small amount of the developed area that remains unaddressed, that area would continue to count toward the allowed effective developed areas.

- The second metric is the mass of phosphorus. The model calibration year of 2003 is used so the mass represents the estimate of how much total phosphorus would be discharged from the basin after 87% of the existing developed area has been retrofitted to match natural conditions. This would be most useful for designing regional stormwater treatment systems that do not infiltrate water and achieve reductions by removal of phosphorus from the water column. An inability to address phosphorus reductions in distributed (small scale) systems can be used to estimate the excess phosphorus that needs removal by regional stormwater treatment systems. The facility can be designed to remove the excess phosphorus to mitigate for the inability site-distributed systems to fully treat the stormwater.

These wasteload allocations will be incorporated in the NPDES Phase II Stormwater Permits as a BMP requiring a continuous improvement strategy. The strategy requires five years focused on setting an implementation timeline, budgets, and short-term milestones. This is followed by five years refining the models used to estimate the loading capacity of Lake Whatcom. Each decade, the implementation plan will be updated and the estimates of the loading capacity will be refined. These actions take place simultaneously to meet short-term implementation goals.

- From TMDL approval to 2018 (the first permit cycle), the city of Bellingham and Whatcom County will develop the first implementation plan. The implementation timeline must be as rapid as feasible. One of the most difficult determinations to make will be how to balance the annual cost of implementation against the time allowed for implementation. The most aggressive schedules would require retrofits to existing infrastructure before normal maintenance or reconstruction would otherwise be required. This may deplete funds necessary to provide incentives to private landowners. To help in that decision-making and provide data for Ecology to reach concurrence with the plan, interim milestones are to be specified.
    - Within six months of TMDL approval, each jurisdiction will prepare two initial plans that frame the balance between the budget and timeline options. One plan requires a fixed timeline and an estimate of the budget necessary. The other plan requires estimating the timeline necessary to complete the implementation on a fixed budget. Each set of plans will have a rough estimate of which activities from the Lake Whatcom Reservoir Management 2010-2014 Work Plan are necessary to meet the TMDL goals within their respective jurisdiction.
    - The fixed- timeline plan will have a 50-year implementation schedule, and the budget will identify annual costs and a proposed means of providing funding. The fixed-budget plan will use existing and reasonably expected revenue streams. The time necessary to complete implementation will be calculated. These plans provide the public, policy makers, and reviewers a framework for deciding what is an acceptable timeline and budget for meeting TMDL goals and Washington State water quality standards.
    - By October 2016, each jurisdiction will adopt, and send to Ecology for concurrence, a preferred budget and timeline for their completed implementation plan.

- By October 2017, each jurisdiction will provide a detailed plan that establishes annual milestones for the next ten years demonstrating that the adopted plan is on track. Milestones must include accomplishments for improvements to both public and private development.
- By 2018 (the expiration date of the permit), each jurisdiction will agree on and send to Ecology a written summary. The summary will describe the studies needed to narrow uncertainty during the course of the next permit and a schedule for completing the work. If the two entities cannot agree on a mutually agreeable study plan, the city of Bellingham will address uncertainty in the lake response model and Whatcom County will address uncertainty in the watershed loading model. Each entity will be required to submit a plan by the expiration date of the permit.

- From 2018 to 2023, permits will require jurisdictions to meet previously set implementation milestones. Permits will also require jurisdictions to complete the studies previously identified and recalibrate the relevant models to identify a more certain loading capacity.
- From 2023 to 2028, permits will require jurisdictions to demonstrate that the implementation milestones are on schedule. The existing implementation plans will be examined by both jurisdictions and adjusted to meet the revised loading capacity by October 2026. Milestones for the next ten years will be established and, as in 2018, one or both jurisdictions will identify studies necessary to reduce uncertainty in model predictions.
- After 2028, each decade will continue to be broken into two five-year periods. One period will focus on narrowing uncertainty in the models and the recalibration of the models to establish a more precise estimate of loading capacity. A second period will focus on revising implementation plans to meet the loading capacity and to establish milestones.

Ecology will assist both jurisdictions as they work to meet planning and study project deadlines. For any submission requiring Ecology approval, Ecology intends to provide comments early in the process of development to help ensure the final product is approvable.

Each year in August, Ecology will discuss with the city of Bellingham and Whatcom County any requests for technical assistance that may be necessary in the near future. These two jurisdictions may apply for grants to facilitate the work, and Ecology may submit a work request to Ecology's Environmental Assessment Program for any support necessary.

Ecology will also ensure decisions made under authorities granted by RCW 90.42, RCW 90.48, RCW 90.56, and supporting rules and regulations are consistent with the Lake Whatcom TMDL.

Forest practices

The state's forest practices regulations will be relied upon to bring waters on private and state forest lands into compliance with the load allocations established in this TMDL. This strategy, referred to as the Clean Water Act Assurances, was established as a formal agreement to the 1999 Forests and Fish Report: www.dnr.wa.gov/Publications/fp_rules_forestsandfish.pdf

Forest practices rules were developed with the expectation that the stream buffers and harvest management prescriptions were stringent enough to do two things: first, meet state water quality standards for temperature and turbidity; and second, 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 streambank stability protection, and meet current BMPs.

To ensure the rules are as effective as assumed, a formal adaptive management program was established to assess and revise the forest practices rules as needed. The agreement to rely on the forest practices rules, in lieu of developing separate TMDL 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 ten-year review of the forest practices and adaptive management programs in 2009: www.ecy.wa.gov/programs/wq/nonpoint/ForestPractices/CWAassurances-FinalRevPaper071509-W97.pdf

Ecology noted numerous areas where improvements were needed. Ecology also recognized the state's program provides a framework for bringing forest practices rules and activities into compliance with water quality standards. Therefore, Ecology decided to conditionally extend the Clean Water Act Assurances with the intent to stimulate the needed improvements. Ecology, in consultation with key stakeholders, established specific milestones for program accomplishment and improvement. These milestones are to provide Ecology and the public with confidence that forest practices in the state will not cause or contribute to a violation of state water quality standards.

Ecology developed estimates of natural loading by calibrating the models to the runoff of forest areas in the watershed in 2002-2003. Continued compliance with forest practice rules to protect water quality is necessary to prevent the forest areas from contributing excess phosphorus to the watershed.

As commercial forest operations are not under control of either Whatcom County or the city of Bellingham, those areas are removed from the wasteload allocations and are considered load allocations. If, in the future, NPDES permits are required for forest practices, those load allocations will be designated the wasteload allocation for the forest practice NPDES permit. The success of this TMDL project will be assessed using monitoring data from streams in the Lake Whatcom watershed. The continuous improvement process will continue to refine loading from all land covers including commercial and recreational forest lands.

State Environmental Policy Act and Land Use Planning

Responsible State Environmental Policy Act (SEPA) officials must consider TMDLs during SEPA and other local land use planning reviews. If the land use action under review is known to potentially impact fecal coliform and dissolved oxygen 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 use findings and actions in this TMDL to help prevent new land uses from violating water quality standards. Ecology recently published a focus sheet on how TMDLs play a role in SEPA impact analysis, threshold determinations, and mitigation: https://fortress.wa.gov/ecy/publications/SummaryPages/0806008.html.

Who needs to participate in implementation?

The city of **Bellingham** holds a permit for the discharge of stormwater. This makes them responsible for meeting wasteload allocations from the discharges of their municipal stormwater system within city limits. The program they developed also controls discharges from areas that reach the lake or tributaries of the lake without entering their stormwater system.

Whatcom County holds a permit for the discharge of stormwater. This makes them responsible for meeting wasteload allocations from the discharges from their municipal stormwater system within the county jurisdiction limits. The program they developed also controls discharges from direct discharge areas that reach the lake without entering their stormwater system. Areas covered by their program may be added to the permit coverage area.

Lake Whatcom Water and Sewer District serves water to, and collects sewage from, many of the residents in the Lake Whatcom watershed. The conveyance of sewage outside of the watershed was adopted by the district to prevent failing on-site septic systems from contributing pollution to the lake. The district is part of the Lake Whatcom Management Team and helps set priorities to protect Lake Whatcom.

The Lake Whatcom Management Team is composed of the three parties listed previously. The management team helps bring the three parties together to harmonize plans and keep focus on water quality improvements in Lake Whatcom.

Ecology has responsibility for enforcing Washington State laws.

- RCW 90.48 is the Water Pollution Control law. It directs Ecology to enforce the law that requires protection of water quality for all citizens and establishes when water quality permits are required for discharge.
- RCW 90.42 is the Water Resource Management law. That law directs Ecology to manage water resources to ensure water is available for beneficial use of the citizens of Washington.
- RCW 90.58 is the Shoreline Management Act of 1971. It directs Ecology to oversee the development and administration of master programs to protect shorelines. Actions Ecology takes under these laws should be consistent with meeting TMDL wasteload allocations.

What is the schedule for achieving water quality standards?

It will take decades to make the changes in the Lake Whatcom watershed needed to reduce loading and meet water quality standards. In the first five years, local governments will need to determine how rapidly the community can afford to implement the required changes.

The lake may take a decade or more to respond to reductions in loading. Each year only about 1/10th of the volume of water in the lake is replaced. The release of phosphorus from sediment is determined by the duration of extremely low oxygen (which can modify the chemistry of the sediment and release phosphorus). This is a function of (1) the quantity of algae settling and decaying in the hypolimnion and (2) the timing and duration of lake stratification. Very cool springs and summers can delay stratification. It is not reasonable to predict how long it will take internal loading to reach a new equilibrium to external loading.

Monitoring progress

A monitoring program for evaluating progress is an important component of any implementation strategy. Monitoring is needed to keep track of what activities have or have not been undertaken, measure the success or failure of target actions, and evaluate improvements in water quality. Monitoring should also be done after water quality standards are achieved (compliance monitoring) to ensure that standards continue to be met.

The Lake Whatcom Management Program (Program) supports a robust monitoring program focused on the water quality of the lake. The Program is developing a monitoring program to identify tributary loading to the lake for the purpose of ongoing model calibration. Maintaining monitoring efforts will be essential to meet the Lake Whatcom Management Team's obligations to improve the model predictions of the lake's loading capacity every ten years.

The city of Bellingham manages a contract with the Institute for Watershed Studies at Western Washington University. Under this program a robust long-term lake monitoring program has been sustained for decades. Watershed monitoring is being incorporated into the ongoing monitoring program. Whatcom County has managed contracts with Brown and Caldwell on runoff monitoring for several years. Both of these programs are essential for maintaining continuous improvement.

Monitoring implementation actions and how they will be maintained

Entities with enforcement authority are responsible for following up on enforcement actions. Stormwater permittees and point source permittees are responsible for meeting the requirements of their permits. Those conducting restoration projects or installing BMPs are responsible for monitoring plant survival rates and maintenance of improvements, structures, and fencing. Whatcom County and the city of Bellingham have a permit obligation to ensure that stormwater BMPs they permit are maintained through an inspection program.

As part of preparing and updating the detailed water quality implementation plan, the city of Bellingham and Whatcom County will set annual milestones for monitoring progress on implementation. These milestones will be incorporated into a coordinated monitoring strategy, and meeting the milestones will be part of permit compliance.

Compliance monitoring will be needed even after water quality standards are believed to be 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 as probabilities or possibilities. 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 actions identified to solve pollution problems are the correct ones and whether they are working. As we implement these actions, the system will respond, and it will also change. Adaptive management allows us to fine-tune our actions to make them more effective. It also allows us to try new strategies, if we have evidence that a new approach could help us to achieve compliance.

TMDL reductions should be achieved by the late 21st century. In the next five years, the interim targets for the following ten years will be established. The targets will describe the actions that must be accomplished in the near-term to meet the long-term goal of implementing the TMDL. These targets will be described in terms of percent reductions, concentrations, and activities.

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.

The continuous improvement process will not only measure progress to meeting goals but will also expand knowledge about the system. The process is expected to continuously adjust targets necessary to meet dissolved oxygen criteria. The WLA and LA expressed as total phosphorus and effective developed acres necessary to meet Water Quality Standards will be reevaluated every 10 years. If meeting Water Quality Standards requires a reduction, or Water Quality Standards can be met with an increase in WLA and/or LA of more than 10%, the revised allocations will be submitted to EPA.

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 WQIP are put into practice.

Step 2. Ecology verifies that practices are in place and being operated properly.

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

Step 3a. If the goals and objectives are achieved, the implementation efforts are considered 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 goals and objectives are not achieved, 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 bacteria sources; new BMPs can be designed and implemented to address all sources of bacteria to the streams.

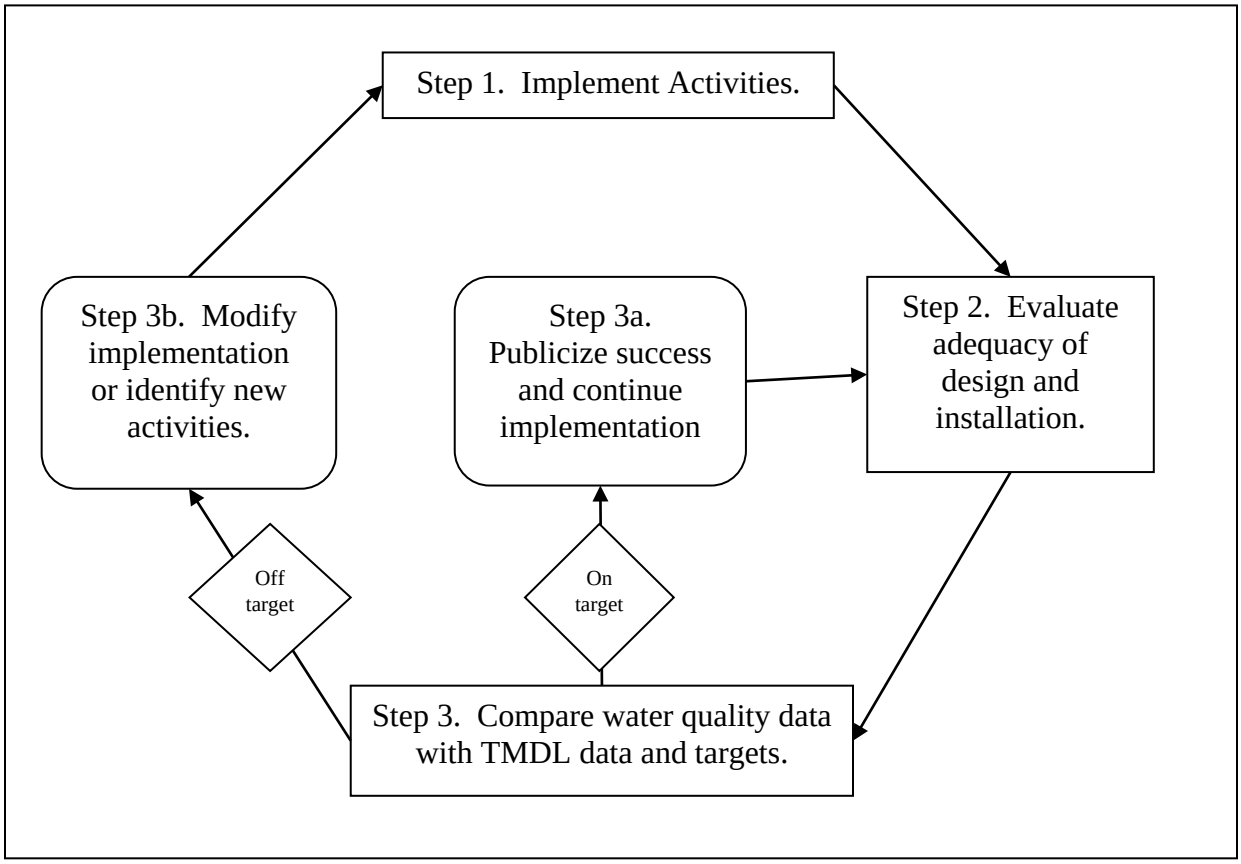

Figure 9. Feedback loop for determining need for adaptive management.

The monitoring plan will be developed as part of the Detailed Implementation Plan (DIP).

Potential funding sources

Identified below are potential funding sources. Several grant programs target improvements to discharges from agriculture and livestock. While these activities are limited in the Lake Whatcom watershed, they do exist and should be examined for the ability to improve the lake by reducing discharge of phosphorus and bacteria.

Table 12. Potential funding sources.

Sponsoring Entity	Funding Source	Uses to be Made of Funds
City of Bellingham	Stormwater Utility Fees	Control urban stormwater runoff
	Water Utility Fees	Source water protection
	Land Acquisition fees	Land purchases to prevent pollution and provide sites for treatment
Whatcom County	Real Estate Excise Tax	Capital investments
	Conservation Futures	Land purchase for conservation
	Flood Fund	Planning activities
Natural Resources Conservation Service	Conservation Programs www.nrcs.usda.gov/programs	These programs "....help people reduce soil erosion, enhance water supplies, improve water quality, increase wildlife habitat, and reduce damages caused by floods and other natural disasters."
	Wetland Reserve Program www.wa.nrcs.usda.gov/programs/wrp/wrp.html	Landowners may receive incentives to enhance wetlands in exchange for retiring marginal agricultural land.
Washington State Recreation and Conservation Office: Salmon Recovery Funding Board	Salmon Recovery Funding Board www.rco.wa.gov/grants/eval_results.shtml Scroll down to "Salmon Recovery"	Provides grants for habitat restoration, land acquisition, and habitat assessment.
Washington State Conservation Commission	www.scc.wa.gov/index.php/contact/Conservation-Districts	Various environmental program grants.
Washington State Department of Ecology: **Water Quality Program (WQP)**	Centennial Clean Water Fund Section 319 State Revolving Fund www.ecy.wa.gov/programs/wq/funding/funding.html	Facilities and water pollution control-related activities; implementation, design, acquisition, construction, and improvement of water pollution control. Priorities include: implementing water cleanup plans; keeping pollution out of streams and aquifers; modernizing aging wastewater treatment facilities; reclaiming and reusing waste water.
	Stormwater Grants www.ecy.wa.gov/programs/wq/funding/funding.html	The State Legislature has periodically made funding available for Municipal Stormwater Permittees.

Sponsoring Entity	Funding Source	Uses to be Made of Funds
Shorelands and Environmental Assistance Program (SEA)	Coastal Zone Protection Fund Watershed Management www.ecy.wa.gov/watershed/index.html	Restoration efforts to improve water quality and aquatic habitat in watersheds where penalties have been assessed. Development of watershed plans to manage water resources and protect existing water rights.
Washington State Public Works Board	Public Works Trust Fund http://pwb.wa.gov/programInfor1.aspx?ActiveView=0	Financial assistance to local government and private water systems. Supports public works projects and encourages independence at the local level.
U.S. Department of Agriculture	Farm Service Agency (FSA): Conservation Reservation Program (CRP) Rural Development: Rural Housing Repair and Rehabilitation	CRP helps agricultural producers protect environmentally-sensitive land. Loans to low-income rural residents to repair, improve, or modernize a home or remove health and safety hazards (e.g. failing on-site septic systems).
U.S. Environmental Protection Agency	Watershed Funding: www.epa.gov/owow/funding.html	Provides tools, databases, and information on funding sources that can be used to protect watersheds.

Summary of public involvement methods

Volume 1 of this report (Pickett and Hood, 2008) was reviewed by the public and published in 2008. Extensive outreach was conducted during the comment period for Volume 1. Substantial media coverage and public discussion regarding the Lake Whatcom TMDL has taken place since publication. This volume (Volume 2) fine-tunes the wasteload allocations within the range given in Volume 1.

The Lake Whatcom Management Team 2010-2014 Action Plan (Action Plan) also received extensive public input and discussion. That plan forms the backbone of the implementation strategy. A common criticism of the Action Plan was the lack of fixed and measureable goals for each activity. That concern is addressed in two ways: (1) by requiring an overall goal for the quantity of each element, and (2) interim goals for ten years to be developed in the first five years after the TMDL is approved.

There was a public review of this Volume 2 publication and a 92-day comment period. During the comment period, there were presentations for elected officials and policy workgroups. A summary of those meetings and the comments received is in Appendix C.

Conclusions

Dissolved oxygen and total phosphorus

- Watershed and lake models were developed, calibrated and reviewed in the TMDL study (Volume 1) and are deemed adequate for development of a TMDL in Lake Whatcom.
- Modeling of Lake Whatcom with CE-QUAL-W2 and its watershed with HSPF, shows land use changes from additional development of the watershed without full controls on phosphorus loading will lead to additional degradation of lake oxygen levels.
- A cumulative volume approach was used to evaluate the conditions under which Lake Whatcom could meet dissolved oxygen standards. Modeling determined that water quality standards would be met if 87% of the existing developed area in the watershed were to hydraulically function like a forest.

Bacteria

- Eleven streams and drains that are tributary to Lake Whatcom were found to not meet state water quality standards for fecal coliform bacteria during the monitoring surveys for this TMDL.
- Bacteria reduction targets from 2003 levels for the eleven tributaries ranged from a 0% to a 92% reduction in the dry season, and from a 37% to a 96% reduction in the wet season.

Findings

- Reductions in fecal coliform bacteria are necessary in most watersheds.
- Deficits in dissolved oxygen are linked to excess phosphorus.
- Excess phosphorus is linked to increased stormwater runoff associated with development.
- Existing development needs to be modified to restore stormwater retention, infiltration and treatment.
- When 87% of the existing developed area functions like a forest, the lake will meet water quality standards.

Implementation

- The primary parties responsible for implementing the TMDL are Whatcom County and the city of Bellingham.
- The implementation will involve a continuous improvement strategy with five-year cycles tied to the Municipal Stormwater Permits.
- Five-year cycles for development of the detailed implementation plans are geared to creating long-range plans, milestones for the near term (ten years) and budgets to implement the plans.
- Five-year cycles of model improvement are geared to narrowing uncertainty in the ability to meet water quality standards.

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Pickett, P. and S. Hood, 2008. Lake Whatcom Watershed Total Phosphorus and Bacteria Total Maximum Daily Loads: Volume I. Water Quality Study Findings. Washington State Department of Ecology, Olympia, WA. Publication No. 08-03-024. https://fortress.wa.gov/ecy/publications/SummaryPages/0803024.html

Appendices

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Appendix A. Glossary, acronyms, and abbreviations

Glossary

303(d) List: Section 303(d) of the federal Clean Water Act requires Washington State periodically to prepare a list of all surface waters in the state for which beneficial uses of the water – such as for drinking, recreation, aquatic habitat, and industrial use – are impaired by pollutants. These are water quality-limited water bodies (ocean waters, estuaries, lakes, and streams) that fall short of state surface water quality standards and are not expected to improve within the next two years.

Best management practices (BMPs): Physical, structural, or operational practices that, when used singularly or in combination, prevent or reduce pollutant discharges.

Clean Water Act: A federal act passed in 1972 that contains provisions to restore and maintain the quality of the nation's waters. Section 303(d) of the Clean Water Act establishes the TMDL program.

Designated uses: Those uses specified in Chapter 173-201A WAC (Water Quality Standards for Surface Waters of the State of Washington) for each water body or segment, regardless whether the uses are currently attained.

Dissolved oxygen (DO): A measure of the amount of oxygen dissolved in water.

Effective developed acres: Acres developed and discharging phosphorus consistent with development regulations at the time of calibration. Developed acres that have stormwater dispersed into large tracts of native vegetation or which fully infiltrate stormwater are not effective developed acres.

Existing uses: Those uses actually attained in fresh and marine waters on or after November 28, 1975, whether or not they are designated uses. Introduced species that are not native to Washington, and put-and-take fisheries comprised of non-self-replicating introduced native species, do not need to receive full support as an existing use.

Extraordinary primary contact: Waters providing extraordinary protection against waterborne disease or that serve as tributaries to extraordinary quality shellfish harvesting areas.

Fecal coliform (FC): That portion of the coliform group of bacteria which is present in intestinal tracts and feces of warm-blooded animals as detected by the product of acid or gas from lactose in a suitable culture medium within 24 hours at 44.5 plus or minus 0.2 degrees Celsius. Fecal coliform bacteria are "indicator" organisms that suggest the possible presence of disease-causing organisms. Concentrations are measured in colony forming units per 100 milliliters of water (cfu/100mL).

Geometric mean: A mathematical expression of the central tendency (average) of multiple sample values. A geometric mean, unlike an arithmetic mean, tends to dampen the effect of very

high or low values, which might bias the mean if a straight average (arithmetic mean) were calculated. This is helpful when analyzing bacteria concentrations, because levels may vary anywhere from 10 to 10,000 fold over a given period. The calculation is performed by either:

(1) Taking the nth root of a product of n factors, or

(2) Taking the antilogarithm of the arithmetic mean of the logarithms of the individual values.

Hypolimnion: The deepest layer of water in a lake where water temperature changes less than 1° C per one meter of depth, and is sufficiently cooler than the surface layers to prevent mixing.

Lake Whatcom Management Interjurisdictional Coordinating Team: The Interjurisdictional Coordinating Team (ICT), created in 2000, coordinates activities and programs between the three jurisdictions. Consisting of staff from each of the three jurisdictions, this team meets on a regular basis to review the progress of tasks identified for the five-year Lake Whatcom Management Program.

Load allocation: The portion of a receiving water's loading capacity attributed to one or more of its existing or future sources of nonpoint pollution or to natural background sources.

Loading capacity: The greatest amount of a substance that a water body can receive and still meet water quality standards.

Margin of safety: Required component of TMDLs that accounts for uncertainty about the relationship between pollutant loads and quality of the receiving water body.

Municipal separate storm sewer systems (MS4): A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains): (1) owned or operated by a state, city, town, borough, county, parish, district, association, or other public body having jurisdiction over disposal of wastes, stormwater, or other wastes and (2) designed or used for collecting or conveying stormwater; (3) which is not a combined sewer; and (4) which is not part of a Publicly Owned Treatment Works (POTW) as defined in the Code of Federal Regulations at 40 CFR 122.2.

National Pollutant Discharge Elimination System (NPDES): National program for issuing and revising permits, as well as imposing and enforcing pretreatment requirements, under the Clean Water Act. The NPDES permit program regulates discharges from wastewater treatment plants, large factories, and other facilities that use, process, and discharge water back into lakes, streams, rivers, bays, and oceans.

Nonpoint source: Pollution that enters any waters of the state from any dispersed land-based or water-based activities, including but not limited to, atmospheric deposition; surface water runoff from agricultural lands, urban areas or forest lands; subsurface or underground sources; or discharges from boats or marine vessels not otherwise regulated under the National Pollutant Discharge Elimination System Program. Generally, any unconfined and diffuse source of contamination. Legally, any source of water pollution that does not meet the legal definition of "point source" in section 502(14) of the Clean Water Act.

Parameter: Water quality constituent being measured (analyte). A physical, chemical, or biological property whose values determine environmental characteristics or behavior.

Pathogen: Disease-causing microorganisms such as bacteria, protozoa, viruses.

Phase II stormwater permit: The second phase of stormwater regulation required under the federal Clean Water Act. The permit is issued to smaller municipal separate storm sewer systems (MS4s) and construction sites over one acre.

Point source: Sources of pollution that discharge at a specific location from pipes, outfalls, and conveyance channels to a surface water. Examples of point source discharges include municipal wastewater treatment plants, municipal stormwater systems, industrial waste treatment facilities, and construction sites that clear more than five acres of land.

Pollution: Such contamination or other alteration of the physical, chemical, or biological properties of any waters of the state. This includes change in temperature, taste, color, turbidity, or odor of the waters. It also includes discharge of any liquid, gaseous, solid, radioactive, or other substance into any waters of the state. This definition assumes that these changes will, or are likely to, create a nuisance or render such waters harmful, detrimental, or injurious to (1) public health, safety, or welfare, (2) domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or (3) livestock, wild animals, birds, fish, or other aquatic life.

Primary contact recreation: Activities where a person would have direct contact with water to the point of complete submergence including, but not limited to, skin diving, swimming, and water skiing.

Reach: A specific portion or segment of a stream.

Salmonid: Fish that belong to the family *Salmonidae*. Basically, any species of salmon, trout, or char. www.fws.gov/le/ImpExp/FactSheetSalmonids.htm

Stormwater: The portion of precipitation that does not naturally percolate into the ground or evaporate but instead runs off roads, pavement, and roofs during rainfall or snow melt. Stormwater can also come from hard or saturated grass surfaces such as lawns, pastures, playfields, and from gravel roads and parking lots.

Surface waters of the state: Lakes, rivers, ponds, streams, inland waters, salt waters, wetlands and all other surface waters and water courses within the jurisdiction of Washington State.

Surrogate measures: To provide more meaningful and measurable pollutant loading targets, EPA regulations [40 CFR 130.2(i)] allow other appropriate measures, or surrogate measures, in a TMDL. The Report of the Federal Advisory Committee on the Total Maximum Daily Load (TMDL) Program (EPA, 1998) includes the following guidance on the use of surrogate measures for TMDL development:

When the impairment is tied to a pollutant for which a numeric criterion is not possible, or where the impairment is identified but cannot be attributed to a single traditional "pollutant," the state should try to identify another (surrogate) environmental indicator that can be used to develop a quantified TMDL, using numeric analytical techniques where they are available, and best professional judgment (BPJ) where they are not.

Total maximum daily load (TMDL): A distribution of a substance in a water body designed to protect it from exceeding water quality standards. A TMDL is equal to the sum of all of the following: (1) individual wasteload allocations for point sources, (2) the load allocations for nonpoint sources, (3) the contribution of natural sources, and (4) a margin of safety to allow for uncertainty in the wasteload determination. A reserve for future growth is also generally provided.

Turbidity: A measure of water clarity. High levels of turbidity can have a negative impact on aquatic life.

Wasteload allocation: The portion of a receiving water's loading capacity allocated to existing or future point sources of pollution. Wasteload allocations constitute one type of water quality-based effluent limitation.

Watershed: A drainage area or basin in which all land and water areas drain or flow toward a central collector such as a stream, river, or lake at a lower elevation.

Acronyms and Abbreviations

Following are acronyms and abbreviations used frequently in this report.

BAS	Base Scenario representing land cover during model calibration (2002-2003)
BMP	Best management practice
EAS	Existing land cover scenario used to represent land cover in 2009
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
GIS	Geographic Information System software
HSPF	Hydrologic Simulation Program Fortran the runoff model used in the study
NPDES	National Pollutant Discharge Elimination System
TMDL	total maximum daily load (water cleanup plan)
WAC	Washington Administrative Code

Units of Measurement

cfu	colony forming units
ft	feet
g	gram, a unit of mass

kg	kilograms, a unit of mass equal to 1,000 grams.
kg/d	kilograms per day
kg/2003 yr	kilograms discharged in one year under 2003 weather conditions.
km	kilometer, a unit of length equal to 1,000 meters.
lb/2003 yr	pounds discharged in one year under 2003 weather conditions
lbs/Ac	pounds per acre
m	meter
mg/Kg	milligrams per kilogram (parts per million)
mg/L	milligrams per liter (parts per million)
mL	milliliters

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Appendix B. Record of public participation

Introduction

This TMDL was developed in close collaboration with the city of Bellingham, Whatcom County, and Lake Whatcom Water and Sewer District. Presentations on the development by Ecology and local government staff are well attended by the interested public.

Summary of comments and responses

Several comments lead to minor corrections. Additional language was provided where comments indicated ambiguity. An explicit margin of safety represented by 0.25% additional reduction in effective developed acres was added.

Because of delays in responding to comments near term (2014) timelines were changed to "within 6 months of TMDL approval."

A complete response to comments is provided in Appendix C.

List of public meetings

During the comment period, Ecology attended and spoke at a city of Bellingham Council Meeting, Whatcom County Council Meeting, and Lake Whatcom Water and Sewer District Commissioner meeting. How to access the document and how to comment was presented; questions from Council Members and Commissioners were answered.

Outreach and announcements

A 92-day public comment period for this report was held from February 25, 2013 through May 28, 2013.
A news release was sent to all local media in the Bellingham area.
Advertisements were placed in the following publications:

- Bellingham Herald

The story was covered by Seattle and Bellingham radio, the Bellingham Herald (daily general circulation paper) and Cascadia Weekly (weekly independent newspaper).

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Appendix C. Response to public comments

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Summary of Changes

Following are public comments the Washington State Department of Ecology (Ecology) received while the draft of this document was posted on the web and available for comment.

Changes to this document are primarily to provide clarification. There have been some corrections to fix units and labels.

Implementation actions during the planning period have been added to document the work taking place concurrent with planning.

In response to comments about lack of enforcement, the city and county will provide a written enforcement policy and procedure to provide transparency.

Whatcom County has been afforded the opportunity to defer permit expansion to regions outside of the urbanized and urban growth areas. This is provided they can demonstrate the developed area not covered by the permit is making equivalent reductions to the areas that are covered by the permit.

An explicit margin of safety has been added. The text read that the TMDL requires an 87% rollback, but this was rounded off from 86.75%. The tables have been changed to reflect the rounding to 87%, providing a 0.25% margin of safety.

List of respondents

ID	Respondent
BPL	Bob and Pat Lindquist
CD	Cheryl Davis
COB	City of Bellingham
DP	Dale R. Petersen
DI	David Insho
EPA	EPA
EH	Eric Hirst
FW	Futurewise
GW	Gaythia Weis
JH	Jim Hanson
LS	Les Scott
MB	Michael Bakke
NA	Nancy Alyanak
RS	ReSources
SK	Sandra E. Kelly
SP	Sandy Petersen
SK	Susan Kahn
TG	Thomas Goetzl
WC	Whatcom County

Response to comment by grouped response

Several comments have a similar response. Under the broad category of the nature of the comment, the individual comments are paraphrased with an indication of which Respondent make the comment. The Ecology response follows. The city of Bellingham had a general statement of agreement with the county comment letter. The city has not been reflected as a second source for each of the Whatcom County comments. The entire text of all of the comments received is at the end of this appendix in the order they were received.

Beyond Scope of a TMDL

- Ecology should have prevented decline (SK1)
- Ecology should have taken lead on Lake Plan (SK2)
- Ecology should have intervened (SK3)
- Lack of intervention created problem (SK4)

Response: A TMDL is initiated after a water body is placed on the 303(d) list. Ecology's role is to determine the loading capacity of the water body and make allocations of the loading capacity. The actions suggested by the comments may have avoided a 303(d) listing and the need to prepare a TMDL, but they are beyond the scope of a TMDL.

Editorial

Clarification

- TMDL reopener needs to be more explicit (COB1)
- Requests more explicit description that wasteload allocation and load allocation will be modified (WC22)

Response: Ecology concurs. The purpose of the continuous improvement of the models and implementation plans is to better define the loading capacity. As loading capacity changes, the TMDL will need to be modified to ensure the wasteload allocations and load allocation do not exceed loading capacity. A description is provided in the section on Adaptive Management in the Implementation section.

- Consistency in usage developed acres/effective developed acres (EPA11)

Response: The document has been revised to read "effective developed acres" when the phrase is used to describe developed acres that have not been fully mitigated. The unqualified "developed acres" is used only when describing existing estimate of acres that have been developed regardless of stormwater mitigation.

- Be more explicit on what parameters were modified on page 16 (EPA16)
- Unclear that HSPF was updated with new land cover information (WC12)

Response: Page 16 text has been revised to describe that the only changes were areas assigned to land cover classes.
A table of Areas by Reach (Table 3) has been added.

- Is Year calendar year or water year (NA5)

Response: The allocations are based on a calendar year as noted in paragraph 5 of the section "Loading capacity". The lake response model was run for consecutive calendar years. January 1 is a much more stable period for the lake with generally well-mixed conditions. At the beginning of the water year October 1, the lake is in a state of decaying stratification. Text was added to the rationale on the selection of period used for annual loading in the section "Loading capacity."

- Include Annual as part of definition of areal loading rate terms (WC15)

Response: Table 5 was updated to add daily and annual to clarify.

- There is confusion over the difference between the reach names and drainage names (WC16)

Response: Text was revised to use reach numbers when referring to HSPF reaches and drainage names when referring to WRIA 1 watershed planning drainages.

- Suggests adding maps showing land use areas and zoning, area considered forest (WC6)

Response: A map (Figure 8) was added that shows areas covered by (1) city of Bellingham wasteload allocation, (2) Whatcom County wasteload allocation, (3) the area proposed for extension of the Whatcom County Stormwater Permit, and (4) the area covered by the load allocation.

Correction

- Inconsistency in description of 87% reduction on pages pp x, 15-16, 22 (WC7)

Response: Language was revised to ensure the intent to reduce 87% of the *excess* phosphorus is made clear.

- There is a mix of pounds and kilograms (COB4)

Response: Table 6 was revised to use only kilograms for total loading. Areal loading is expressed in pounds per year and pounds per day.

- WQS apply, not TMDL criteria (EPA5)

Response: Page 9 was revised.

- page 27 missing "d" on based (EPA6)

Response: Page 27 was revised.

- Table 10 should refer to wasteload allocation not load allocation (WC18)

Response: Table headings were corrected to agree with text.

- Suggests that wasteload allocation for non UGA/UA should not be listed as wasteload allocation (WC20)

Response: Text was revised to describe allocation to area outside existing permit and not zoned Commercial Forest as proposed load allocation.

- Total phosphorus loading allocated to developed area only (WC9)

Response: Text was revised to reflect total phosphorus loading beyond forest loading was allocated to developed area only.

Organization

- Table ES-1 could be moved to allocations section (EPA20)
- Page xvi "Approach to permitting" could be moved to WLA section (EPA21)

Response: The data in the table is in the executive summary to provide a complete overview. The relevant data also appears in the appropriate load allocations and wasteload allocations sections. The approach to permitting section was incorporated into the wasteload allocation section.

Surrogate Choice

- Prefers mass per unit time over surrogate (WC4)
- Do not include annual P load as surrogate (WC11)

Response: The effective developed acres surrogate was retained. The variability of phosphorus in the water column prevents using direct measurements of phosphorus for any meaningful measure of compliance with the TMDL. The annual loading and the daily loading are estimates based on the runoff model described in the TMDL. The model scenario with 87% of the developed area modeled as forest area meets the targets. Developed areas that have stormwater improvements to reduce and treat stormwater runoff to more nearly approximate forest conditions can be reliably measured.

The mass per unit time measurements are provided in the TMDL in anticipation of considering future water quality trading. Results from the models in Volume 1 and 2 show that there is a remarkable insensitivity to where phosphorus enters the lake. Yet the estimated background loading and the allowable excess loading vary around the lake. So pound for pound, offsets are the most appropriate way to ensure that any contemplated trades will support meeting water quality standards over the long term.

Feasibility

- Suggests protecting known uses more reasonable than meeting dissolved oxygen criterion (WC3)

Response: Comments were received questioning the feasibility of reducing phosphorus enough to meet dissolved oxygen water quality standards. The question of feasibility is premature at this early stage, given that we have not yet begun to actively implement the TMDL. This TMDL recognizes that reducing phosphorus in Lake Whatcom to levels needed to meet dissolved oxygen standards will be challenging and will take many years to implement. The steady decline of Lake Whatcom's water quality happened over the course of decades. It will likely take a commensurate amount of time to reduce phosphorus inputs and associated internal recycling that will result in meeting water quality standards. Cities and counties across the country will adaptively manage their water quality programs to achieve pollution control limits. As a result, Ecology anticipates the emergence of new technologies for removing phosphorus and controlling stormwater. We may find, after the TMDL has been fully implemented, that it is not possible to meet dissolved oxygen levels. In that case, we would use information and data gathered during the TMDL implementation phase to determine what steps should be taken next.

The need to protect existing uses was reviewed with Whatcom County subsequent to receiving their comments. The only way to relax our water quality criteria requires ensuring that existing uses will be protected. That process is called a Use Attainability Analysis.

A Use Attainability Analysis (UAA) may only be developed to modify the standards in certain situations. For example, a UAA can only change a designated use if it is not an "existing use." Designated uses are assigned in our standards for each water body, whereas EPA regulations define existing uses as "those uses actually attained in a water body on or after November 28, 1975 whether or not they are included in the water quality standards."[1],[2] Therefore, existing uses serve as the baseline or "floor" of the uses required to be maintained, as well as the water quality defined in the standards as necessary to fully protect them.

In the case of Lake Whatcom, the aquatic life use has been impacted by increased phosphorus inputs due to human action. These uses must be restored to levels that were achieved in 1975 or any time thereafter. Since phosphorus inputs have increased over the years, we can assume that

[1] 40 C.F.R. § 131.3(e)
[2] November 28, 1975, is the date EPA promulgated the initial federal water quality standards regulations related to existing uses.

the water quality was better and possibly meeting (or more closely meeting) DO criteria in the past.

The following link is to a frequently asked question on UAAs. This will help explain UAAs further -- https://fortress.wa.gov/ecy/publications/summarypages/0410021.html

Another question often asked is whether the numeric criteria can be modified through a UAA or some other standards path. See answer in UAA FAQ under Question: Can a water quality criterion be made less stringent? The answer is yes, but this must be based on a UAA or determination of natural conditions – which would lead to a site-specific criteria. The site-specific criteria tool recognizes that there are situations in which the water body-specific numeric criteria provided to maintain full protection of the most sensitive aquatic life uses may naturally be of lesser quality. However, lesser quality due to human action cannot lead to site-specific criteria.

Here are a few other resources from EPA that address UAAs and "existing uses:"
http://water.epa.gov/scitech/swguidance/standards/handbook/chapter04.cfm#section4
http://water.epa.gov/scitech/swguidance/standards/uses/uaa/index.cfm

- Loss of transpiration and limited infiltration makes 87% reduction infeasible (WC2)

Response: Loss of transpiration will require additional storage. Rainwater harvest replacing other water uses may make significant contributions to runoff reduction in many cases. In the most extreme cases, water may need to be stored for months to allow infiltration during summer.

Naturally low rates of infiltration affect the estimates of runoff in both forested and developed conditions. So both conditions will have more runoff than areas with high rates of infiltration. In areas with low infiltration, impervious areas will likely require more storage than areas with greater infiltration capacity. This is one reason why Table 5 lists natural loading rates by specific HSPF-modeled reach. As the continuous improvement of the models takes place, a more refined list of expected natural loading rates in the watershed is anticipated.

- HSPF shows high phosphorus levels in the interflow. How does that work with proposed soil infiltration (WC27)

Response: The groundwater study done for this project (Pitz, 2005) identified groundwater phosphorus concentrations existing around Lake Whatcom. The author notes that the phosphorus levels are higher than we see in the lake. The author also notes that those concentrations are a maximum and should be reduced by 50% to 90% due to phosphorus adsorption as water passes through the sediment layer where dissolved oxygen is present. The CE-QUAL model was balanced with groundwater concentrations reduced by 50%. The same data was supplied to the consultants who developed the HSPF model.

As identified in Volume 1, the HSPF model developed for Lake Whatcom has a very simple phosphorus fate and transport mechanism. As noted by the comment, the maximum interflow values are 70 micrograms per liter. That maximum occurs during July on residential pervious areas in 7 of the 22 reaches. June and August also have fairly high interflow concentrations. The median interflow concentration is 8 mg/L from October to April. Groundwater outflow concentration for those areas is 45 mg/L with a median value of 5 micrograms in October to

April. These are the estimates of the concentration of interflow and groundwater that enter tributary streams. For comparison, surface runoff from the same areas would approach 200 mg/L with median hourly rainfall intensity. The model calibration indicates infiltrated water has lower contribution of phosphorus than surface water.

The recommendations section of Volume 1 identified interflow and groundwater discharges as appropriate fields of study for the future. Those studies could verify that the model predictions are accurate estimates of soil treatment of phosphorus.

Implementation

Enforcement

- Fertilizer restrictions lack enforcement (MB1)
- Ecology should require stricter and stronger measures from the city of Bellingham and Whatcom County (BL2)

Response: Ecology is not in a position to tell the local governments how to enforce their regulations. However, TMDL-related requirements in municipal stormwater permits are enforceable. The implementation section was modified to require the city and county to provide a written enforcement process to provide transparency.

Equity

- It is not fair to put the entire burden on Homeowners (DP1)

Response: The TMDL does not place the entire burden of phosphorus reduction to Lake Whatcom on private homeowners. Phosphorus reduction goals and development restrictions are largely applied to public stormwater programs through their municipal stormwater permits. The balance of the burden between public and private-controlled sources will have to be decided by local governments using the tools that they have. The TMDL does not stipulate the exact balance between public and private sources; it only defines the overall goal.

Funding

- Commenter has suggestions on funding mechanisms (EH5)

Response: There is no doubt that implementing the TMDL will be costly. The TMDL provides descriptions of potential funding mechanisms and Ecology administers numerous grant and loan programs for local government financial assistance. It is at the local government level that the decisions on how to secure the funding will be made. It is too early for Ecology to define a budget that the local governments must meet. We do not yet know what the total budget will be. That is why the TMDL requires a preliminary budget be developed for a fixed timeline and to define the timeline necessary with existing budgets.

- State should provide funding to address loads from historic forest practices (COB8)

Response: Funding for addressing loads from historic forest practices on state owned lands could be pursued with the Department of Natural Resources through the Interjurisdictional Committee set up under the Landscape Plan.

If there are specific projects identified that would address legacy sources, they may be eligible for funding through Ecology's competitive process of allocating Centennial Clean Water Fund, 319, and State Revolving Fund funds.

New Development

- Restrict or eliminate future development around the lake (EH4)(BPL3)(GW2)

Response: This TMDL restricts the impacts of runoff from development in the Lake Whatcom watershed and makes no allowance for increased discharge from new developments. At the time of publication, both the city of Bellingham and Whatcom County have development regulations in place that require new development to not exceed the phosphorus loading that would occur under forested conditions.

- If new regulations are not adequate, problems from new development will not be easy to fix (GW1)

Response: Retrofitting existing development to reduce phosphorus is challenging. The regulations in place at the time of TMDL publication and the knowledge we now have are believed to eliminate any excess phosphorus. If we are wrong, the development regulations may have to be amended and our target for reductions on existing development may have to be increased to meet the TMDL.

New responsibility for Lake Whatcom Water and Sewer District

- Evaluate feasibility of LWWSD addressing stormwater (SP4)

Response: The Phase II Western Washington Municipal Stormwater Permit (MS4 permit) allows Whatcom County to develop an interlocal agreement with other related entities to perform some or all of Whatcom County's responsibilities. Whatcom County, as the owner of the MS4, would retain the responsibility to ensure the permit conditions are met. The decision to do so must be made by Whatcom County.

Recommended clean up actions

- Supports full infiltration and limiting impervious surfaces (FW1)

Response: Ecology concurs that the minimum departure from the natural hydrologic cycle has the least risk of exceeding water quality standards. However, any approach that meets the goals will be allowed.

- Suggests adding treatment BMPs to list (WC5)

Response: Ecology concurs that treatment will be necessary to meet the goals. The Executive Summary page vii was revised.

- In-lake treatment to control internal recycle recommended; delay other actions until in-lake treatment is evaluated; possible alteration of source control (SP2)

Response: The commenter provided references to several projects that had made allocations based on reductions on internal phosphorus recycling achieved with in-lake treatment. Ecology contacted the managers of the projects. None of them have been successful. Most failed due to lack of funding. Some failed because the scope of the treatment was underestimated, and the problem was only partly addressed then overwhelmed by external loading. In this TMDL, we

anticipate that it will take many years to meet the load reductions for external sources. Over that period of time, the internal recycle rate will have an opportunity to reach a new equilibrium. As our target external load is very close to natural loading, we anticipate that internal recycle rates after many years will also be near natural recycle rates.

- Need stronger protection for lake (SK1)

Response: The TMDL sets a goal that is necessary to meet water quality standards. The standard is a very protective standard for the designated aquatic life uses in Lake Whatcom and should only allow a very small deviation from natural conditions.

Timeframe

- Time line too long (EH1)
- Clean-up should be in the shortest time feasible (EPA2)(LS1)
- Need more aggressive schedule (TG1)

Response: As pointed out previously, reducing external phosphorus load and allowing the internal lake phosphorus cycling to re-equilibrate to post-implementation conditions will take time. Ecology will revise text to make clear that the 50-year fixed timeline is not the minimum but just a fixed point that is expected to be useful to determine what is the shortest feasible time for completing the TMDL implementation.

- Now is time for action (BPL1)(FW2)
- Require some implementation during initial planning (EPA8)
- Do not allow 5 year of planning prior to implementation (EH2)

Response: Both the city of Bellingham and Whatcom County have implementation projects planned. Ecology will work with both entities to frame those projects in terms of TMDL obligations completed. This will enable the public to better understand the work that will take place while planning progresses. Table C-1 provides an estimate of the progress made by the city and county toward the TMDL goals while the TMDL was in development. The estimates were made based on an assumption of 100% removal for infiltration, 50% removal for filtration systems and 10% removal for overland flow through bioswales. The estimates are somewhat lower than each jurisdiction estimated but represents a minimum progress. With additional data on loading and efficiency more progress may be warranted. As this TMDL is written, Whatcom County is proposing significant increases in funding for implementation activities while the planning continues.

Table C-1. Progress made while TMDL was in development

Drainage Name	EDA Reduction Target	EDA Reduction Completed	% EDA Completed	TP Reduction Target (lbs)	TP Reduction Completed	% TP Completed
Academy	253.2	22.54	9%	293.4	26.15	9%
Agate Bay	289.2	0.00	0%	335.3	0.00	0%
Anderson	221.4	0.00	0%	65.7	0.00	0%
Austin/Beaver	335.6	0.01	0%	283.5	0.00	0%
Bloedel	53.9	21.90	41%	41.4	16.91	41%
Blue Canyon	220	0.00	0%	55.6	0.00	0%
Brannian	101.2	0.00	0%	63.9	0.00	0%
Cable	87.2	49.17	56%	46.3	26.13	56%
Carpenter	208.7	0.00	0%	255.5	0.00	0%
Donovan	42.3	2.06	5%	26.0	1.10	4%
Eagle Ridge	41.1	0.00	0%	47.6	0.00	0%
Fir	7.5	0.00	0%	4.9	0.00	0%
Geneva	59.9	0.00	0%	26.5	0.00	0%
Hillsdale	283.9	34.87	12%	310.2	38.69	12%
North Shore	205	0.00	0%	207.2	0.00	0%
Olsen	23.9	0.00	0%	30.0	0.00	0%
Oriental (Mill Wheel Ck)	83.6	0.00	0%	58.2	0.00	0%
Silver Beach	225.5	93.96	42%	261.0	109.07	42%
Smith	95.4	0.00	0%	11.0	0.00	0%
South Bay	296.1	0.00	0%	314.4	0.00	0%
Strawberry	221.9	67.21	30%	140.2	35.86	26%
Sudden Valley	216.4	0.00	0%	269.8	0.00	0%
Total	**3572.9**	**291.726**	**8%**	**3147.8**	**253.93**	**8%**

Ecology is comfortable that efforts by the city and county to develop long range plans and coordinate their implementation efforts will not interfere with the continued implementation of this TMDL.

- 5 years for plan development is too long (RS3)
- 2014 or 2015 implementation plan date suggested (RS4)

Response: The plan that Ecology is asking for is complex both technically as well as politically. The technical issues have to be addressed first. That is, which implementation actions and how

much implementation activity will be needed to meet the TMDL goals and what will those activities cost.

The political complexity is answered in making the decision about how rapidly we can accomplish those goals. Very short timelines will require more money. Not only because of accelerated expenditures to get more done in a shorter period of time, but also the shortest timeframes require rebuilding functional infrastructure. Longer timelines can align retrofit needs into expected replacement schedules.

The deadlines in the TMDL are required to be met when they are part of NPDES permits. The jurisdictions are already beginning to address that work while the TMDL is being finalized. They are free to complete the tasks ahead of schedule.

- New Development continues to add burden while planning (RS1)

Response: Development regulations in place now are designed to ensure any new development will not add to phosphorus loading to the lake.

- Model improvements can happen parallel to regulation and be incorporated into TMDL (RS2)

Response: Ecology concurs. This is why our TMDL incorporates model improvement followed by implementation schedule improvements. The text was revised to make clear that TMDL modification may occur with implementation schedule revisions.

While this TMDL was in development, the city and county were building a program for retrofitting the stormwater system to provide treatment. Ecology evaluated the extent to which those efforts make progress toward meeting TMDL reductions. Table C-1 is a summary of the estimated progress in each basin that has been accomplished through stormwater treatment. This estimate should be considered a minimum level. It did not include residential lot level source reduction efforts or stream bank erosion efforts. It is based on the estimated efficiency and the estimated loading received. The values in columns labeled with "EDA" represent how many developed acres would have to be converted to function like a forest to achieve an equivalent phosphorus reduction.

Water Quality Trades

- Make explicit allowance for water quality trades between basins (COB5)

Response: Basin-specific loading conforming to the drainages defined by the WRIA 1 Watershed Plan was made at the request of local governments. The target reduction in effective developed acres is uniform across the reach. But, the mass loading achieved for each reduced effective developed acre varies by basin. The results of Volume 1 indicate that there is little sensitivity in the lake to the location of where a mass of phosphorus enters the lake. Therefore, inter-basin water quality offsets (or water quality trades) should be mass neutral.

WAC 173-201A-450 defines the conditions that need to be met for a water quality offset. In anticipation that a trading program may be considered in the future, the mass loading expected from effective developed acres and forest acres is calculated in Table 5. The text will make clear that this data is in anticipation of the development of a water quality trading or offset program.

Required Elements

303(d) listing

- Ensure Table 6 updated (EPA15)
- Lake not listed for Phosphorus (SP1)

Response: Table 6 was updated based on the latest approved 303(d) list at the time of publication. Lake Whatcom is currently listed for Total Phosphorus. The listing identifier is 562. Information on the listing can be viewed at http://apps.ecy.wa.gov/wats/ViewListing.aspx?LISTING_ID=8621.

Critical Conditions

- Need to identify critical conditions (EPA14)

Response: This is addressed on pages 59 and 79 of Volume 1 for phosphorus and fecal coliform respectively. Volume 1 and the appendices (including response to comments) will be submitted to EPA with Volume 2 as the TMDL submittal.

Daily Load

- Need to add Daily Load (EPA1)

Response: Daily load was added. The daily load is taken from the maximum daily load simulated in calendar year 2003 from the 87% rollback. Over a 50-year time span, a higher daily load could be anticipated consistent with the 87% rollback, especially when one considers naturally occurring mass wasting events. However, our model is not calibrated to include rare events. This is one reason our surrogate of effective developed acres is used to measure progress to meeting the TMDL. If we are meeting the total phosphorus loading in most normal years, the lake's response to rare but natural events will be a natural response.

Loading capacity

- Loading capacity not repeated from Volume 1 (EPA12)

Response: Volume 1 will be submitted with Volume 2 as part of TMDL package.

Margin of Safety

- Need to provide margin of safety for DO/Phosphorus (EPA7)

Response: The original tables showing allocations of effective developed acres and mass of phosphorus were based on an 86.75% reduction in effective developed acres. This was the minimum reduction that meets the water quality standard for DO. The TMDL has been revised to reflect an 87% reduction in effective developed acres providing an explicit margin of safety. The text in the margin of safety section has been revised to reflect the change.

Reserve for growth

- A reserve for growth should be considered (EPA19)

Response: The decision not to make an allocation for growth in the fecal coliform TMDL was documented on page 84 of Volume 1. Pages 75 and 76 describe options on how future growth could be accommodated in a TMDL. Both city of Bellingham and Whatcom County indicated an intent to regulate new development to be phosphorus neutral, equivalent to forested land

cover. The TMDL allocations were based on that assumption. If allocation is needed for a project in the future, it can only be accommodated with a water quality offset. See also *Water Quality Trades* under the **Implementation** section of this appendix.

Surrogate

- Should include language on authority (EPA 3)
- What is a surrogate (EPA4)
- Provide more clarity on connection between surrogate and pollutant of concern (EPA9)
- Which targets used for permitting (EPA10)

Response: Text was revised to include standard language regarding the definition of a surrogate and authority to use surrogates in a TMDL. The text will also be revised to indicate that mass loadings are calculated from models dependent upon the surrogate. That is, the mass of phosphorus per year and per day are calculated based on a model that reflects 87% of effective developed acres having been retrofit to function like forested land cover.

Wasteload Allocation

- Forested area should not be considered as part of Whatcom County wasteload allocation (WC19)
- Failure to distinguish wasteload allocation from load allocation (WC10)
- Need to provide reasonable assurance that Forest load allocation will be met (EPA18)

Response: Ecology concurs that pollutants from areas zoned Commercial Forest are not part of Whatcom County wasteload allocation. The phosphorus and fecal coliform allocations in Whatcom County are broken down into wasteload allocation, proposed wasteload allocation, and load allocation. The wasteload allocation is based on the area that is covered by the current Western Washington Phase II Municipal Stormwater Permit. The proposed wasteload allocation is based on the proposed expansion of the area covered by that permit. The load allocation is based on the area zoned for commercial forest, respectively. Figure 8 maps out those areas.

The forest load allocation is already being met. The estimate of the natural runoff was based on calibration of the runoff model. In the model, forest land reflected existing forest practices in place during calibration sampling in 2002 and 2003. Since then, the Department of Natural Resources has implemented a Landscape Plan (Plan). The Plan puts additional restrictions on about half of the forest land in the Lake Whatcom watershed. The Plan reduces the risk of human- caused mass wasting and accelerates road improvements to reduce surface erosion. Adaptive management under forest practice rules (RCW 76-09) is based on the Forest and Fish report regulating commercial forestry, and required by the Clean Water Assurance granted by Ecology. These ensure that if practices are identified that cause an increase in background loading, we will have the tools to assess the impact on Lake Whatcom and can address it though the continuous improvement process.

- How will wasteload allocation be calculated for year other than 2003 (EPA13)

Response: Mass-based wasteload allocations can be calculated for any period of time, based on the surrogate effective developed acres. Runoff models are used to estimate the runoff and concentration that would be generated for a given time period. The models use the period of interest's meteorology to calculate loading from a land cover that meets the TMDL target for Effective Developed Acres.

- Expresses opinion that MEP requirement overrides need to meet wasteload allocation in Stormwater NPDES permits (WC8)

Response: The Clean Water Act section 402(p)(3)(B)(iii) requires controls to reduce the discharge of pollutants to the maximum extent practicable for municipal stormwater discharge permits. This requirement is included in the Western Washington Phase II Municipal Stormwater Discharge Permit as Part C of Condition S4.

Municipal Stormwater permits *also* require compliance with applicable TMDLs in addition to meeting other limits in the permit. This is a federal regulation found at 40CFR122.34(e)(1). That requirement is reflected in Condition S7 of the Western Washington Municipal Stormwater Permit.

- Proposes permit not be expanded to include all of Whatcom County (WC17)

Response: Ecology is proposing expanding permit requirements to all of the land in the Lake Whatcom watershed over which Whatcom County has land use authority which drains to an MS4. All development that increases phosphorus loading over natural rates is "significant" in the context of CWA 402(p)(2)(E). 40CFR122(a)(9)(i)(C) makes clear that stormwater discharges that are identified in a TMDL, and would not otherwise be regulated, can be required to have a permit. Ecology could also issue an individual municipal stormwater permit for that area outside of the existing permit. However, the agency believes it would be more effective to cover the expanded area under a general permit. Whatcom County will have an opportunity to appeal that decision when Ecology takes formal action to expand the coverage through an administrative order or permit reissuance.

The wasteload allocation for areas not yet permitted was separated and identified as proposed wasteload allocation that will be converted to wasteload allocation when permit coverage is expanded. The expansion of the coverage can be deferred as long as Whatcom County can demonstrate that control of the developed area not covered by the permit is receiving control equivalent to the area covered by the permit,

Water Quality Standards

Uses

- Has the Lake Whatcom Water and Sewer District experienced algae clogging (SP5)

Response: No, but other indications of changes due to increasing algae have been reported by the district to the Lake Whatcom Management Date Team.

Criteria

- Figure 5 difficult to interpret. Looks like scenario matches full rollback (WC14)

Response: The full water column results are shown. In the final report, a second figure that only addresses the portion of the water column with dissolved oxygen levels below 8 mg/L was provided. This figure has an inset showing that 1.626 million cubic meters of water has a dissolved oxygen level 0.19789 mg/l less than the same volume of water in the full rollback scenario. This is just 0.0021 mg/l better than the criteria for that volume of water, and represents a margin of safety.

Water Quality Models

Sensitivity

- Requests more discrimination of loading and WQ effects between basins (COB6)

Response: Volume I provided an informal sensitivity analysis of the location of phosphorus inputs. The partial rollback from the base case has more of the loading concentrated in Basin 1 than the partial rollback from full build-out. But, the total loading is very nearly the same. As more sophisticated models are developed in the future, we may find that there is some sensitivity. Currently, it appears that a mass of phosphorus has essentially the same effect regardless of where it enters the lake. See also response to COB5 comment under *Water Quality Trades* under **Implementation**.

Expertise

- Local governments lack expertise (SK5)
- Questions how local jurisdictions will improve watershed models (WC21)

Response: Ecology has worked with and will continue to work with local governments to assist them as they implement the TMDL and the continuous improvement process. Both jurisdictions have hired consultants in the past that are qualified to conduct the proposed work. Both have made progress already on identifying improvements that could be made on the runoff model.

Improve Models

- Concern about how Middle Fork Diversion was incorporated into HSPF and CE-QUAL-W2 (NA3)

Response: The Middle Fork was treated as a separate tributary to Lake Whatcom. The flow was subtracted from the Anderson Creek Gage when the diversion was in operation. The total phosphorus concentrations, and partitioning of the total phosphorus, were based on data provided by the city of Bellingham. Anderson Creek flows, from the Anderson Creek watershed, were based on the HSPF calculated flows for the Anderson Creek watershed.

- Internal Loading needs to be better quantified (COB7)
- Wasteloads based on limited stormwater data (WC1)

Response: Ecology acknowledges that model improvements can be made, especially on internal loading and loading from stormwater. This is why the continuous improvement process was included as part of TMDL implementation. Ideally, the city of Bellingham and Whatcom County will cooperate to identify the most important model improvements, collect data to implement the improvements, and revise the TMDL every decade.

- Was consideration of HSPF recalibration considered? (WC13)

Response: Yes. In collaboration with the Lake Whatcom Management Program's data team, the runoff model selection was discussed in early 2009 after the release of Volume 1. The data team recommended that Ecology proceed with the existing model and that improvements be incorporated as part of the TMDL implementation.

- Mass wasting events from forested areas are not properly characterized in models (WC23)

Response: Mass wasting is part of natural background loading. However, historic forest practices increased the frequency and severity of mass wasting events beyond natural levels. Current forest practice rules have been modified to address increases in mass wasting caused by forestry. The Lake Whatcom Watershed Analysis addressed the mass wasting element so there are Lake Whatcom specific prescriptions to protect against increased mass wasting. Department of Natural Resources (DNR) managed land has additional protection in the buffers of land at risk of mass wasting. The major cause of mass wasting associated with historic practices is associated with historic forest practice roads. Whatcom County and the city of Bellingham both reviewed the Road Management and Abandonment Plan prepared by the DNR under an accelerated schedule imposed by the Lake Whatcom Landscape Plan. We conclude that if a periodic load associated with mass wasting were added, it would be similar in both the Natural Background and TMDL scenarios. As the magnitude would be similar in both scenarios, it would not have a detectable effect on other watershed loading reductions needed.

No major mass wasting events occurred during the calibration monitoring. The model as currently calibrated does not have a way to incorporate mass wasting. There are several options to consider for improvements in the modeling process in relation to mass wasting. As computer resources improve allowing for longer periods of time for simulations, this will become more important. For this TMDL, a typical year was repeated for seven years back-to-back, during which mass wasting from forest roads was not predicted. When modeling simulations cover periods of a decade or more, it may be both possible and important to incorporate and forecast loading associated with mass wasting.

Sources

Forest

- Request identification of Wasteload Allocation for Forestry now or in future (COB2)
- Questions forest approaching Background (COB3)

Response: Section 404(f) of the Clean Water Act exempts silvicultural activities from NPDES permitting under Section 402 of the Clean Water Act. If nonsilvicultural activities in commercial zoned land take place that cause a discharge, the activity may need to have an NPDES permit. The wasteload available to them would be equivalent to the load allocation for the same area that is now being covered by the NPDES permit.

If future model improvements allow discrimination of managed forest from natural forest, the local governments may provide the revised model for TMDL modification.

Funding

- Charge for outdoor parking (CD3)

Response: TMDLs do not normally specify funding mechanisms such as parking fees as part of a water quality improvement plan. The city of Bellingham and Whatcom County would be the jurisdictions to decide on the appropriate funding mechanism and means of controlling parking behavior.

Other Pollutants

- The TMDL does not address benzene and invasive species (DI2)

Response: Lake Whatcom is not 303(d) listed for benzene or invasive species. The city of Bellingham and Whatcom County have taken measures to control both benzene and invasive species. The ban on two-cycle engines removed the largest known source of benzene and other hydrocarbons to the lake.

A lake impaired by aquatic invasive species is not typically addressed by a TMDL as it is considered impaired by a non-pollutant. Ecology administers grant programs which address lake algae and invasive species. The Lake Whatcom Management Team has formed an Aquatic Invasive Species program which is designed to eliminate introduction of invasive species.

Other Source - animals

- Pets and wildlife should be quantified (DP3)
- Relocate Deer (CD2)
- Deer are a significant source in Sudden Valley (NA1)

Response: Restoration of forest hydrology should bring down pet and wildlife sources in the developed areas to more nearly match natural levels. To the extent that treatment is used to control phosphorus but does not reduce fecal coliform, pet and wildlife contributions in the developed area may need to be quantified. Significance of pet and wildlife contributions should become clearer after several years of implementation.

- Ban Chickens (CD8)

Response: Chickens are prohibited in the city by BMC 16.580.060. Agriculture is prohibited in the county by WCC 20.51.099. Each jurisdiction has different ways to address existing non-conforming uses.

- Ban dogs from Bloedel Donovan Park (CD6)
- Relocate or kill geese in Bloedel Donovan Park (CD2)

Response: Dogs and geese in Bloedel Donovan Park can be a significant source. The city has appropriate controls for dog feces by requiring pet-owner pick up. As long as dogs are urinating on vegetated areas they should not be a significant source of pollution and may help control the attractiveness of the area to geese. Prohibiting the feeding of geese will also help control the attractiveness of the park to geese, but ultimately the city may have to alter vegetation along the shoreline to fully control the goose sources.

Other sources – autos and oil

- Development, resource extraction and petrol-based recreation pollutes our drinking water (DI1)
- Motor oil contains phosphorus and is visible as sheen on roads (DP4)
- Fluid leaking from parked vehicles is a source (CD4)

Response: Oil on roads that flows off to ditches or pipes represents an illicit discharge. The city of Bellingham and Whatcom County must have ordinances that effectively prohibit illicit discharges. As part of that program, each has a phone line to receive complaints. For discharges

in the city call 360-778-7979; in the county call (360) 715-7450. Spills can also be reported to Ecology by calling 1-800-258-5990.

Other Sources – miscellaneous

- Ban boats from the Lake (CD1)(TG2)
- Developed areas are the source (LS2)
- Discharge of phosphorus in chemicals used by people (TG3)

Response: Ecology is not authorized to prohibit boating on Lake Whatcom. If a significant source of phosphorus or bacteria is associated with boating activity, local governments will need to address the source in future updates to the models and recommended reapportionment of allocations if necessary.

Developed areas are identified in the TMDL as phosphorus sources that need to be reduced. Both the city of Bellingham and Whatcom County have ordinances that prohibit illicit discharges. Any chemicals added to stormwater are an illicit discharge. The illicit discharges can be controlled with education and enforcement of the ordinance. But development does change the characteristic of the allowed stormwater discharges; more water with more phosphorus is typically discharged in developed areas because there is less infiltration. The discharge of stormwater will have to be controlled with education and retrofit to change how stormwater runs off and is treated.

- Investigate old dump (DP2)

Response: There are two former dumps in Lake Whatcom watershed on the Y Road. Both have been investigated at various levels of intensity. Leachate from the dumps would reach Lake Whatcom via Carpenter Creek. Investigations have never found an effect from the dumps on Carpenter Creek. Whatcom County continues to monitor both dumps to ensure contamination from them does not enter Carpenter Creek.

- Fireworks (CD5)

Response: The quantification of phosphorus associated with fireworks has not been undertaken at this time. If fireworks are discovered to be a source that needs to be controlled, it will be a responsibility of Whatcom County to do so.

- Middle Fork Diversion should be better controlled and receive allocation (NA2)(NA4)(SP3)
- Ecology must require specific steps the local governments take to reduce phosphorus (EH3)

Response: The diversion of water from the Middle Fork of the Nooksack River introduces phosphorus that is accounted for in the TMDL. It is part of the load allocation that is not required to be reduced. That was reflected in Table 9 as the Middle Fork Diversion. This is because the phosphorus is introduced as part of the exercise of a water right. RCW 90.48.422(3) limits a TMDL's authority over the exercise of a water right. The phosphorus in the diversion is included in both the full rollback and the 86% rollback scenarios. If the city can operate the diversion in a way to reduce phosphorus and still exercise their full water right, we would make the reductions in both the full rollback and partial rollback scenarios. Those reductions would not be available to offset other contributions.

Ecology is requiring local governments to make reductions to phosphorus entering Lake Whatcom. Ecology set the targets and will allow local governments some flexibility in how they can most efficiently meet those targets. Each entity has different scales at which they must prioritize and Ecology is allowing them to explore how best to meet the targets. Note that both local governments are currently making progress on reductions from existing development. Both local governments will be required to express their progress in terms of schedule and the fraction of the reduction they have achieved.

Miscellaneous

- List any threatened or endangered species (EPA17)

Response: No threatened or endangered species are known to exist in the Lake Whatcom Watershed. The large stands of forest provide for the possible recruitment for marbled murrelet and northern spotted owl. No change to the document is required.

From:	petersencldr@comcast.net
To:	Hood, Steve (ECY)
Cc:	Council, County
Subject:	Phosphorous in Lake Whatcom
Date:	Tuesday, February 26, 2013 7:34:40 PM

Below are my comments on the subject:

1. I agree with Councilman Crawford, it may be unfair to put the burden of reducing phosphorous on all the homeowners in the lake drainage area.

2. I recall a possible major source may be from an old dump perhaps up Olsen Creek. All drainage into the lake should be checked for possible sources.

3. With wildlife and pets on and around the lake, these are sources that should be quantified.

4. Motor oil contains phosphorous, some more than others. There are many oil sheens from vehicles when it rains. This should be quantified as well. One of the worse offenders is some Sanitary Service trucks dripping oil (it could be hydraulic fluid).

Dale R Petersen
Ferndale (Sandy Point) and former resident nearby Lake Whatcom
360-380-1338

From: CDAVIS1952@aol.com
To: Hood, Steve (ECY)
Subject: Lake Whatcom cleanup
Date: Saturday, March 09, 2013 1:34:01 PM

I live in the watershed, a few ideas

Ban all boats

Relocate the deer, they defecate all over my yard and I would imagine the entire watershed

Higher watershed fees to homeowners who park in the driveways when they have a garage available,

I would guess more than 1/2 of my neighbors do this and it is due to a garage full of junk.The fluid leaks

from the vehicles wash into the rain gutters.

Ban all fireworks, the chemicals leach into the soil into the watershed.

No dogs in the Blodel Donovan park

Relocate or kill the geese at Blodel Donovan park

Harsh , yes but we all drink the water from the lake!!!!! Time to get tough, this conversation has been going

on for too long ,time to take action, popular or not!

Cheryl Davis

From: CDAVIS1952@aol.com
To: Hood, Steve (ECY)
Subject: Re: Lake Whatcom cleanup
Date: Tuesday, March 12, 2013 12:56:07 PM

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one more .....ban chicken raising and use of manure in the watershed, both sources of phosphorus

In a message dated 3/11/2013 9:33:21 A.M. Pacific Daylight Time, shoo461@ECY.WA.GOV writes:

> Thanks for your comments. I have filed it for response after the comment period is closed.
>
> ---
>
> **From:** CDAVIS1952@aol.com [mailto:CDAVIS1952@aol.com]
> **Sent:** Saturday, March 09, 2013 1:34 PM
> **To:** Hood, Steve (ECY)
> **Subject:** Lake Whatcom cleanup
>
> I live in the watershed, a few ideas
>
> Ban all boats
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> Relocate the deer, they defecate all over my yard and I would imagine the entire watershed
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>
> from the vehicles wash into the rain gutters.
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> Harsh , yes but we all drink the water from the lake!!!!! Time to get tough, this conversation

has been going

on for too long ,time to take action, popular or not!

Cheryl Davis

From: Michael Bakke
To: Hood, Steve (ECY)
Subject: lake whatcom
Date: Wednesday, April 03, 2013 7:33:20 PM

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the major problem with lake whatcom is the fertilizer the people are putting on those very green lawn along the lake the landscapers are putting tripling the amount of the legal fertilizer on the lawns they are over loading the lawns and when it rains it goes into lake their needs to be a complete ban on fertizer in lake whatcom water shed i agree that bad logging practices in the past are part of the problem but the fertilizer is the main problem why wont city of belllingham and whatcom county listen to me take a boat trip down the lake you will see how green the lawns are can you please get them to listen thanks michael

From: Michael Bakke
To: Hood, Steve (ECY)
Subject: Re: lake whatcom
Date: Tuesday, April 09, 2013 1:35:24 PM

---

steve what is the city going to do about these homeowners with such green lines on the lake thanks mike

On Fri, Apr 5, 2013 at 8:59 AM, Michael Bakke <michael.bakke2@gmail.com> wrote:

> people are not going by the law steve the city needs to check out the homes with these very green lawns like the the 2 stroke ban their is boats going up and down the lake with old 2 strokes their is no action by the city at county what a joke thanks mike
>
> On Fri, Apr 5, 2013 at 8:47 AM, Hood, Steve (ECY) <shoo461@ecy.wa.gov> wrote:
>
> > Mike - the problem for enforcement is they need to have evidence that would prevail in an appeal of any enforcement action. They have the correct ordinance in place and the people I know are applying Lake Whatcom Blend but as you suggest probably not all people are doing so.
> >
> > ---
> >
> > **From:** Michael Bakke [mailto:michael.bakke2@gmail.com]
> > **Sent:** Thursday, April 04, 2013 7:58 PM
> > **To:** Hood, Steve (ECY)
> > **Subject:** Re: lake whatcom
> >
> > hi steve why wont the the city and county listen to me about the fertilizer and very green lawn along lake whatcom this is the number 1 problem spending all this money on clean up on the lake and the fertilizer is the main problem thanks mike
> >
> > On Thu, Apr 4, 2013 at 10:04 AM, Hood, Steve (ECY) <shoo461@ecy.wa.gov> wrote:
> >
> > > Thanks for your comments. I have filed it for response after the comment period is closed.
> > >
> > > ---
> > >
> > > **From:** Michael Bakke [mailto:michael.bakke2@gmail.com]
> > > **Sent:** Wednesday, April 03, 2013 7:33 PM

To: Hood, Steve (ECY)
Subject: lake whatcom

the major problem with lake whatcom is the fertilizer the people are putting on those very green lawn along the lake the landscapers are putting tripling the amount of the legal fertilizer on the lawns they are over loading the lawns and when it rains it goes into lake their needs to be a complete ban on fertizer in lake whatcom water shed i agree that bad logging practices in the past are part of the problem but the fertilizer is the main problem why wont city of belllingham and whatcom county listen to me take a boat trip down the lake you will see how green the lawns are can you please get them to listen thanks michael

From: Ragsdale, Dave (ECY)
To: Hood, Steve (ECY)
Cc: Mann.Laurie@epamail.epa.gov
Subject: comments on Lake Whatcom D.O. and bacteria TMDL
Date: Monday, April 22, 2013 5:01:34 PM
Attachments: Review of the proposed Lake Whatcom 4-1.docx

Hello Steve. Missed you today at the first of the two day LSPC model training. Hope you can come down for tomorrows session which will focus more on Squalicum Creek.

Attached are my comments on the proposed Lake Whatcom TMDL. The lack of a MOS and need to express P targets in terms of a daily load are the most significant. The surrogate "developed area" and annual loading should accompany the daily loading targets. Laurie Mann was planning to also review the TMDL and is supposed to be back in the office next week. She may have some additional comments which would be transmitted before the close of the PN period. I'm overwhelmed with some other project work and wanted to get my input to you while I still remembered what I read. Also, it may be Laurie processing the final approval action depending on when this TMDL is submitted to EPA for approval (I could be retired from EPA).

Talk with you soon. Dave

Review of the proposed Lake Whatcom D.O. and Bacteria TMDL
February 2013 (public notice version)

First of all, let me reiterate congratulations for completing this innovative TMDL. It was a long and technically difficult undertaking which resulted in proposed loading targets for both the pollutant that is causing the degradation (phosphorus) and connecting it with a meaningful surrogate measure (developed area). This surrogate will more effectively guide land use/treatment decisions by local municipal jurisdictions and land owners than a pollutant loading target by itself.

The major comments from EPA on this TMDL relate to the need for a margin of safety and expressing pollutant loading into the Lake in terms of daily loading. Both of these are essential elements of a TMDL and addressing them may lead to some editing in various parts of the TMDL to provide continuity. I've looked for such sections in my review and tried to flag them in my comments below.

Daily loading

The analysis of loading capacity was focused on how the Lake responds to the amount of phosphorus delivered from the watershed over the course of the year because the Lake responds during the growing season to cumulative loading received throughout the year. In addition, the primary source of loading is from runoff from the various land use activities in the watershed which vary with both type of land use and runoff producing rainfall events. As is presented in the TMDL, measuring loading associated with an individual storm event is very difficult and there can be great variation in loading from one storm event compared to the next (or to a standard storm event). So, setting annual targets for the subbasins in the Lake Whatcom watershed makes practical sense. However, to meet federal requirements that TMDL express loading targets as the maximum daily load I suggest the annual loading be divided by a method of your choice and presented along the annual loading targets. A statistical approach for translating the annual loading target into a maximum daily load such is used for deriving daily maximum permit limitations in NPDES permit might be one option for this translation.

Page x, What needs to be done in this watershed. I suggest mentioning the annual loading also has a daily loading target associated with it.

Page xi, Table ES-1. Identify daily load target in addition to annual loading targets for phosphorus.

Page xvii, fourth paragraph under Permit Implementation. State water quality standards for implementing WQ-based requirements is "the shortest reasonable time, and not to exceed 10 years". Even if 50 years is the shortest reasonable time for retrofitting treatment and BMPs throughout the watershed, I recommend the statement "(50 years to complete all actions)" be removed from the TMDL because this statement presumes we have the authority to change applicable WQS. I recommend just stating that Ecology will be working with the communities to achieve compliance in the shortest timeframe possible.

Page xviii, Why this matters. I like the simple explanation in this explanation about the Lake's sensitivity to loading and how runoff from a large part of its watershed needs to function like a natural forest to prevent excess phosphorus from degrading water quality.

Page 4, Surrogate measures. The discussion about use of surrogate measures does not include Ecology's standard TMDL language which cites our authority to use "surrogates". As you know, this is a sensitive topic these days and I recommend the final TMDL include language about surrogates that is being developed by your HQ. Also, I disagree with the explanation provided in the second paragraph about surrogates being used to set allocations. It is actually the other way around, in that a surrogate measure that matches/represents necessary management actions may be specified if it correlates with achieving load allocations. If the loading targets for phosphorus are presented as both daily maximum and annual, then the discussion about annual loading being a surrogate can be dropped, as it is just another expression of the daily loading target.

Page 5, second paragraph. Even if a daily load in the Lake Whatcom situation is "meaningless or misleading", we are bound by the regulations to specify one. I recommend that wording in this section be modified to indicate that although a daily load is calculated and established in the TMDL, that the amount of loading received by the Lake over the course of the year is what drives the water quality response. Accordingly, you have also specified annual loading. I'm not sure I would even call annual loading a surrogate, as you have done. Rather, I would simply say it was a more meaningful expression of the daily load.

Page 9, Dissolved Oxygen, last sentence of first paragraph. Water quality standards apply, not "TMDL criteria".

Page 22, paragraph 5. Revise to address previous comment about the need to identify a daily load for P (to accompany the more meaningful annual loading target).

Page 27, Load and Wasteload Allocations. I appreciate that Ecology will be implementing this TMDL after approval by issuing A.O.s to the Phase II municipalities, which will then be incorporated into their permits during the next reissuance.

Page 27, third paragraph. d missing on based in third paragraph. (How's that for nitpicking?)

Page 28 -30, tables 7, 8 and 9. Include columns for daily WLA for P. There are a number of ways to calculate a daily load such that it correlates with the annual loading targets. [Again, although I agree annual loading targets are more meaningful, daily loads are required by regulation].

Page 31, Margin of Safety. An implicit or explicit MOS for P is needed. "Continuous improvement of the model over time" is a good thing to hope for, but does not provide a MOS. Perhaps you could add a percent developed area to the loading target as an explicit MOS? I think you have an adequate MOS for bacteria.

Page 32, Reasonable Assurance. Expanding the areas covered under the Phase II permits is a very proactive way to require planning and implement treatment/BMPs and building codes that will over

time reduce P loading to the Lake from the surrounding watershed. With the exception of forest practices, it minimizes contributions from NPS. Good move!

My review stopped at Reasonable Assurance because implementation is not a TMDL element for which EPA takes approval action. However, I did look to see that implementation was addressed and noted that the first five year period after TMDL approval was devoted to evaluating model uncertainty and loading capacity. My perspective is that this wastes important time because the huge reductions in P loading that are necessary will remain huge, even if the model were subsequently found to be off by even 50%! The model was already peer reviewed by more than one third party, which greatly reduced the chance of significant modeling error. I suggest not investing time/resources in model evaluation until after implementation has progressed significantly.

From:	Eric Hirst
To:	Hood, Steve (ECY)
Subject:	LTE on Lake Whatcom
Date:	Sunday, April 28, 2013 10:28:59 AM

Steve,

Thanks for taking time to talk with me on Friday about your draft report. Here is a letter to the editor on the topic that I sent to the Herald and the Weekly.

Eric

We have known for two decades that Lake Whatcom water quality is getting worse. In 1998 the WA Dept. of Ecology (DOE) officially declared the lake polluted with excess bacteria and insufficient dissolved oxygen because of phosphorous runoff.

Since then, the City of Bellingham has acted to slow the decline in water quality, in particular buying almost 1,500 acres of land in the watershed to prevent further development. The county has been largely indifferent to the issue.

DOE issued a draft report on phosphorous and bacteria in the lake and asked for public comment by May 28. To date, few people have responded, and the local media have generally ignored this important report.

The report requires the city and county to clean the lake – eventually. My grandkids will likely be dead by the time DOE expects the lake to be fully restored in 100 years. DOE asks the city and county “to develop plans” during the next five years, but requires no actions until those plans are complete (in 2018) to actually slow the runoff of phosphorous and other pollutants.

If you care about Lake Whatcom, please email Steve.Hood@ecy.wa.gov by May 28 and tell him your preferences about cleaning the lake. In particular, ask that DOE require the city and county to adopt additional and stronger measures *now* to protect the source of our drinking water and this important part of our ecology.

Eric Hirst
1932 Rhododendron Way
Bellingham, WA 98229
☎ 360-656-6690 💻 EricHirst@comcast.net

From: Les Scott
To: Hood, Steve (ECY)
Subject: Lake Whatcom
Date: Saturday, May 04, 2013 6:43:06 AM

As a Bellingham resident, I am asking that you do all you can to clean up Lake Whatcom as fast as possible. We need to implement the strongest measures possible to accomplish this.

I am assuming that the developed areas are the major cause of this pollution and proper restrictions on the use of lake-damaging practices be outlawed.

Thank you,
Milton L Scott
2427 Vista Drive
Bellingham, WA
98229

From: Lundquist Studio
To: Hood, Steve (ECY)
Subject: Lake Whatcom Water Quality
Date: Saturday, May 04, 2013 1:40:10 PM

Dear Mr. Hood,

We, Bob and Pat Lundquist, are collectively writing to express our concern about the declining water quality in Lake Whatcom and the continuing lack of enforcement and action on the part of those with the power to do something about the lake water quality.

When I (Pat) worked for Whatcom County Executive Shirley Van Zanten from 1985 to 1995, the water quality of the lake was a concern back then. Some progress was made, but obviously in the last 18 years, no significant progress has been made. In fact, the quality has worsened. It's unbelievable to us that this remains unaddressed.

Local lawmakers apparently lack the spine to pass the strict and necessary laws to assure the quality of drinking water for an ever growing community. The affluent who have the privilege of living around the lake do not respect this natural resource which belongs to all, and local legislators seem unwilling to go against these property owners. It is their private playground and private properties are maintained with whatever chemicals and fertilizers they wish to use. In addition, the boating, water skiing, skidoos and other motorized entertainment that occurs on, and pollutes, the lake continue without regard for the way these activities degrade the lake.

We don't feel there is time to wait five more years while "plans" are developed by the city and the county. We ask that the Department of Ecology wield a big hammer over our local officials. We ask that you:

- require a much shorter timeline for developing plans; we knew about this problem 20 years ago! There is no time to waste
-require stricter, stronger measures from Bellingham and Whatcom County
-restrict building around the lake; this should have been done years ago

Please feel free to contact us if you have any questions or comments.

Thank you for taking time to read this!
Best wishes,
Bob and Pat Lundquist

From: Sandy & Larry
To: Hood, Steve (ECY)
Subject: Lake Whatcom Water Quality
Date: Sunday, May 05, 2013 10:14:44 AM

I an writing request that Ecology require the city of Bellingham & the county to adopt additional & stronger measures now to protect the source of our drinking water & this important part of our ecology. I lived in Buffalo, NY for many years (thru the 60's & 70's) & saw first hand how a great lake like Lake Erie almost died due to pollution (Bethlehem Steel & phosphates etc.) but responsible action brought it back to good condition. Thank you for your attention to this critical problem.
Sandra E. Kelly
1335 Whatcom St.\Bellingham 98229

From: Thomas Goetzl
To: Hood, Steve (ECY)
Subject: Protecting our drinking water in Lake Whatcom
Date: Thursday, May 09, 2013 12:35:01 PM

Dear Mr. Hood:

Please work to adopt a more aggressive schedule for the cleaning of Lake Whatcom so it has a chance to be fully restored on a more rapid timeline. We can only hope that will occur within our lifetimes.

To that end, no doubt it would greatly help if power boats were removed from the lake. The pleasure afforded the few comes at too high a cost for the many. Similarly, stronger restrictions of the use of phosphorus and other chemicals that then wash inot the waters of the lake need to be adopted and enforced sooner than later.

Thank you.

Tom Goetzl

From: JIM HANSEN
To: Hood, Steve (ECY)
Subject: Lake Whatcom TMDL Implementation
Date: Thursday, May 09, 2013 6:16:24 PM

Dear Steve

I'm writing to urge you to recommend immediate implementation of steps to limit additional phosphates and other pollutants in Lake Whatcom. There is no technical reason to give them another 4 years to start making progress. There are simple but politically unpalatable steps that could be taken immediately. An emergency permanent ban on all new housing starts would have the biggest impact. The notion that a few more years of haggling might have a beneficial outcome is possibly predicated on the notion that impacts can be mitigated We know in our hearts that they cannot be effectively mitigated. Other jurisdictions have closed watersheds around their reservoirs.

Don't get me wrong. Its easier for me to give you an opinion than it is for you top balance all the legal, technical and political factors. I know that the only reward Ecology will get for doing its job will be to have its budget cut one more time. Despite that, please do the right thing rather than the acceptable thing. Please come up with a plan that really addresses the problems and put those up the chain of command on the spot.

Jim Hansen

From:	Susan Kaun
To:	Hood, Steve (ECY)
Cc:	Ranker, Kevin; morris.jeff@leg.wa.gov; Lytton, Kris; Whatcom County Council; Jack Louws; Bellingham City Council; Mayor Kelli Linville
Subject:	Draft Lake Whatcom TMDL Final Report - Comment: Coulda, Shoulda, Woulda
Date:	Tuesday, May 14, 2013 2:12:42 PM

TO: Steve Hood, Bellingham Field Office
Washington State Department of Ecology

FROM: Susan Kaun
613 Donovan Avenue
Bellingham WA 98225

DATE: May 13, 2013

SUBJECT: Draft Lake Whatcom TMDL Final Report - Comment: Coulda, Shoulda, Woulda

As you know, Lake Whatcom is owned in common by the people of the State of Washington, and since 1970 the lake's well-being has been entrusted to the Department of Ecology; as well as supported by the Agency's mission: *to protect, preserve and enhance Washington's environment.* In 1987, following two studies underwritten with Ecology funding, the lake's water quality was determined to be 'very good'. However, development was occurring at a rapid pace, so specific protection measures were recommended for implementation and enforcement in order to provide for continued good water quality levels. Unfortunately, the protective recommendations were not followed, and the lake's water quality has become very seriously degraded over the intervening 25 years, as documented in the published annual monitoring reports from the Institute for Watershed Studies, Huxley College for the Environment, WWU.

During that time Ecology took little or no action, except to add the lake to the 303d list of impaired lakes, and initiate a study of the lake and watershed beginning over 10 years ago, culminating with the present final draft TMDL. The scientists and engineers of Ecology ignored the early studies of Lake Whatcom and best available science of the day, when the Agency could have worked in cooperation with local governments to protect the lake from the known harm of unrestrained development. **I believe Ecology has failed utterly in its mission *to protect*, *preserve and enhance Washington's environment,*** and I would like to offer the following observations about what could have been done:

1.) I believe Ecology could have **prevented** the lake's deterioration by adopting the results and recommendations of two early scientific lake studies that had been directed by and supported with Ecology grant funds: *The Lake Whatcom Restoration Study* prepared by URS Corporation in 1985; and the follow-up *Lake Whatcom Watershed Management Plan* of 1986-7, which had been carefully prepared by the Institute for Watershed Studies, Western Washington University with contributions from the Lake Whatcom Watershed Advisory Committee. These early studies were not mentioned on Ecology's website for the TMDL.

2.) Ecology, should have become the lead agency, and **acted** on the specific recommendations contained in the Lake Whatcom Watershed Management Plan, which

stated: *The recommendations in this plan were developed to preserve the current high lake water quality and protect the other beneficial uses of the lake.* The first recommendation was: *Prevent an increase in sediment and pollution load in the lake from land development activities.*

Across the nation it was obvious by the late 1970's that development related phosphorus runoff was being carried over impervious surfaces along with sediments in stormwater, to enrich and pollute lakes and other water bodies. Strict development controls and limits on impervious surfaces had been recommended by the lake's newly completed Watershed Management Plan in 1987. Preventing urban runoff was accepted science even then. In 1979 Robert Burd, EPA's Region 10 Director, Water Division, enclosed articles, such as *The Hidden Dangers of Urban Runoff,* along with EPA directives to advise local agencies about how to protect water quality in lakes, rivers and aquifers from development runoff.

3.) Ecology's website on the TMDL also states: *Since 1990, the city and county have worked to develop a strategy to improve water quality in Lake Whatcom to meet state and federal standards for dissolved oxygen.* In my opinion Ecology scientists and engineers should have **intervened** in 1990 to insist local governments follow the recommendations contained in the *Lake Whatcom Watershed Management Plan,* and not just develop a strategy but implement and enforce it with carefully written ordinances.

Due to the lack of enforced watershed stormwater management guidelines on Lake Whatcom, the lake's water quality deteriorated to the point that Lake Whatcom was declared impaired, and added to the 303d list. This designation should have been a wake-up call that the lake management *strategy* was not effective by itself, and would require ordinances with careful enforcement. Somehow it seemed to have made little or no impact on the local governments or Ecology, or cause them to step back and revise their failing *strategy to improve water quality in the lake.*

4.) Subsequent to the 303d listing, Ecology began more studies of the lake in 2002 that have resulted in the final draft TMDL and a plan for implementation. I am surprised to note from an Agency with responsibility for environmental protection, the TMDL seems to have little in the way of benchmarks, deadlines, or sanctions to require local governments to restore the lake. Instead of years of delay to document a known problem, Ecology could have **partnered** with the city and county in 1990 to develop a program of relatively inexpensive protection and enforcement measures. However, what began as a prevention issue has now evolved into a huge restoration project that will require enormous outlays of public resources to repair the damage created as a result of 25 years of development without oversight or regulation. How could this have been allowed to happen?

The City and County do not have the resources to have lake management experts on staff, and will need to contract with professional engineers and scientists to develop and implement a multifaceted restoration project for the lake. Surely, as part of its 'mission', Ecology must have the resources and expertise to assist the City and County with such important work.

As the former manager of a successful, multifaceted lake restoration and protection project at Liberty Lake, Washington that took place from 1976-1985, I can attest we worked closely and in partnership with Ecology and EPA. An essential part of the project was to have professional engineers and scientists study the watershed and develop a set of stormwater management guidelines in 1985. Those guidelines continue to be carefully enforced today. Actually, I think Liberty Lake's watershed protection guidelines, prepared with Ecology and EPA funds, could be used as a general blueprint for any lake watershed. A 2008 Ecology report, *Liberty Lake Dataset Evaluation*, indicates that thirty years after restoration, the lake continues to remain within the water quality standard parameters set by Ecology.

The Department of Ecology was created in 1970 amid great concern by a governor and legislature to address an increasingly deteriorating environment, and the Agency was provided with a special grant funding program by the people of the State. In the beginning staff worked with energy and passion to fulfill their mission. Over the years though, Ecology seems to have become a bureaucracy that moves with no sense of urgency to study problems and develop solutions for failing ecosystems. In my opinion Ecology should have acted on the recommendations of best available science in 1987. Ecology could have begun working with local agencies in 1987 to create and enforce protective guidelines for watershed development. I am convinced Ecology's early involvement would have protected, preserved and enhanced the lake, and prevented the need for future outlays of scarce financial resources to solve a problem that should not have occurred. Time was of the essence.

Citizens like me are extremely frustrated that Lake Whatcom's water quality has been allowed to decline over the past 25 years. Therefore, I believe Ecology has a responsibility to work closely with Whatcom County and the City of Bellingham to reverse the decline of the lake and sole-source drinking water supply for 100,000 people by providing leadership, financial support, and scientific guidance**. If Ecology assumes these local governments have the financial resources, expertise, or political will to address Lake Whatcom's heartbreaking degradation, then nothing will change in the next 25 years.**

I appreciated having this opportunity to provide comment on the Department of Ecology's Draft Lake Whatcom TMDL Final Report.

cc: Jay Inslee, Governor State of Washington
Senator Kevin Ranker
Representative Jeff Morris
Representative Kristine Lytton
Maia Bellon, Director, Washington Department of Ecology
Whatcom County Council
Whatcom County Executive, Jack Luows
City of Bellingham, City Council
City of Bellingham Mayor, Kelli Linville

From:	David Inscho
To:	Hood, Steve (ECY)
Subject:	Lake Whatcom
Date:	Saturday, May 18, 2013 11:28:55 AM

Dear DOE:
The water supply for greater-Bellingham is in decline and getting worse. Development, resource extraction, and petrol-based recreation pollutes our drinking water with phosphorus, benzene, and introduces invasive species. I urge the Dept. of Ecology to ask city and county counsels for immediate action to protect our reservoir from continued pollution and degradation. Clean water is a basic need for everyone. The time to protect our municiple water supply is NOW, not in 5 years.

Sincere regard,
David Inscho
Bellingham

David Inscho
Landscape Photography
http://david-inscho.smugmug.com/

From: Sandy Petersen
To: Hood, Steve (ECY)
Subject: Public Review Draft Lake Whatcom Watershed Total Maximum Daily Loads Volume 2 Water Quality Improvement Report and Implementation Strategy document / comments
Date: Sunday, May 26, 2013 7:12:48 PM

I offer the following three comments regarding the *Public Review Draft Lake Whatcom Watershed Total Maximum Daily Loads Volume 2 Water Quality Improvement Report and Implementation Strategy* document:

Comment No 1.
Given that Lake Whatcom, per said document, is explicitly:

- 303(d)-listed for the following two substandard water quality conditions:

    1. Low dissolved oxygen (DO) in Basins 1 and 2 (Basin 3 DO levels do meet water quality standards), and

    2. Excessive fecal coliform bacteria concentrations in its tributaries, and

- **Not** 303(d) listed for excessive phosphorus (P) loading (although P loading does contribute to the substandard DO condition)[(1)],

and contrary to the document statement on page 35 that says, in part, that:

> "The Lake Whatcom Reservoir Management 2010-2014 Work Plan is **an exhaustive list** [Appendix D] **of the known tools available for restoring the lake** [emphasis added].",

I submit that the implementation strategies (i.e., problem solution alternatives) list in said document is **possibly** incomplete. To the best of my knowledge, direct DO remedies to the Lake water itself, such as by mechanical aeration and aluminum sulfate treatment, which other communities across the United States have employed as legitimate (i.e., USEPA-approved) physical and chemical water quality restoration actions in their TMDLs for similarly excess P/low DO impaired lakes[(2)], have not yet been seriously considered for Lake Whatcom. This direct lake water rehabilitation approach reflects the same premise that is customarily used to treat sewage generated in highly urbanized/densely populated settings, i.e., that pollution control or prevention at its source or origin may not be the preferred solution; that sometimes the preferred solution is to treat the resulting polluted water, air, or other substance, material, or matter.

Accordingly, before WSDOE finalizes any solution/implementation strategies list for submission to the USEPA for approval, I recommend that experts in the fields of lake aeration and chemical treatment, respectively, evaluate them for technical and economic feasibility in Lake Whatcom, particularly given the probable significant costs, implementation time delays, and other challenges that the favored on-site retrofits for developed properties and community/regional stormwater P removal systems pose, and given that the document as written does not address reduction of the P loading into Lake Whatcom from the man-made Nooksack River Middle Fork Diversion facilities. Such an expert evaluation would also inherently account for the DO conditions in each basin, which are not the same.

Furthermore, if either or both of the suggested techniques above proves technically and economically feasible, then I also recommend that you evaluate a further revision to the proposed implementation strategy in the document to abandon altogether

> (1) the requirement that all new development and redevelopment meet the so-called "P neutral" standard for stormwater runoff, and
>
> (2) the P neutral retrofit program for existing development (which physical and/or chemical treatment would accommodate instead),

with the substitute requirement that all new development and redevelopment within the Lake Whatcom watershed must comply with the current version of the WSDOE *Stormwater Management Manual for Western Washington*, which imposes a sequenced examination and evaluation of two P-neutral BMPs (i.e., Downspout Full Infiltration and Full Dispersion) for residential roof construction as a routine step. If, however, neither BMP proves feasible for a particular development or redevelopment, then at least some P treatment will occur via the other BMPs on the standard menu (which are not P-neutral), with the lake aeration system and/or chemical treatment handling the remaining P load from the new development or redevelopment.

Additionally, if lake aeration and chemical treatment proves infeasible, then the document should address mitigation of P loading from the Nooksack River Middle Fork Diversion facilities.

Comment No 2.
Given the evolving jurisdictional complexities of managing the Lake Whatcom watershed and its resources since the inception of the Lake Whatcom Management Program, and the looming significant economic impacts that the TMDL holds, the document should evaluate the feasibility of establishing an RCW 85.38 or 85.08-authorized Drainage District (aka Stormwater Utility District) for the Lake Whatcom watershed with its own elected governing body vs retaining the Lake Whatcom Management Program as is.

Comment No 3.
The document should discuss whether Lake Whatcom Water and Sewer District's Sudden Valley Water Treatment Plant (which draws its water from Basin 3) has ever experienced filter clogging problems due to algae.

[(1)] The following link apparently states otherwise:

http://apps.ecy.wa.gov/wats/ViewListing.aspx?LISTING_ID=8621,

although I don't know if the "grid cell" information noted corresponds to the entire lake or just a portion of the lake. Please also note that the grid cell information for the phosphorus listing at the above link differs from the grid cell information for the dissolved oxygen listing at the following link:

http://apps.ecy.wa.gov/wats/ViewListing.aspx?LISTING_ID=5846

[2] See the following TMDL example links that include aeration and/or chemical treatment:

http://www.epa.gov/region9/water/tmdl/la-lakes/LALakesTMDLsSection6EchoParkLake.pdf

http://www.deq.idaho.gov/media/451046-winchester_lake_ag_imp_plan.pdf

http://www.swrcb.ca.gov/rwqcb8/water_issues/programs/tmdl/docs/elsinore/implemetation/Lake_Elsinore_Sediment_Nutrient_Reduction_Plan_10-22-07.pdf

http://www.bassettcreekwmo.org/TMDLs/SweeneyLakeTMDL/SWEENEY-TMDL-10-29-2010.pdf

http://denr.sd.gov/dfta/wp/tmdl/TMDL_Sylvan.pdf

http://www.neglwatersheds.org/images/WhiteLakefinalreportTMDL4.pdf

http://www.washingtonwatch.com/bills/show/ED_80235.html

http://www.epa.gov/owow/tmdl/examples/nutrients/sd_hiddenwood.pdf

and these other aeration and chemical treatment-related links as follows:

http://link.springer.com/chapter/10.1007%2F978-1-60327-133-2_13#, which states, in part, that:

> "Phosphorus may be permanently removed from a lake by various processes, whereas nitrogen is difficult to remove permanently due to the fact that certain blue-green algae can fix atmospheric nitrogen as a nitrogen source. Thus, emphasis has been placed on the removal of phosphorus. There are various methods for the treatment of wastewaters to remove the nutrients before being discharged to a body of water. Once in a lake, phosphorus removal is most frequently achieved by producing an insoluble aluminum salt of the phosphorus, but iron salts are effective under aerobic conditions. Calcium salts are effective in removing phosphorus, but they generally adversely increase the pH of the lake. Precipitated aluminum phosphate salts may be allowed to settle to the bottom of the lake, or they may be removed from the water column. A study showed that removing the phosphate-rich hypolimnetic waters from a summer stratified temperate climate lake, precipitating the phosphorus as either aluminum or iron salts, separating the precipitate by DAF [diffused air flotation], and returning the phosphate reduced water to the lake were very effective in controlling the phosphorus nutrient content in Devils Lake, WI.".

http://www.spokaneriver.net/wp-content/uploads/2008/11/stdsclarificationtoepa.pdf (a WSDOE letter to USEPA Region 10 where Attachment A to that letter acknowledges that lake aeration or oxygenation is a possible solution for the Spokane River Dissolved Oxygen TMDL.)

http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/upload/day2_gibson.pdf

Regards,
Robert "Sandy" Petersen, PE
2300 39th Street
Bellingham, WA 98229-3380

From: bc98229@comcast.net
To: Hood, Steve (ECY)
Subject: Public Review Comment: Draft Report: Lake Whatcom Watershed Total Phosphorus TMDL: Volume 2.
Date: Monday, May 27, 2013 4:32:32 PM

Public Review Comment for
Draft Report: Lake Whatcom Watershed Total Phosphorus and Bacteria Total Maximum Daily Loads: Volume 2.Water Quality Improvement Report and Implementation Strategy, February 2013

The Middle Fork Nooksack (MFN) River diversion dam, pipeline and tunnel system moves water and sediment from the River into Lake Whatcom under the ownership, management and control of the City of Bellingham. As the MFN diversion flows, the total phosphorus load associated with the diversion's water and sediment moves from Mirror Lake to Anderson Creek and on into Lake Whatcom. Even though City of Bellingham diversion operations deposited the sediment mass into Mirror Lake, the Draft Report (2013) allocations assign the total phosphorus load responsibility only to Whatcom County.

It is not possible to determine the magnitude of diversion sediment total phosphorus load with the sampling program designed for the Lake Whatcom Total Maximum Daily Load (TMDL) Study. Allocating total phosphorus contribution between the City of Bellingham's diversion and Anderson Creek requires samples from the MFN diversion AND Anderson Creek. Only Anderson Creek samples were collected and documented. Sampling required to allocate between the MFN diversion and Anderson Creek has not been conducted. Inexplicably, the Lake Whatcom Total Maximum Daily Load Study field sampling program did not include sampling the MFN diversion for water quality (QAPP 2002). No collected, measured and documented individual total phosphorus samples from the MFN diversion can be found in any reports. However a Lake Whatcom 2002-2003 creek monitoring schedule prepared for the City of Bellingham Public Works Department (LWMPFR 2003, Table 15) shows monthly MFN diversion sampling. It is possible the MFN diversion samples were collected and analyzed, but for some unexplained reason not provided to the TMDL study.

The Lake Whatcom TMDL Study field sampling program did include Anderson Creek (QAPP 2002). Samples taken from near the mouth of Anderson Creek were collected and analyzed over a two year period from Jan 23, 2002 through Jan 28, 2004 using Quality Level 3 protocol ("Data Verified and Assessed for Usability"). Anderson Creek as well as other tributary sampling results are listed in the TMDL Study results spreadsheet available for download on the Washington Department of Ecology's(DOE) Environmental Information Management website. No diversion samples are in the spreadsheet. Apparently no diversion samples were taken in the same time period as those for Anderson Creek and the other Lake Whatcom tributaries.

The lack of MFN diversion samples compromised attempts to model the watershed. In order to run the Hydrological Simulation Program—Fortran (HSPF) watershed

modeling software, modelers needed diversion total phosphorus input -- so they invented synthetic values. The first attempt to run HSPF used simulated MFN diversion total phosphorus load input created from a statistical regression model. That run attempt failed. The modelers found "when diversion flows are continuous, the regression model simulates an increasing total phosphorus load that exceeds HSPF simulation results..."(FMR 2007). In other words, sometimes the simulated MFN diversion total phosphorus was so large the HSPF model became unstable.

The HSPF run failure required modelers to make a second attempt to find input data for the diversion total phosphorus load. Two years and eight months after Lake Whatcom Total Maximum Daily Load Study field sampling stopped, MFN diversion total phosphorus sampling began. The City of Bellingham collected samples at the Mirror Lake outfall from October 17, 2006 to May 1, 2007. For their second attempt to run HSPF, modelers input "total phosphorus loads associated with the diversion inflow ... approximated by applying the average concentration of 0.0259 mg/L from total phosphorus data collected by the City of Bellingham" (FMR 2007). In July 2007 the Final Model Report was issued with the caveat "This average total phosphorus data used for the HSPF input does not coincide with the simulation run time and should be considered approximate until additional diversion flow data is collected simultaneous with observed data and calibrated." (FMR 2007)

The MFN diversion total phosphorus input to HSPF watershed model has multiple shortcomings:

1) Determination of average total phosphorus concentration is flawed:
--- individual sample results are undocumented
--- a total phosphorus concentration was calculated from an undocumented number of samples
--- sample collection and analysis quality level protocol is undocumented

2) To fulfill City of Bellingham demands, each year the diversion flow rate varies from month to month. Average total phosphorus concentration input from 2006-07 does not coincide with the 2003 flow rates and volumes used in the HSPF watershed model.

3) The average total phosphorus concentration calculated from winter only sampling of the Mirror Lake Outfall was misleading. "Anderson Creek had high total suspended solids and turbidity values in the summer because of the glacial silt entering the creek from the Nooksack River diversion."(LWMPFR 2002). High levels of phosphorus are derived from glacial silt input (Edmundson & Koenings 1986). The Mirror Lake outflow was not sampled during summer -- the warmest part of the year. Maximum phosphorus release from lake sediments into water occurs at higher water temperatures (Wildung & Schmidt 1973). Failure to sample over summer months underestimated the actual diversion total phosphorus load contribution.

The Draft Report does provide a possible estimate for the total phosphorus load contributed to Lake Whatcom by the MFN diversion. The MFN diversion total phosphorus should be less than the sum of the MFN diversion total phosphorus and

the Anderson Creek total phosphorus. From the two TMDL reports, the estimated total phosphorus load for the MFN diversion and Anderson Creek ranges from 13% (Draft Report 2013 Table 6) to 14% (LWWTMDL 2008 Table ES-1) of the total phosphorus load transported into Lake Whatcom via tributaries. Although it's total phosphorus input has shortcomings, HSPF watershed model calculations show 11% of the Lake Whatcom's total phosphorus load is from the diversion alone (FMR 2007). These numbers suggest the Draft Report (2013) underestimates the MFN diversion total phosphorus and overestimates the Anderson Creek total phosphorus.

Since going on line in 1962, the City of Bellingham's MFN diversion has deposited a significant volume of sediment into Mirror Lake. A lake bed coring program in 2000 found 78,477 yd^3 +/- 10% of sediment deposited on top of the pre-diversion Mirror Lake bottom (Tracy, 2001). Sediment and associated phosphorus is continuously moved into and then out of Mirror Lake by diversion flow. According to the Draft Report, "all potential nonpoint sources in the watershed must use the appropriate best management practices to reduce impacts to water quality." That is not happening in the case of the City of Bellingham's MFN diversion sediments.

The MFN diversion flow "augments Lake Whatcom for the City of Bellingham's water supply" (FMR 2007). It appears Whatcom County is being maneuvered into paying for City of Bellingham water supply practice. As a county watershed homeowner, I am being dragged along with it.

Nancy Alyanak
4 Sandalwood Circle
Bellingham, WA
May 27,2013

REFERENCES:

(QAPP 2002): Quality Assurance Project Plan Lake Whatcom TMDL Study, July 2002, Robert F. Cusimano, Steve Hood, Jing Liu Washington State Department of Ecology

(LWMPFR 2003): Lake Whatcom Monitoring Project 2002/2003 Final Report, April 2004, Matthews, R.A., M. Hilles, J. Vandersypen, R.J. Mitchell, and G.B. Matthews, Prepared for the City of Bellingham Public Works Department

(FMR 2007) FINAL Model Report for Lake Whatcom Watershed TMDL Model, July 2007,The Cadmus Group, Inc. and CDM, Bellevue, WA

(LWMPFR 2002): Lake Whatcom Monitoring Project 2001/2002 Final Report, April 2003,Matthews, R.A., M. Hilles, J. Vandersypen, R.J. Mitchell, and G.B. Matthews, Prepared for the City of Bellingham Public Works Department

(Edmundson & Koenings 1986): The Effects of Glacial Silt On Primary Production Through Altered Light Regimes and Phosphorus Levels in Alaska Lakes, 1986, Jim A. Edmundson & J. P. Koenings, Alaska Department of Fish and Game

(Wildung & Schmidt 1973): Phosphorus release from lake sediments, 1973, Raymond E. Wildung & R. L. Schmidt, United States Environmental Protection Agency, Office of Research and Monitoring

(Tracy 2001) Changes in Mirror Lake, Northwestern Washington, as a Result of the Diversion of Water from the Nooksack River, November 2001,Karel Tracy, WWU Masters Thesis

(LWWTMDL 2008)Lake Whatcom Watershed Total Phosphorus and Bacteria Total Maximum Daily Loads: Volume 1. Water Quality Study Findings, November 2008

From:	Eric Hirst
To:	Hood, Steve (ECY)
Cc:	Bellingham City Council; Kelli Linville; council@co.whatcom.wa.us; Jack Louws; Ranker, Kevin; Rep. Jeff Morris; Lytton, Kris; Bellon, Maia (ECY)
Subject:	Comments on 2/2103 Dept. of Ecology Lake Whatcom Report
Date:	Monday, May 27, 2013 9:52:01 PM

Dear Steve Hood,

Please include these comments in the official Department of Ecology (DOE) record for the February 2013 Public Review Draft Report on Lake Whatcom water quality.

We have known for at least 15 years (since DOE published a report in 1998) that Lake Whatcom suffers from two serious problems: (1) low dissolved oxygen associated with phosphorous-laden runoff, and (2) fecal coliform bacteria.

Since that time, local governments (City of Bellingham, Whatcom County, and Lake Whatcom Water & Sewer District) have developed various plans and taken several steps to address these problems. Unfortunately, water quality has continued to decline.

Because we have failed to halt the drop in water quality, let alone improve the situation, it is long past time for serious action. DOE's proposed Implementation Strategy (page 35) is, in my view, incredibly weak. It calls for five years of local-government planning (2013 – 2018) and a "50-year implementation schedule" with the hope that "TMDL reductions should be achieved by the late 21st Century." By that time, my wife and I will be long dead, so will our kids, and so will our grandkids.

Plans are good, and I am glad that DOE calls for more plans. But plans alone will not solve our water-quality problems. DOE must require local governments to take concrete steps (on-the-ground projects) that will dramatically reduce (by 87%, as called for in the DOE report) the runoff of phosphorous from existing developments. In addition, DOE should require that all new construction allows no stormwater runoff to occur (e.g., with water storage and increased infiltration).

To achieve these dramatic changes, DOE must require governments to raise enough money to fund the necessary projects. The county could form a taxing district that encompasses the entire Lake Whatcom watershed. Similarly, all users of water from Lake Whatcom should have their bills increased to provide money for these projects. This proposal:

- Ensures that money is available on a continuing basis to fund water-quality projects,
- Requires that those who contribute to the problem (developed property) pay for improvements, and

- Requires that those who benefit from improvements (water consumers) also pay.

I strongly urge you to rewrite the Implementation Strategy along the lines suggested here so that we can halt the decline in water quality within a few years and begin to see real improvement soon thereafter.

Eric

Eric Hirst
1932 Rhododendron Way
Bellingham, WA 98229
(360-656-6690 :EricHirst@comcast.net

From:	bc98229@comcast.net
To:	Hood, Steve (ECY)
Subject:	Public Review Comment for Draft Report: Lake Whatcom Watershed Total Phosphorus and Bacteria Total Maximum Daily Loads: Volume 2
Date:	Tuesday, May 28, 2013 8:56:35 AM

Public Review Comment for
Draft Report: Lake Whatcom Watershed Total Phosphorus and Bacteria Total Maximum Daily Loads: Volume 2.Water Quality Improvement Report and Implementation Strategy, February 2013

In tables, charts or plots does year refer to water year (October-September) or calender year (January-December)?

Nancy Alyanak
4 Sandalwood Circle
Bellingham, WA
May 28,2013

From:	Wendy Steffensen
To:	Hood, Steve (ECY)
Subject:	Lake Whatcom comments
Date:	Tuesday, May 28, 2013 1:12:56 PM
Attachments:	Lake Whatcom _052713.doc

Here you go , Steve.

Thanks for your work on this. I know it is a thankless task...
Wendy
--

May = Spring Fund Drive.
Thank you for supporting the mission of RE Sources to advocate for and protect our natural environment in the face of growing threats. Engaged citizens like you keep our home a wonderful place to live. Please donate this month to have your gift matched.

Wendy Steffensen, Lead Scientist
North Sound Baykeeper Team
RE Sources for Sustainable Communities
2309 Meridian St.
Bellingham, WA 98225

360 733-8307 (office)
360 739-5518 (cell)

RESources
for Sustainable Communities

2309 Meridian Street • Bellingham, WA 98225 • (360) 733-8307 • fax (360) 715-8434 • resource@re-sources.org

Steve Hood
Bellingham Field Office
WA State Department of Ecology
1440 10th St., Suite 102
Bellingham, WA 98225
steve.hood@ecy.wa.gov

May 28, 2013

RE: Lake Whatcom Watershed Total Phosphorus and Bacteria TMDL, Volume 2, publication #13-10-012

Dear Steve,

The North Sound Baykeeper mission is to safeguard marine and freshwater water quality and habitat in Whatcom and Skagit Counties. It is in this spirit, that we share our concerns with you in regard to volume 2 of the Lake Whatcom TMDL.

We welcome movement and focus on the plight of Lake Whatcom, our drinking water source. It is evident that you and others are attempting to make the models as accurate as possible, given the available and newly collected information. It is also evident that Ecology is sensitive to the large task ahead for the City of Bellingham and Whatcom County.

We agree with the approach whereby the large near-term actions, or "big bang for the buck" projects should occur for phosphorus reductions, regardless of further modeling refinements. Adjustments to models over time will not alleviate the need to accomplish these first projects. We also agree that modeling for the most sensitive portion of the Lake for the bacteria TMDL is sound.

The most concerning issue in the report is the outlined timeline. It is simply too lengthy.

- The Volume 1 report, published in 2008, stated that 85.5% rollback was needed for phosphorus and dissolved oxygen to meet the TMDL, and now 5 years later, in Volume 2, the Water Quality Implementation Report (WQIR), 87% is estimated to be needed. Granted, Volume 2 contains more direction about the

TMDL process, but the refinements to the model and data collection were not necessary to the ultimate conclusion. It is disheartening to witness the pace at which the TMDL process proceeds. It is unclear why the WQIR needed to include further modeling.

- Modeling updates can be done as needed on a tract separate from the regulatory mechanism, while still being incorporated into the TMDL. We ask that any further modeling updates be published as addendums with a formal comment period and that they be used to inform the process, but not become roadblocks to implementing the TMDL.
- The final Water Quality Implementation Plan is not due for one permit cycle. If this means that the responsible parties can wait until 2017 or 2018 to start implementation of the plan, this is far too long.
- We request that the plan and milestone be developed before the end of 2014 and that work on the milestones occur concurrently, as the City of Bellingham is already doing with its Homeowner Improvement Program, or at the beginning of 2015.

Thank you for your attention to these comments and for helping the community advance protection of Lake Whatcom. We look forward to reviewing further implementation plans.

Sincerely,
Wendy Steffensen, [waters@re-sources.org]
Lead Scientist, RE Sources

From:	Kaneshige, Iris S.
To:	Hood, Steve (ECY)
Cc:	Reilly, William M.; Hutchings, Jonathon J.
Subject:	FW: Response to Lake Whatcom TMDL / WQIR Implementation Report
Date:	Tuesday, May 28, 2013 2:42:56 PM
Attachments:	201305281436.pdf

Hi Steve,

Oh behalf of Bill Reilly, I am sending you a scanned copy of the City of Bellingham's comments to your draft lake Whatcom TMDL, Vol. 2., Water Quality Improvement Report. A hardcopy is coming your way via US Mail.

If you have any questions, please contact Bill directly.

Thank you!

Iris Kaneshige
Administrative Assistant (Temporary)
City of Bellingham ~ Public Works
Natural Resources Division
2221 Pacific Street
Bellingham, WA 98229
360.778-7719
iskaneshige@cob.org

-----Original Message-----
From: ricohmpc4502@cob.org [mailto:ricohmpc4502@cob.org]
Sent: Tuesday, May 28, 2013 2:36 PM
To: Kaneshige, Iris S.
Subject: Message from "RNP0026735771C6"

This E-mail was sent from "RNP0026735771C6" (Aficio MP C4502).

Scan Date: 05.28.2013 14:36:22 (-0700)
Queries to: ricohmpc4502@cob.org

DEPARTMENT OF PUBLIC WORKS 2221 Pacific St Bellingham, WA 98229
Telephone (360) 778.7700 ◆ FAX (360) 778.7701

May 28, 2013

Steve Hood
Ecology Water Quality Engineer
Department of Ecology
1440 10th Street, Suite 102
Bellingham, WA 98225

Dear Steve,

This letter transmits the City of Bellingham's comments to your draft Lake Whatcom TMDL, Vol. 2., Water Quality Improvement Report. I look forward to discussing our concerns and observations with you in person. The comments are enumerated below:

1. TMDL Modification Assurances

The TMDL for Lake Whatcom is based upon a complex calculation of loading to the Lake with an equally complex calculation to describe the effects from that loading on the Lake DO levels. The implementation requirements of this TMDL mandate that the City and County jointly or separately monitor water quality and update the TMDL models for the Lake every 10 years. Notwithstanding, the necessity of this work, it is onerous and perhaps unprecedented to explicitly burden a regulated party with the task of affirming a TMDL decision.

The City appreciates Ecology's work to provide a resilient action plan that is able to change as more information is gained; however, we are very concerned that the proposed framework lacks the necessary language to reopen the TMDL. Please provide information on the process that will allow modification to the TMDL. We believe that this process needs to be included into the TMDL as a portion of the implementation plan to assure that EPA will be supportive of such a process in the future.

2. Forest Practices

The draft TMDL plan proposed by Ecology indicates that all Forest Practices within the Lake Whatcom Watershed will be covered under a load allocation rather than a waste load

allocation. Due to the small set of data (2003), the lack of storm derived measurements within that data set and other factors we believe that determination may be flawed.

Forest management practices should be either revised to indicate a waste load allocation at this time or the TMDL should be constructed in such a way that, in the future, this decision can be revisited. The City believes that any and all causes of excess nutrient pollution need to be addressed in order to successfully protect Lake Whatcom.

The City and County have for several years been expanding the monitoring record to include phosphorus sampling associated with storms. The preliminary results of that sampling show substantial storm event loading that occur in all basins including those associated mainly with forestry.

The draft TMDL document calls out that the State's Forest Practice regulations assure excess phosphorus is not being discharged to the Lake Whatcom from regulated forest lands. It is indicated that these state wide rules were developed in 1999 to deal with the issues of TMDL's for turbidity and temperature. Ecology's conclusion that these rules provide adequate protections for this phosphorus TMDL is based on supposition. There is no data to support Ecology's assurance.

At a minimum, it is requested that Ecology provide a means for forestry to be brought under a waste load allocation now or in the future. Ecology or DNR should also find the means to provide water quality monitoring to prove or disprove the sufficiency of Forest Practice rules to protect a phosphorus limited lake.

3) Page 26 of the draft document has a mistake in the calculation of the total phosphorus load for both the existing and rollback conditions. It appears that there is a mixture of lbs. and kgs. being used.

4) The TMDL has provided for specific load reductions that are required for individual watershed sub-basins. The City would like to avoid the possibility of separate prescriptions for properties dependent on drainage basin. To that end, the TMDL should indicate the ability for the City and County to deviate from individual sub- basin loading restrictions, if an overall plan is brought forward that addresses loading for a substantially similar water quality result.

5) Future modifications to the TMDL should allow for further discrimination of loading, water quality effects and implementation strategy based upon the individual Lake basins. This would allow for and recognize the possibility of a more targeted strategy toward lake recovery.

6) Internal loading within the Lake presents great uncertainty to the success of this TMDL. The City believes that a better understanding of the extent and location of that load could be helpful to the TMDL.

The majority of this load is the result of historic forest practices and the timber industry in general. While it might seem appropriate that the DNR contribute to the mapping of these loads we simply request that the State, in general, provide funding to enable such work.

7) The City of Bellingham has also reviewed the comments being forwarded by Whatcom County. The City is in general agreement with most of these comments and hopes that resolution to their questions, as well as our own, can be provided.

Respectfully,

William M. Reilly
Surface and Stormwater Utility Manger

cc: Jon Hutchings

WMR/isk

From:	Kate Blystone
To:	Hood, Steve (ECY)
Cc:	Tim Trohimovich
Subject:	Futurewise Comments on the Lake Whatcom Water Quality Report
Date:	Tuesday, May 28, 2013 3:26:42 PM
Attachments:	FW to Ecology-LkWhatcom - Water Quality Report - Comments (3).docx

---

Steve,

Please see our attached comments. Let me know if you have any questions.

Thank you,

Kate Blystone
Futurewise
Whatcom Chapter Director

---

email: kate@futurewise.org
web: www.futurewise.org

1155 N State Street, #310
Bellingham, WA 98225
p 360-306-5708

Futurewise works throughout Washington State to create healthy livable communities, protect our working farmlands, forests and waterways, and ensure a better quality of life for present and future generations.

May 28, 2013

Steve Hood
Bellingham Field Office
Washington State Department of Ecology
1440 10th St., Suite 102
Bellingham, Washington 98225

Dear Mr. Hood:

Subject: Comments on the February 2013 Lake Whatcom Water Quality Report.

Send via email to steve.hood@ecy.wa.gov.

Thank you for the opportunity to comment on the Department of Ecology's February 2013 Lake Whatcom Watershed Total Phosphorus and Bacteria Total Maximum Daily Loads Volume 2. Water Quality Improvement Report and Implementation Strategy.

As you may know, Futurewise Whatcom is the local chapter of Futurewise. Futurewise is working throughout Washington State to create livable communities, protect our working farmlands, forests, and waterways, and ensure a better quality of life for present and future generations. We work with communities to implement effective land use planning and policies that prevent waste and stop sprawl, provide efficient transportation choices, create affordable housing and strong local businesses, and ensure healthy natural systems. We are creating a better quality of life in Washington State together. We have more than 600 local supporters in Whatcom County.

We appreciate Ecology's work on this issue as Lake Whatcom serves as the sole drinking water source for the City of Bellingham and parts of Whatcom County. Futurewise remains interested in protecting the quality of Lake Whatcom and supports efforts to improve that water quality. We believe this report identifies a reasonable target for phosphorus and fecal coliform concentrations and provides the City of Bellingham and Whatcom County with a path to success.

We are hopeful that the City and the County will diligently work to achieve these targets through identifying and retrofitting existing pollutant sources, and by limiting the impervious surface of new development in the watershed to 10 percent of the site with 65 percent of the area remaining in native vegetation as is recommended in the report.[1] We have advocated for such limitations on impervious surfaces in the County's portion of the Lake Whatcom Watershed before and have been met with resistance. We hope the words of this report and the support of Ecology's expertise will help the County realize the importance of limiting impervious surfaces in this manner.

We understand that the next TMDL report will be available in five years and that TMDLs will be prepared as long as is necessary, every five years after that. We urge Ecology to not allow the intervening five years to be a time of "wait and see" but an active period in which the state works

[1] Lake Whatcom Watershed Total Phosphorus and Bacteria TMDLs, pg X.

closely with local governments to improve Lake Whatcom's water quality for our generation and for future generations.

Thank you for considering our comments. If you require additional information please contact Tim Trohimovich at telephone 206-343-0681 or email tim@futurewise.org or Kate Blystone at telephone 360-306-5708 or email kate@futurewise.org.

Sincerely,

Tim Trohimovich, AICP
Director of Planning & Law

Kate LK Blystone
Whatcom Chapter Director

\\trunk\Futurewise\Planning\Comment Letters\Comp Plans & DRs\Whatcom\2013 Rural Element\FINAL-Futurewise Comments for County Council Hearing on May 21 Comprehensive Plan and Develop Reg Amendments.docx

From:	Mann, Laurie
To:	Hood, Steve (ECY)
Subject:	Lake Whatcom draft TMDL comments
Date:	Tuesday, May 28, 2013 4:10:37 PM
Attachments:	2013 0528 EPA comments Lake Whatcom.docx

Hi Steve,
Here are the additional comments from EPA on the draft Lake Whatcom TMDL.
thanks,
Laurie

May 28, 2013

Review of Volume 2 of draft Lake Whatcom TMDL

These comments supplement the EPA comments previously provided to you by Dave Ragsdale, regarding daily loads, margin of safety, and surrogate measures. Comments 1 through 10 address TMDL regulatory requirements, and comment 11 is organizational in nature (so no response is required to comment #11).

1) Surrogate Measures. EPA Region 10 commends Ecology for the development of a water quality model that predicts the way in which urban development, specifically stormwater runoff from impervious areas, affects the water quality of Lake Whatcom. The water quality model estimates the impact of "developed acres" on water quality, and informs the resulting "developed acre" targets that are described in the draft TMDL as surrogate measures. EPA Region 10 supports the use of surrogate measures in this TMDL where a linkage to the pollutants in stormwater, the impaired condition of the waterbody, and the water quality standard that the TMDL is designed to achieve can be demonstrated. In such a case, a surrogate measure can provide more meaningful and measurable pollutant loading targets to facilitate TMDL implementation into NPDES permits.

   In the draft Lake Whatcom TMDL, phosphorus is described as the "primary pollutant of concern". Please describe how the surrogate measure represents the "pollutant of concern," phosphorus, and is set at a level necessary to attain the applicable water quality standards. Please clarify whether both the phosphorus allocation and the surrogate measure are needed to achieve water quality standards; or whether implementation of either target, on its own, will result in attainment of water quality standards for DO and phosphorus. Can you clarify which target(s) will be used for purposes of NPDES Permitting?

2) Effective Developed Acres. The way in which the "effective developed acres" are defined and described varies throughout the document and can be somewhat confusing. EPA recommends that the term "effective developed acres" (or whatever term you use) be clearly explained and defined early in the document, and be used consistently throughout the document. For example, on page iv of the draft, Ecology states that " the amount of phosphorus that can be discharged to the lake is expressed both as *a percent rollback of the effect of development* and in pounds per year." In Table ES-1, the terms "*existing dev. Acres*" and "*87% rollback dev acres*" are used. The term is defined on page 27, but is still rather difficult to understand. Finally, given that the term "impervious surface" is commonly used as an indicator of development in urbanized areas, please explain how developed acres differs from impervious surface (or perhaps they are similar, and you could adopt the more conventional term).

3) Loading Capacity. The loading capacity section doesn't include the LC for bacteria. Please include the bacteria LC in this section of the document (or provide a different reference to the table where the LC can be found).

4) Wasteload Allocation. How should the WLA be interpreted if the hydrology is different from 2003 (i.e. "lb/2003 year")? The WLA should be calculated for critical conditions so that water quality is protected even when conditions change.

5) In addition, critical conditions are required to be identified. We strongly recommend that you add a discussion of critical conditions to the TMDL.

6) On page 6 of the TMDL, please make sure this table includes any updated listing IDs from the 2010 / 2012 303(d) list.

7) Model Calibration. On page 16 of the TMDL, Ecology states that the draft TMDL was developed using a calibrated model "with inputs modified as identified previously." Please be more specific about the inputs that were modified - - by inserting a table, for example.

8) Are any threatened or endangered species present in the waters covered by this TMDL (the Lake itself and/or the tributaries that drain to it)?

9) The discussion of reasonable assurance needs to include a demonstration that forest LAs will be achieved. The draft includes a reference that neither the city nor the municipality have authority over the silviculture activities, which casts further doubt in this area.

10) We suggest you consider adding a reserve for growth, especially given that land development is at issue.

11) Organization.

    a. On page x of the draft TMDL (*What needs to be done in this watershed?*), Ecology briefly discusses the allocations and includes a 5 page table entitled "Scenarios showing effective developed acres, total phosphorus and fecal coliform loading by tributary." EPA recommends that Ecology consider moving the allocation table to the "allocations" section of the document, and that the table be accompanied by a thorough explanation of all elements of the table.

    b. EPA also recommends that the "Approach to Permitting" section that currently starts on page xvi of the draft TMDL be moved to the WLA section.

From:	Gaythia Weis
To:	Hood, Steve (ECY)
Subject:	Lake Whatcom Water Quality Improvement Project - Public Comments
Date:	Tuesday, May 28, 2013 7:11:47 PM

Steve Hood
Bellingham Field Office
WA State Department of Ecology
1440 10th St., Suite 102
Bellingham, WA 98225
steve.hood@ecy.wa.gov

May 28, 2013

Dear Mr. Hood,

I am an analytical chemist and a resident of the City of Bellingham. My husband and I relocated ourselves and our small consulting firm to this area because of the high quality of the natural environment of this area. Water quality is a very important part of this environment.

I agree with the City of Bellingham position that the Lake Whatcom Watershed should be closed to additional groundwater withdrawals. I also agree with the city's finding that phosphorus-laden runoff from cleared and developed land is impairing the city's ability to exercise its municipal water right from Lake Whatcom and supply water to nearly 100,000 people.

The Department of Ecology has asserted its right to deny the petition but provide an alternative means to address the concerns of the petition.

But in my opinion, allowing development which then turns out not to meet the stated standards (to ensure no additional phosphorus contamination of the lake) offers no ability to undo that development should such development and accompanying groundwater withdraws be determined to be hindering meeting water quality standards.

Lake Whatcom already has 11 tributaries flowing into the lake have fecal coliform levels that are too high. Lake Whatcom is already on the state's 303(d) list of impaired water bodies. If the amended regulations are adopted and turn out not to be effectively implemented, the new development put into place cannot easily be undone..

In my opinion, no further development should proceed until and unless it can be demonstrated that controls and remediation of existing development can be implemented in ways that effectively rollback phosphate loading to that seen for a natural forest and dissolved oxygen levels in the lake meet water quality standards.

Sincerely,

Gaythia Weis

InfoPteryx LLC
1713 Edwards Ct.
Bellingham WA 98229

From:	Sandy Petersen
To:	Hood, Steve (ECY)
Subject:	Public Review Draft Lake Whatcom Watershed Total Maximum Daily Loads Volume 2 Water Quality Improvement Report and Implementation Strategy document / comments
Date:	Tuesday, May 28, 2013 8:09:53 PM

Ref:
(a) My 2013.05.26 1912 email same subject

I've just now discovered that some type of formatting corruption occured to ref (a) email. Please therefore substitute the one below for ref (a).

I offer the following three comments regarding the *Public Review Draft Lake Whatcom Watershed Total Maximum Daily Loads Volume 2 Water Quality Improvement Report and Implementation Strategy* document:

Comment No 1.
Given that Lake Whatcom, per said document, is explicitly:

- 303(d)-listed for the following two substandard water quality conditions:

  1. Low dissolved oxygen (DO) in Basins 1 and 2 (Basin 3 DO levels do meet water quality standards), and

  2. Excessive fecal coliform bacteria concentrations in its tributaries, and

- **Not** 303(d)-listed for excessive phosphorus (P) loading (although P loading does contribute to the substandard DO condition)[(1)],

and contrary to the document statement on page 35 that says, in part, that:

> "The Lake Whatcom Reservoir Management 2010-2014 Work Plan is **an exhaustive list** [Appendix D] **of the known tools available for restoring the lake** [emphasis added].",

I submit that the implementation strategies (i.e., problem solution alternatives) list in said document is **possibly** incomplete. To the best of my knowledge, direct DO remedies to the Lake water itself, such as by mechanical aeration and aluminum sulfate treatment, which other communities across the United States have employed as legitimate (i.e., USEPA-approved) physical and chemical water quality restoration actions in their TMDLs for similarly excess P/low DO impaired lakes[(2)], have not yet been seriously considered for Lake Whatcom. This direct lake water rehabilitation approach reflects the same premise that is customarily used to treat sewage generated in highly urbanized/densely populated settings, i.e., that pollution control or prevention at its source or origin may not be the preferred solution; that sometimes the preferred solution is to treat the resulting polluted water, air, or other substance, material, or matter.

Accordingly, before WSDOE finalizes any solution/implementation strategies list for submission to the USEPA for approval, I recommend that experts in the fields of lake aeration and chemical treatment, respectively, evaluate them for technical and economic feasibility in Lake Whatcom, particularly given the probable significant costs, implementation time delays, and other challenges that the favored on-site retrofits for developed properties and community/regional stormwater P removal systems pose, and given that the document as written does not address reduction of the P loading into Lake Whatcom from the man-made Nooksack River Middle Fork Diversion facilities. Such an expert evaluation would also inherently account for the DO conditions in each basin, which are not the same.

Furthermore, if either or both of the suggested techniques above proves technically and economically feasible, then I also recommend that you evaluate a further revision to the proposed implementation strategy in the document to abandon altogether

(1) the requirement that all new development and redevelopment meet the so-called "P neutral" standard for stormwater runoff, and

(2) the P neutral retrofit program for existing development (which physical and/or chemical treatment would accommodate instead),

with the substitute requirement that all new development and redevelopment within the Lake Whatcom watershed must comply with the current version of the WSDOE *Stormwater Management Manual for Western Washington*, which imposes a sequenced examination and evaluation of two P-neutral BMPs (i.e., Downspout Full Infiltration and Full Dispersion) for residential roof construction as a routine step. If, however, neither BMP proves feasible for a particular development or redevelopment, then at least some P treatment will occur via the other BMPs on the standard menu (which are not P-neutral), with the lake aeration system and/or chemical treatment handling the remaining P load from the new development or redevelopment.

Additionally, if lake aeration and chemical treatment proves infeasible, then the document should address mitigation of P loading from the Nooksack River Middle Fork Diversion facilities.

Comment No 2.
Given the evolving jurisdictional complexities of managing the Lake Whatcom watershed and its resources since the inception of the Lake Whatcom Management Program, and the looming significant economic impacts that the TMDL holds, the document should evaluate the feasibility of establishing an RCW 85.38 or 85.08-authorized Drainage District (aka Stormwater Utility District) for the Lake Whatcom watershed with its own elected governing body vs retaining the Lake Whatcom Management Program as is.

Comment No 3.

The document should discuss whether Lake Whatcom Water and Sewer District's Sudden Valley Water Treatment Plant (which draws its water from Basin 3) has ever experienced filter clogging problems due to algae.

[(1)] The following link apparently states otherwise:

http://apps.ecy.wa.gov/wats/ViewListing.aspx?LISTING_ID=8621,

although I don't know if the "grid cell" information noted corresponds to the entire lake or just a portion of the lake. Please also note that the grid cell information for the phosphorus listing at the above link differs from the grid cell information for the dissolved oxygen listing at the following link:

http://apps.ecy.wa.gov/wats/ViewListing.aspx?LISTING_ID=5846

(2) See the following TMDL example links that include aeration and/or chemical treatment:

http://www.epa.gov/region9/water/tmdl/la-lakes/LALakesTMDLsSection6EchoParkLake.pdf

http://www.deq.idaho.gov/media/451046-winchester_lake_ag_imp_plan.pdf

http://www.swrcb.ca.gov/rwqcb8/water_issues/programs/tmdl/docs/elsinore/implemetation/Lake_Elsinore_Sediment_Nutrient_Reduction_Plan_10-22-07.pdfhttp://www.bassettcreekwmo.org/TMDLs/SweeneyLakeTMDL/SWEENEY-TMDL-10-29-2010.pdf

http://denr.sd.gov/dfta/wp/tmdl/TMDL_Sylvan.pdf

http://www.neglwatersheds.org/images/WhiteLakefinalreportTMDL4.pdf

http://www.washingtonwatch.com/bills/show/ED_80235.html

http://www.epa.gov/owow/tmdl/examples/nutrients/sd_hiddenwood.pdf

and these other aeration and chemical treatment-related links as follows:

http://link.springer.com/chapter/10.1007%2F978-1-60327-133-2_13#,

which states, in part, that:

> "Phosphorus may be permanently removed from a lake by various processes, whereas nitrogen is difficult to remove permanently due to the fact that certain blue-green algae can fix atmospheric nitrogen as a nitrogen source. Thus, emphasis has been placed on the removal of phosphorus. There are various methods for the treatment of wastewaters to remove the nutrients before being discharged to a body of water. Once in a lake, phosphorus removal is most frequently achieved by producing an insoluble aluminum salt of the phosphorus, but iron salts are effective under aerobic conditions. Calcium salts are effective in removing phosphorus, but they generally adversely increase the pH of the lake. Precipitated aluminum phosphate salts may be allowed to settle to the bottom of the lake, or they may be removed from the water column. A study showed that removing the phosphate-rich hypolimnetic waters from a summer stratified temperate climate lake, precipitating the phosphorus as either aluminum or iron salts, separating the precipitate by DAF [diffused air flotation], and returning the phosphate reduced water to the lake were very effective in controlling the phosphorus nutrient content in Devils Lake, WI.".

http://www.spokaneriver.net/wp-content/uploads/2008/11/stdsclarificationtoepa.pdf (a WSDOE letter to USEPA Region 10 where Attachment A to that letter acknowledges that lake aeration or oxygenation is a possible solution for the Spokane River Dissolved Oxygen TMDL.)

http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/upload/day2_gibson.pdf

Regards,
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Bellingham, WA 98229-3380

WHATCOM COUNTY
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May 28, 2013

Steve Hood
Bellingham Field Office
Washington State Department of Ecology
1440-10th Street, Suite 102
Bellingham, WA 98225

Re: Comments on TMDL Report Volume 2

Dear Steve:

Thank you for providing Whatcom County (County) the opportunity to review and comment on the "Public Review Draft Lake Whatcom Watershed Total Phosphorus and Bacteria Total Maximum Daily Loads, Volume 2. Water Quality Improvement Report and Implementation Strategy," dated February 2013. The draft report follows Volume 1 (November 2008) to which Whatcom County submitted written comments. The County comments on both the preliminary draft report and the draft report of Volume 1 were contained in letters to Ecology dated June 3, 2008, and September 17, 2008, respectively.

In reviewing the Volume 2 draft report, we noted that only a few of our previous comments were addressed. All of our prior comments that have not been addressed are incorporated by reference because they are reasonable and valid.

Our key concerns include the following:

(1) Wasteload allocations (WLAs) are focused on stormwater discharges, but the models used to derive the WLAs are based on very limited stormwater data (two storms sampled at a few of the numerous tributaries to the lake).

(2) Retrofitting 87% of the existing developed area so that runoff matches forest conditions is infeasible for many reasons, including the fact that it would require infiltration volumes substantially greater than volumes under natural forested conditions because evapotranspiration, canopy interception, and forest floor storage volumes would need to be infiltrated. Most of the watershed soils have been formed on bedrock and have very low permeabilities in their lower horizons.

(3) Proposed WLAs are based on a model-simulated comparison of whole-lake dissolved oxygen (DO) under simulated baseline and natural conditions. Protection of the water supply, recreation, aquatic life, and other designated uses of the lake is a more reasonable and appropriate goal than meeting a model-simulated DO value in the deepest portion of the lake.

In addition, we have the following comments related more specifically to Volume 2:

1. We would like to reiterate our previous comment that we do not believe that expressing load reductions in terms of "effective developed acres" is appropriate or reasonable. This method of expressing load

reductions does not accurately communicate the magnitude of the reductions. Phosphorus load per acre of developed area could vary considerably from place to place within the watershed depending on the nature of the development, the development regulations in place at the time of construction, stormwater treatment retrofits, proximity to streams or stormwater conveyances, soils, and other factors. Therefore, it would be more appropriate to express the load reduction in terms of mass per unit time rather than effective developed acres. This would provide a more flexible and direct method for accounting of load reductions through targeting of various management measures in priority locations. As you are probably aware, in January 2013, a federal court in Virginia ruled that runoff and other "nonpollutants" could not be used as surrogates for pollutants to meet a total maximum daily load (Accotink Creek TMDL). Consequently, we urge you to reconsider your approach.

2. *Page vii.* The executive summary specifies methods for managing runoff to reduce phosphorus levels so they more closely mimic forested conditions. Methods specified include: (1) providing storage to promote infiltration, (2) rainwater harvesting, and (3) decreasing impervious surfaces. Methods should also include the application of devices that provide filtration. There may be areas where space is limited and underground structural filtration devices could provide an effective mechanism for reducing phosphorus. We recommend adding this to the list of options. In relation to this comment, we request removing the fifth paragraph on page x as it seems to dismiss this practice as a viable option.

3. *Page ix.* A large, detailed map in the document should be included to help reflect the various land use areas and zoning and sub-basin boundaries described in the report. For example, the report discusses how land zoned for commercial forest has been removed from the WLAs and is listed separately as a load allocation, but there is no map that shows those areas.

4. *Page x.* In some areas the report states that the requirement is 87% conversion of effective developed acres so that runoff from these acres is similar to forested conditions. In others (see bottom of page 15 and top of page 16) it states that an 87% reduction in phosphorus loading is needed. These two goals are not the same. As land uses and runoff concentrations differ throughout the watershed, the goal of reducing 87% effective developed acres (i.e. 87% of the 2010 developed area functions as forest) does not equate to 87% reduction in phosphorus. At the top of page 22, it states that "When 87% of the developed land within each sub-basin is modeled as forest land, the lake meets the water quality standards." Later on the same page it states that "In this TMDL, the annual loading from the base condition (calendar year 2003) is reduced by 87% in order to meet water quality standards." In addition to our prior comments outlining our disagreement with expressing WLAs in terms of 87% reduced effective developed acres, there is significant inconsistency in how the WLA is expressed throughout the report.

5. *Page xvi.* The report states that "The permit must also require that the wasteload allocations in the TMDL are met as a part of permit compliance." It then states that "Permits for the discharge of stormwater may use mandatory activities as the means of meeting the wasteload allocations, instead of only requiring direct water quality monitoring measurements." On page xvii it states that "...the permit requirement to comply with the wasteload will be expressed as actions that must be taken under the NPDES Phase II Municipal Stormwater permit." Underlines have been added in the previous sentences for emphasis. Other sentences to the same effect are scattered throughout the report implying that WLAs must be met under the municipal separate storm sewer system (MS4) National Pollutant Discharge Elimination System (NPDES) permit.

   A significant body of law and regulation around this topic has concluded that the requirement to meet WLAs is a subset of the requirement to meet water quality standards. Additionally, Washington's Phase II MS4 Permit contains a compliance pathway that recognizes that MS4 discharges are different from

other types of discharges and entitled to the "maximum extent practicable" or "MEP" standard. Consequently, MS4 compliance with WLAs established by TMDLs is subject to the MEP standard established in the Clean Water Act and Washington State's compliance pathway.

6. *Page xvi.* The second paragraph states that "the allocation is based on a unit load method." The third paragraph defines unit load as "the total load in the watershed divided by the total area of the watershed." This definition appears inconsistent with the first sentence of paragraph 2 which states, "In the DO TMDL, the total phosphorus loading levels are associated with the developed land area." As noted on page 15 of the report, only 12% of the watershed has been developed. Please clarify.

7. *Page xvi.* The second paragraph states that "In the DO TMDL, the total phosphorus loading levels are associated with the developed land area." Given that 88% of the watershed is undeveloped, what is the rationale for this approach?

8. *Pages xvi-xvii.* It states in the second paragraph that "In this TMDL, instead of estimating the area that is subject to the NPDES permit, the allocation is based on a unit load method." And in the third paragraph it states, "... because the boundary of the land that drains to storm drainage systems is not mapped, we cannot accurately separate load allocations from wasteload allocations. In this situation, loading capacity has been listed as a waste load allocation." On page 2 it states that "To avoid more stringent requirements being placed on the permit, the Stormwater Management Program must provide reasonable assurance that load allocations will be met."

   Several similar references throughout the document combine areas outside of the MS4 permit's jurisdiction with permitted areas. Under TMDL requirements, non-point sources are required to comply with load allocations and an implementation plan is required. For MS4 point sources, WLAs are addressed in the MS4 NPDES permit within the context of the MEP standard, and actions toward addressing the TMDL are implemented in the stormwater management plan (SWMP) that is part of the permit. It is important from a regulatory standpoint that these areas are distinguished from each other and kept separate given that they are subject to different standards.

   In Washington Department of Ecology Municipal Stormwater Permit Criteria for Designating Phase II Bubble Cities, the MS4 must either serve a substantial population or area, or it must be contiguously located to an already regulated municipal storm sewer. The forest areas in the Lake Whatcom watershed do not meet either of these requirements for inclusion in the permit.

9. *Pages 4-5.* The report states that there are two surrogate measures. The first surrogate measure is listed as the reduction in effective developed acres. As we understand, the reduction in effective developed acres reflects reduced phosphorus loading, which in turn reflects improved DO levels. The second surrogate measure is listed as the 2003 annual load. Listing the 2003 annual load as a surrogate is confusing. As defined in the glossary of the report (page 52), a surrogate is an environmental indicator that is used to develop a quantified TMDL when a numeric criterion for the specified pollutant is not possible. We do not see how the 2003 annual load is a surrogate for a pollutant parameter. We suggest that the description of the 2003 annual load as a surrogate is removed. In addition, it seems that phosphorus is the surrogate for DO and there is no need for an additional surrogate of effective developed acres (see also Comment 1).

10. *Pages 11-13.* It is very difficult to understand what was done and how it affects the TMDL. Was the HSPF model updated to include new land use information? If so, was consideration given to re-calibrating the model using the substantial amount of storm event monitoring data collected by the County and City since 2007?

11. *Page 21, Figure 5.* This graph is difficult to interpret. In the report it states that the green line, representing the cumulative dissolved oxygen at 87% rollback from the Existing Conditions scenario, is about 0.2 milligram per liter (mg/L) lower in oxygen than a comparable volume of water under the Full Rollback scenario. However, in the figure it appears as if the full rollback and 87% rollback have the same results. Based on this figure, it seems as if there should be an additional allowance for loads as it does not appear that the full or 87% rollback are below criteria, and there is an allowance for 0.2 mg/L below criteria.

12. *Pages 22-23.* It would help to provide clarification to the formulas by adding the word "annual" in front of the definition for items C and F. It would also be helpful to add the word "annual" to the column headers in Table 5.

13. *Pages 22-23.* The Loading Capacity section of the report is difficult to follow. Specifically, it is hard to understand how Tables 3, 5, 6, and 7 relate to each other. As an example, Table 6 indicates that the Silver Beach sub-basin encompasses 328 acres while Table 3 lists the total area of this sub-basin is 712 acres. In addition, it is hard to know how to apply areal loadings given that the reach number is not provided for sub-basins. We request that sufficient information be provided for the document user to be able to track how mass loads were calculated from areal loading rates. It would help if we had the ability to take the areas from Table 3 and the annual mass loads from Table 6 and determine how they were derived from Table 5. This could require an additional table connecting reaches in Table 5 with tributary sub-basin names in Table 6 in order to allow for an accounting of areas.

14. *Page 28. Table 7.* "Waste Load Allocations for municipal stormwater dischargers in the watershed covered by NPDES permits" includes a number of areas that are not covered by the County's municipal NPDES permit (e.g., Smith, Olsen, and Blue Canyon). These forested basins have low population densities that do not meet the criteria for inclusion in a Phase II municipal NPDES permit.

15. *Page 30.* It seems the title to Table 10 and column 4 of Table 10 should refer to WLAs and not LAs.

16. *Page 30.* The statements regarding loading capacity for fecal coliform are inaccurate to the extent that they include forested areas because the MS4 permit does not cover these areas.

17. *Page 30.* Table 10 indicates that fecal coliform levels in Smith and Olsen Creeks will need to be reduced substantially. Considering that these basins are forested with little or no developed land or agricultural use, the observed fecal coliform loads are likely from wildlife. Therefore, it is inappropriate to include these as WLAs in the County's MS4 permit.

18. *Page 30.* The report refers to Table 10 and states that "the associated wasteload can be re-categorized as a load allocation, provided the same level of control remains in place when the discharge was regulated by a permit." This implies that all of the area listed in Table 10 is currently covered by MS4 permits. This is not the case. Large portions of the listed basins are outside the County or City MS4 and therefore cannot be covered by an MS4 permit.

19. *Page 31.* The report suggests that the County and City will be responsible for refining the models developed by Ecology. Exactly how would this be accomplished?

20. *Page 31.* The report states that if the improved models indicate that the previous models were overly protective, the most expensive and least effective implementation measures can be eliminated. In fact, if the models indicate that the previous models were overly protective (or prescriptive), the TMDL's WLAs and LA's should be modified.

21. *Page 38.* The report states that the models were calibrated to runoff from forest areas during 2002-03. The data set used for calibrating Ecology's HSPF model did not include samples collected during large storm events when mass wasting or channel erosion are more likely to occur. The Washington State Department of Natural Resources estimated that legacy forest practices have increased sediment inputs by about 14,844 tons per year over a 90-year period, and that about 95% of the sediment increase was associated with mass wasting (WDNR, 1997; Grizzel, 2001). Because the HSPF model was calibrated with data collected when mass wasting or road erosion from past forest practices was not occurring, the "full rollback" scenario may under-predict current phosphorus loads of forest areas, yet provide a reasonable estimate of phosphorus loads from natural forests. If so, the difference between natural- and base-year phosphorus loads to the lake could be less than the TMDL assumes.

Protection of Lake Whatcom is critically important to Whatcom County, and we have already devoted substantial effort toward protecting the lake. We are committed to doing our part to control pollution and preserve the beneficial uses of the lake. At the same time, we need to ensure that our control efforts are practical and cost-effective. We intend to continue to work closely with Ecology, the City of Bellingham, and other key stakeholders to protect Lake Whatcom.

We are requesting that you provide specific written responses to each of our comments. Further, we request that DOE delay finalization of the TMDL until our comments can be satisfactorily addressed. With the significant technical issues we have noted above, finalizing the TMDL at this time without addressing these issues will reduce the ability of Whatcom County and DOE to successfully implement the TMDL.

If you would like to discuss these comments, contact me to arrange a meeting or conference call.

Sincerely,

Joseph P. Rutter For C.B.

Chris Brueske, P.E.
Assistant Director
Whatcom County Public Works

cc: Dan Gibson, Whatcom County Chief Civil Deputy Prosecutor
Kirk N. Christensen, P.E., Whatcom County Public Works Stormwater Manager
Maia Bellon, Director, Washington State Dept. of Ecology Director

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Appendix D. Lake Whatcom Reservoir Management Program 2010-2014 Work Plan

Lake Whatcom Reservoir Management Program
2010-2014 Work Plan

Prepared by the Lake Whatcom Reservoir
Interjurisdictional Coordinating Team

July, 2010

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4.5 Reduce pollution associated with landscape practices

Introduction

For the past several decades, the Lake Whatcom Reservoir's water quality has been deteriorating as a result of phosphorus entering the lake from residential development, forest practices, natural processes and other sources. This phosphorus loading has resulted in widespread algal blooms and dissolved oxygen deficits causing problems for the City's water supply system, fish and recreational users of the lake. In 1998, Lake Whatcom water quality failed to meet state dissolved oxygen standards and was placed on Washington's list of polluted waters. In response to this listing, a Total Maximum Daily Load (TMDL) study was completed by the Washington Department of Ecology (DOE) to determine the amount of phosphorus reduction needed to return the lake to acceptable water quality standards. The City of Bellingham and Whatcom County will submit this work plan to the Department of Ecology to fulfill the requirement for a Summary Implementation Strategy, the initial phase of the TMDL response strategy.

The Lake Whatcom Cooperative Management Program was established by an Interlocal Agreement in 1998 between the City of Bellingham, Whatcom County and the Lake Whatcom Water and Sewer District (formerly Water District 10). The goal of the program is to jointly manage and implement programs affecting the Lake Whatcom watershed.

Since 2003, staff from the three jurisdictions have worked to improve the functional components of the management program. The Interjurisdictional Coordinating Team (ICT) was created in 2000 to help coordinate activities and programs between the three jurisdictions. The ICT, composed of staff from each of the three jurisdictions, meets regularly to coordinate Work Plan implementation, evaluate program effectiveness and analyze data collection and monitoring results. Findings from those efforts as well as information from the TMDL study and other reports, were used to develop tasks for this work plan, tasks that will improve the water quality of the lake.

The Lake Whatcom Reservoir Management Program 2010-2014 Work Plan is the third five-year work plan. Over the next five years, this work plan will guide management activities focused on the water quality issues that result from excess phosphorus loading into the lake. Similar to preceding work plans this five-year work plan is organized around twelve Program Areas with tasks and actions for each. However the format of this plan is much different. It is a modified version of the format used in the Lake Whatcom Reservoir Technical Review Task Force report, *Recommended Management Actions for the Protection and Restoration of the Lake Whatcom Reservoir,* that was presented to the Mayor and City Council of Bellingham in May, 2009. This format was adopted in order to:

- Present the tasks in a clearer and more detailed format
- Improve the accountability by tracking the progress and resource-use of each task
- Provide flexibility to allow for changes and improvements during the five-year timeframe

Each Program Area's tasks have been color-coded for easy identification throughout the work plan. A header table at the top of each task sheet provides a quick overview of the task and includes:

- the time period in which the task will be implemented,
- the party or parties responsible for implementing the task,

- an estimate of the costs associated with the task,
- the status of the task, and
- the phosphorus reduction pathway.

Each task sheet also includes a section of one or more performance measures, indicators of effectiveness for each of the actions of each task. Also included are more detailed cost estimate tables.

We highly recommend reading the detailed explanation of the new format and the header table that can be found on pages 6 and 7.

The *Silver Beach Creek Pilot Project* (SBCP) continues to be an important focus for the Lake Whatcom Management Program under this current work plan. The project involves implementing a comprehensive strategy of Capital Improvement Projects (CIP), public outreach and education, stewardship efforts, and enforcement in the Silver Beach Creek watershed. Silver Beach Creek has some of the highest development/residential related phosphorus loading of all the Lake Whatcom tributaries and is shared by both the City and County jurisdictions making it an ideal setting for the pilot study. Implementation of the tasks in the SBCP will reduce pollution entering the lake and will also serve to test the stewardship focus of many of the tasks. The successes from this pilot project will then be applied to the entire Lake Whatcom watershed. Tasks that are being implemented as part of the Silver Beach Creek Pilot can be found in the Task Summary Table under a separate sub-section entitled *Silver Beach Creek Pilot* in addition to their standard location under the appropriate Program Area.

Successful implementation of this work plan is predicated on continued or increased funding and staffing. Obviously if funding in a Program Area is less than projected then the tasks will need to be reduced either in scope, number or timing to adjust to the funding constraint. Recently awarded and expected 2010 grant funding will be an integral part of the work plan implementation strategy. ICT staff will continue to seek additional grant funding as described in Task 11.2. Appendix B provides additional information on funding.

An annual report on work plan progress will be prepared by January 31st of the following year.

Reading the Header Table

Program Area: 1. Land Preservation

Task: 1.3 Manage Acquisition Program properties

Quick Reference: Program Area and Task Number

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 2010-2014 2011-2012	City County SVCA District WSU Extension Education Team Data Team	$20,000	Active Hold	Indirect Direct

Quick Reference: Key information for each task is found in the **Header Table** (left) and can also be found in the **Task Summary Table on pages 8-11**

Header Table Descriptions:

Period: This column refers to the time period in which the task was/is being implemented. This entry includes the year the task started and the expected duration. For example, the period **2010-2014** indicates that the task is first being implemented in 2010 and is expected to continue until 2014. **2010** or any other single year indicates the task will be completed in one year.

Responsible Party: This column refers to the party or parties responsible for implementing the task.

Cost Estimate: This column gives an estimated cost for the implementation of the task during the period indicated. When applicable this estimate will be a combined amount for staff, capital and other costs for all participating parties. Details are broken out in the Cost Estimates Table.

Status: This column refers to the status of the task which is indicated by the following:

- **Active** indicates the task is funded and will be implemented.
- **Hold** indicates the task is on hold due to staff and/or funding constraints .

P Reduction: This column is used to indicate 1) whether this task is expected to result in a reduction in phosphorus loading, and 2) if there is an expected reduction, will it be a) **Indirect**, meaning that the phosphorus reduction will occur as a result of the impact this task will have on other actions, e.g. education program influence on stewardship activities, or b) **Direct**, meaning that this task is expected to directly result in a reduction in phosphorus loading, e.g. retrofitting a stormwater facility.

Quick Reference: Detailed descriptions of all **Header Table** entries can be found here

Reading the Task Sheet

The reference task number and name can be found here

Here is an example of the **Header Table** from the previous page

Program Area: 1. Land Preservation
Task: 1.3 Manage Acquisition Program properties

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	City ER/County Parks	$2.77 million	Active	Direct

Task Objective: Protect the watershed by managing Acquisition Program properties

A detailed **Task Objective** can be found in this section

Actions:

- Inventory and create management plans for new acquisitions
- Implement management plans for all properties
- Conduct periodic inspections, invasives control, planting, trail construction, encroachment [illegible] other tasks as needed

A list of **Actions** that will be taken to meet the Task Objective . This list will be updated as needed.

Intended Lake Benefits: Phosphorus Reduction ☒ Fecal Coliform Reduction ☐ Sediment Reduction ☒ Other ☐

If other, please describe:

Performance Measures: 1) Acres restored, encroachment responses, special projects
2) Summary of projects completed on properties

Boxes in this section are checked to indicate specific benefits the lake may receive as a result of this task. If **Other** is checked, a description will follow below.

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	
2010	City	1.0 ($100,000)		$30,000	
	County	1.0 ($100,000)	$225,000	$50,000	
	District/Other				
2011	City	1.0 ($100,000)		$35,000	$135,000
	County	1.0 ($100,000)	$75,000	$55,000	$230,000
	District/Other				
2012	City	1.0 ($100,000)		$40	
	County	1.0 ($100,000)		$55	
	District/Other				
2013	City	1.0 ($100,000)		$45	
	County	3.0 ($300,000)	$150,000	$205	
	District/Other				
2014	City	1.0 ($100,000)		$50,000	$150,000
	County	3.0 ($300,000)	$150,000	$205,000	$655,000
	District/Other				
Total		**14.0 ($1.4 million)**	**$600,000**	**$770,000**	**$2.77 million**

Performance Measures indicate how progress toward completing the task objective is being measured

The **Cost Estimates** section gives an estimate of the resources and funding to be used to implement the task for the designated period. Cost estimates are divided into Full Time Equivalents (1.0 FTE = $100k), Capital Costs ($), Other Costs ($), and Total Costs ($) for the respective jurisdictions. Undetermined is used to indicate when no resource/funding information is currently available.

Task Summary Table

1. Land Preservation	Period	Responsible Party	Cost Estimate	Status	P Reduction
1.1 Acquire easements or titles to watershed properties	2010-2014	City/County	$14.16 million	Active	Indirect
1.2 Create Conservation Easements for Preserves	2010-2014	City	$110,000	Active	Indirect
1.3 Manage Acquisition Program properties	2010-2014	City/County	$2.77 million	Active	Direct
2. Stormwater Management	**Period**	**Responsible Party**	**Cost Estimate**	**Status**	**P Reduction**
2.1 Identify and prioritize stormwater projects utilizing models	2010-2014	City/County	$490,000*	Active	Indirect
2.2 Improve phosphorus removal in stormwater facilities	2010-2011	City/County	$580,000	Active/Hold	Direct
2.3 Implement comprehensive stormwater plans for phosphorus control	2010-2014	City/County	$2.74 million	Active/Hold	Direct
2.4 Conduct inspections and assessments	2010-2014	City/County/SVCA	$1.1 million	Active	Indirect
2.5 Coordinate NPDES Phase II implementation	2010-2014	City/County	$500,000	Active	Indirect
2.6 Restore stream riparian areas	2010-2014	City/County	$70,000	Active	Direct
3. Urbanization & Land Development	**Period**	**Responsible Party**	**Cost Estimate**	**Status**	**P Reduction**
3.1 Maintain and improve permit tracking system	2010-2014	City/County/District	$26,000	Active/Hold	Indirect
3.2 Maintain joint development review process	2010-2014	City/County	$4,000	Active/Hold	Indirect
3.3 Continue to assess the effectiveness of regulations	2010-2014	City/County/SVCA	$45,000	Active/Hold	Indirect
4. Community Outreach	**Period**	**Responsible Party**	**Cost Estimate**	**Status**	**P Reduction**

4.1 Improve outreach and participation strategies through staff collaboration	2010-2014	Education Team	$30,000	Active	None
4.2 Educate and engage watershed residents and visitors	2010-2014	Education Team	$150,000	Active/Hold	Indirect
4.3 Reduce pollution from animal waste	2010-2014	City/County/District	$30,200	Active/Hold	Direct
4.4 Reduce pollution from vehicle washing and maintenance	2010-2014	City	$18,400	Active/Hold	Indirect
4.5 Reduce pollution associated with landscape practices	2010-2014	WSU Extension	$15,900	Active/Hold	Direct/Indirect
4.6 Continue Residential Stormwater Retrofit Program	2010-2011	City/DOE	$338,471	Active	Direct
4.7 Continue water conservation outreach	2010-2011	City/District	$170,400	Active	None
4.8 Report toxic algal blooms	2010-2014	Data & Ed Teams	$15,000	Active	None
5. Data Management & Information	**Period**	**Responsible Party**	**Cost Estimate**	**Status**	**P Reduction**
5.1 Continue lake water quality monitoring	2010-2014	Data Team	$1.23 million*	Active/Hold	Indirect
5.2 Update tributary pollutant loading models	2010-2014	Data Team	$362,000	Active/Hold	Indirect
5.3 Review and summarize monitoring studies and reports	2010-2014	Data Team	$10,000	Active	None
5.4 Maintain and update data records	2010-2014	Data Team	$5,000	Active	None
5.5 Establish new monitoring programs	2010-2014	Data Team	As needed*	Hold	Indirect
6. Spill Response & Hazardous Materials	**Period**	**Responsible Party**	**Cost Estimate**	**Status**	**P Reduction**
6.1 Amend local Emergency Operations Plans to include Lake Whatcom chapter	2010	ICT	$3,000	Active	None
6.2 Coordinate spill response and reporting among all jurisdictions	2010, 2014	ICT	Staff	Hold	None
6.3 Conduct hazardous waste collection events	2010, 2013	ICT	$56,000	Hold	Indirect

7. Forestry/Fish/Wildlife	Period	Responsible Party	Cost Estimate	Status	P Reduction
7.1 Review IJC reports of DNR activities	2010-2014	ICT	$15,000	Active	None
7.2 Enforce water quality assurances	2010-2014	ICT	$25,000	Active	Indirect
8. Transportation	**Period**	**Responsible Party**	**Cost Estimate**	**Status**	**P Reduction**
8.1 Improve transportation planning	2010-2012	City/County	$2,000	Active	None
8.2 Reduce vehicle mile trips in watershed	2010-2014	City/County	$5,000	Active	None
9. Recreation	**Period**	**Responsible Party**	**Cost Estimate**	**Status**	**P Reduction**
9.1 Prevent aquatic invasive species infestations	2010-2014	ICT	$14,000	Active	None
9.2 Design recreational opportunities to protect water quality	2010-2014	ICT	$13,000	Active	Indirect
10. Utilities & Waste Management	**Period**	**Responsible Party**	**Cost Estimate**	**Status**	**P Reduction**
10.1 Continue OSS contract with County Health Department	2010-2011	City	$195,040	Active	Indirect
10.2 Promote water conservation	2010-2014	City	$1.43 million	Active	None
10.3 Protect lake from wastewater pollution	2010-2014	District	$4.08 million	Active	Direct/Indirect
11. Administration	**Period**	**Responsible Party**	**Cost Estimate**	**Status**	**P Reduction**
11.1 Staff the ICT, Management Committee, and Joint Council meetings	2010-2014	ICT	$185,000	Active	None
11.2 Establish funding needs and strategy	2010-2014	ICT	$45,000	Active	None
11.3 Coordinate Program Area committees	2010-2014	ICT	$15,000	Active	None
11.4 Maintain contact with regulatory agencies	2010-2014	ICT	$15,000	Active	None
11.5 Oversee contracts and work	2010-2014	ICT	$47,000	Active	None

products					
11.6 Integrate Lake Whatcom Management Program goals into Comp Plans	2010-2011	City/County	$2,000	Hold	None
12. Enforcement	**Period**	**Responsible Party**	**Cost Estimate**	**Status**	**P Reduction**
12.1 Improve enforcement capabilities	2010-2014	ICT/City/County/SVCA/District	$265,000	Active	Indirect
12.2 Improve reporting of enforcement actions	2010-2014	City/County/SVCA	$80,000	Active	Indirect
Silver Beach Creek Pilot	**Period**	**Responsible Party**	**Cost Estimate**	**Status**	**P Reduction**
2.1 Identify and prioritize stormwater projects utilizing models	2010-2014	City/County	$490,000*	Active	Indirect
2.2 Improve phosphorus removal in stormwater facilities	2010-2011	City/County	$580,000	Active/Hold	Direct
4.2 Educate and engage watershed residents and visitors	2010-2014	Education Team	$150,000	Active/Hold	Indirect
4.3 Reduce pollution from animal waste	2010-2014	City	$25,200	Active/Hold	Direct
4.4 Reduce pollution from vehicle washing and maintenance	2010-2014	City	$18,400	Active/Hold	Indirect
4.5 Reduce pollution associated with landscape practices	2010-2014	WSU Extension	$15,900	Active/Hold	Direct/Indirect

Program Area: 1. Land Preservation

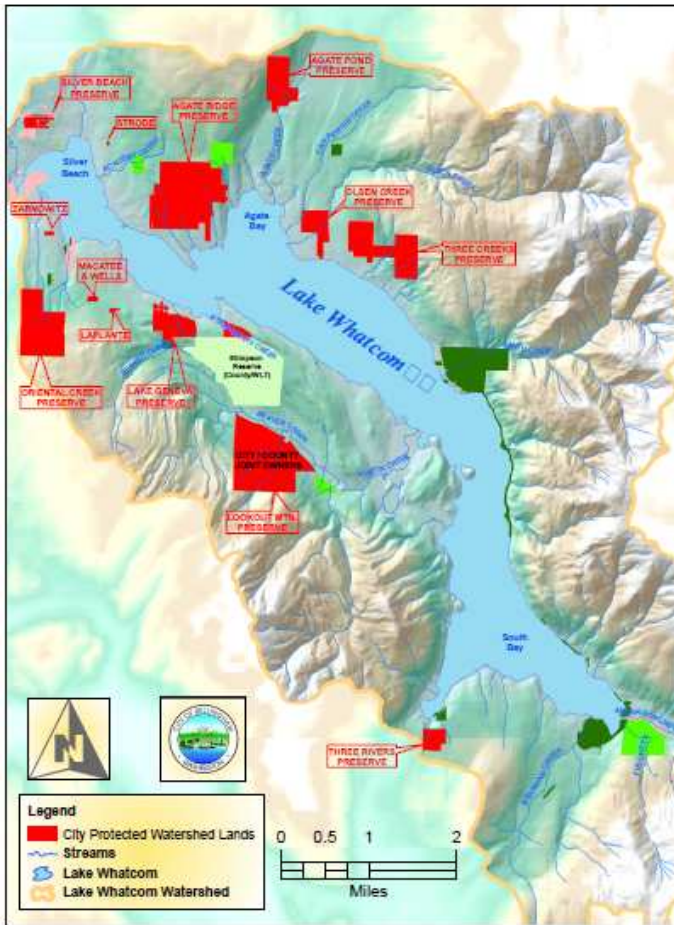
Goal:

Pursue public ownership and protection of the watershed whenever possible through public/private partnerships, tax exemptions, transfer of development rights, land trusts, and other means.

Land preservation strategies help preserve or rehabilitate natural areas for the benefit of protecting water quality. The Land Preservation Program Area aims to reduce water quality impacts to Lake Whatcom by preserving land within the watershed that might otherwise be made available for development. Land preservation strategies that have been used in the Lake Whatcom watershed include: acquisition, conservation easements, transfer of development rights, purchase of development rights, lot consolidation, and other incentive programs.

Notable Accomplishments:

To date, the City has purchased approximately 1,312.88 acres of land at a cost of $20.5 million dollars. The City has also protected an additional 164 acres of land through conservation easements or restrictive covenants (both of which serve to restrict development). Total acreage protected now stands at 1,476 acres or 704 development units.



Reference Documents:

Goals and policy of the Land Preservation Program Area can be viewed at:
http://www.lakewhatcom.whatcomcounty.org/UserFiles/File/allWatershed Ownership.pdf

Program Area: 1. Land Preservation
Task: 1.1 Acquire easements or titles to watershed properties

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 – 2014	City/County	$14.16 million	Active	Indirect

Task Objective: Reduce the potential number of development units in the watershed through the acquisition of easements or titles to watershed properties

Actions:

- Purchase property to reduce development and improve natural functions of property
- Finalize reconveyance of over 8000 acres from DNR to Whatcom County by 2013

Intended Lake Benefits: Phosphorus Reduction ☒ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☒

If other, please describe: Reduction in potential development will reduce other pollutants associated with urbanized land use.

Performance Measures: Annual report to include:

1) Reduction of development potential (# of units)
2) Acres purchased
3) Property locations

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.5 ($50,000)	$1 million	$2 million	$3.05 million
	County	0.25 ($25,000)	$150,000		$175,000
	District/Other				
2011	City	0.5 ($50,000)	$700,000	$2 million	$2.75 million
	County	0.25 ($25,000)	$150,000		$175,000
	District/Other				
2012	City	0.5 ($50,000)	$350,000	$1.87 million	$2.27 million
	County	0.25 ($25,000)	$50,000		$75,000
	District/Other				
2013	City	0.5 ($50,000)	$250,000	$1.89 million	$2.19 million
	County	0.25 ($25,000)	$1.2 million		$1.225 million
	District/Other				
2014	City	0.5 ($50,000)	$220,000	$1.9 million	$2.17 million
	County	0.25 ($25,000)	$50,000		$75,000
	District/Other				
Total		**3.75 ($375,000)**	**$4.12 million**	**$9.66 million**	**$14.16 million**

Program Area: 1. Land Preservation
Task: 1.2 Create Conservation Easements for Preserves

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	City	$110,000	Active	Indirect

Task Objective: Create Conservation Easements (CEs) for Preserves

Actions:

- Negotiate Conservation Easements either creating new or adding to existing Preserves

Intended Lake Benefits: Phosphorus Reduction ☒ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☒

If other, please describe: Reduction in potential development will reduce other pollutants associated with urbanized land use.

Performance Measures: Annual report to include: Summary of acres included in Preserves

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.02 ($2,000)		$20,000	$22,000
	County				
	District/Other				
2011	City	0.02 ($2,000)		$20,000	$22,000
	County				
	District/Other				
2012	City	0.02 ($2,000)		$20,000	$22,000
	County				
	District/Other				
2013	City	0.02 ($2,000)		$20,000	$22,000
	County				
	District/Other				
2014	City	0.02 ($2,000)		$20,000	$22,000
	County				
	District/Other				
Total		**0.1 ($10,000)**		**$100,000**	**$110,000**

Program Area: 1. Land Preservation
Task: 1.3 Manage Acquisition Program properties

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	City/County	$2.77 million	Active	Direct

Task Objective: Protect the watershed by managing Acquisition Program properties

Actions:

- Inventory and create management plans for new acquisitions
- Implement management plans for all properties
- Conduct periodic inspections, invasives control, planting, trail construction, encroachment response and other tasks as needed

Intended Lake Benefits: Phosphorus Reduction ☒ Fecal Coliform Reduction ☐ Sediment Reduction ☒ Other ☐

If other, please describe:

Performance Measures: Annual report to include:

1) Inventories and property management plans for all new properties
2) Annual summary of inspections and projects completed including: percentage of properties inspected, acres of uplands restored, linear feet of stream or shoreline restored, percentage of completed encroachment responses, special projects.

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	1.0 ($100,000)		$30,000	$130,000
	County	1.0 ($100,000)	$225,000	$50,000	$375,000
	District/Other				
2011	City	1.0 ($100,000)		$35,000	$135,000
	County	1.0 ($100,000)	$75,000	$55,000	$230,000
	District/Other				
2012	City	1.0 ($100,000)		$40,000	$140,000
	County	1.0 ($100,000)		$55,000	$155,000
	District/Other				
2013	City	1.0 ($100,000)		$45,000	$145,000
	County	3.0 ($300,000)	$150,000	$205,000	$655,000
	District/Other				
2014	City	1.0 ($100,000)		$50,000	$150,000
	County	3.0 ($300,000)	$150,000	$205,000	$655,000
	District/Other				
Total		**14.0 ($1.4 million)**	**$600,000**	**$770,000**	**$2.77 million**

Program Area: 2. Stormwater Management

Goal:

Prevent water quality and quantity impacts due to stormwater runoff by implementation of best management standards and practices, pollutant source control, and construction, maintenance and retrofit of stormwater facilities.

The Stormwater Management Program Area aims to prevent water quality and quantity impacts associated with stormwater runoff. This program area focuses on the implementation of options for stormwater control including best management practices and standards, capital projects, pollutant source control and treatment, and the evaluation of stormwater control options that can be applied to both existing and new development in the watershed.

Notable Accomplishments:

For almost 20 years, the City and County have been engaged in protecting the lake through stormwater management efforts. During that time, the City's Stormwater Code has been revised four times to reflect new information on the water quality of the Lake (1990, 1995, 2006, 2009) and the County adopted three major changes to its code to add protections for Lake Whatcom and other sensitive watersheds (1994, 1999, 2002). Over the years, the City and County have continued to increase their investments in capital projects designed to slow the amount of phosphorus entering the lake.

In 2010, the City plans to complete the last of a series of capital projects to provide a first line of defense to the Lake from major stormwater inputs from City public stormwater systems. Due to differences in the treatment effectiveness of previously completed projects, the City will also concentrate on making previously completed stormwater systems more efficient at removing phosphorus and will assist private property owners to take actions to reduce water quality impacts originating on their properties.

Over the next few years, the County has plans to complete several capital improvement projects to reduce water quality impacts associated with stormwater runoff. The County will also work to provide resources and information to private property owners to help them minimize water quality impacts from their properties. Both the City and County have submitted grant proposals that could significantly increase these activities if approved.

Reference Documents:

City of Bellingham 2007 Comprehensive Stormwater Plan
http://www.cob.org/documents/pw/storm/2007-stormwater-comp-plan.pdf

City 1990 Watershed Stormwater Ordinance 10023
City 1995 Stormwater Ordinance 10633
City 2006 Ordinance 2006-05-047 (Amendment to BMC 15, 16, 15.40, 15.42)
City 2009 Ordinance 2009-06-041 (Amendment to BMC 15.42 Stormwater Code)

Whatcom County 2008 Lake Whatcom Comprehensive Stormwater Plan (LWCSWMP)
http://www.whatcomcounty.us/publicworks/water/compstormwaterplan.jsp

County 1994 Stormwater Conformance Ordinance 94-022
County 1999 Water Resource Protection Overlay District Ordinance 99-086
County 2002 Stormwater Special Districts Ordinance 2002-034

Program Area: 2. Stormwater Management
Task: 2.1 Identify and prioritize stormwater projects utilizing models

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	City/County	$490,000*	Active	Indirect

Task Objective: Prioritize nutrient reduction projects in the watershed using sub-watershed scale pollutant loading models

Actions:

- Define criteria for prioritization of stormwater projects
- Use pollutant loading models to identify priority stormwater projects in the sub-basins of the watershed
- Identify suitable sites for stormwater retrofits
- Inspect and evaluate all seven stormwater treatment facilities in the upper SBC watershed and prepare pre-design reports for retrofitting

Intended Lake Benefits: Phosphorus Reduction ☒ Fecal Coliform Reduction ☒ Sediment Reduction ☒ Other ☒

If other, please describe: Remove pollutants e.g. oil, grease and metals

Performance Measures: Annual report to include:

1) Criteria for prioritization of projects
2) Prioritized list of stormwater projects in the watershed, updated annually
3) Prioritized list of suitable sites for stormwater retrofits including options, costs, and timelines for projects
4) Formalized plan to retrofit existing facilities and other suitable sites

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.1 ($10,000)		$100,000	$110,000
	County	0.1 ($10,000)		$115,000	$125,000
	District/Other				
2011	City	0.1 ($10,000)		$100,000	$110,000
	County	0.1 ($10,000)		$75,000	$85,000
	District/Other				
2012	City	0.1 ($10,000)			$10,000
	County	0.1 ($10,000)			$10,000
	District/Other				
2013	City	0.1 ($10,000)			$10,000
	County	0.1 ($10,000)			$10,000
	District/Other				
2014	City	0.1 ($10,000)			$10,000
	County	0.1 ($10,000)			$10,000
	District/Other				
Total		**1.0 ($100,000)**		**$390,000***	**$490,000***

Program Area: 2. Stormwater Management
Task: 2.2 Improve phosphorus removal in stormwater facilities

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 – 2011	City/County	$580,000	Active/Hold*	Direct

Task Objective: Improve phosphorus removal in stormwater facilities

Actions:

- City and County will assess stormwater facilities
- City will conduct full scale testing for Imbrium Systems phosphorus removal media (2010)
- County will conduct testing for PhosphoSorb phosphorus removal media (2010)
- County will retrofit private stormwater ponds in Silver Beach Creek Watershed (2010-2011)
- City will reconstruct Barkley/Britton wet pond to a rock/plant filter design (similar to site at WWU)

Intended Lake Benefits: Phosphorus Reduction ☒ Fecal Coliform Reduction ☒ Sediment Reduction ☒ Other ☒

If other, please describe: Remove pollutants e.g. oil, grease and metals

Performance Measures: Annual report to include:

1) Number of stormwater facilities assessed, actions taken, percent treatment improvement for phosphorus, reductions in phosphorus, fecal coliform, flow velocity, TSS, and turbidity.
2) Summary of phosphorus removal efficiency of Imbrium and PhosphoSorb media
3) Summary of Barkley/Britton wet pond project

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.1 ($10,000)	$170,000		$180,000
	County	0.2 ($20,000)	$125,000	$10,000	$155,000
	District/Other				
2011	City	0.1 ($10,000)	$100,000		$110,000
	County	0.1 ($10,000)	$125,000		$135,000
	District/Other				
Total		**0.5 ($50,000)**	**$520,000**	**$10,000**	**$580,000**

Program Area: 2. Stormwater Management
Task: 2.3 Implement comprehensive stormwater plans

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	City/County	$ 2.74 million	Active/Hold*	Direct

Task Objective: Implement existing comprehensive stormwater plans for phosphorus control

Actions:

Public Property Actions:

- Pilot projects to reduce phosphorus using bio-infiltration in public rights of ways
- Institute a tree/vegetation project on streets in watershed to increase vegetated cover
- Schedule reconfiguration of roadside ditches & regular maintenance
- County will construct projects in the Silver Beach Creek watershed to reduce erosion
- County will complete construction of Lahti Drive/Britton Road Bioswale

Private Property Actions:

- Prioritize infiltration project techniques and locations based on the outcome of soil studies
- Pilot infiltration projects providing technical assistance and financial incentives to property owners
- Establish design standards for types of infiltration techniques and a homeowner's handbook with descriptions and illustrations for each

Intended Lake Benefits: Phosphorus Reduction ☒ Fecal Coliform Reduction ☒ Sediment Reduction ☒ Other ☐

If other, please describe:

Performance Measures: Annual report to include:

1) Summary (cost, location, site conditions, project type, area treated and monitoring plan) for all public and private infiltration and treatment projects
2) Homeowner's Handbook of design standards and infiltration techniques

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.2 ($20,000)	$175,000		$195,000
	County	0.4 ($40,000)	$750,000		$790,000
	District/Other				
2011	City	0.4 ($40,000)	$100,000		$140,000
	County	0.4 ($40,000)	$600,000		$640,000
	District/Other				
2012	City	0.4 ($40,000)	$100,000		$140,000
	County	undetermined*	$300,000		$300,000
	District/Other				
2013	City	0.4 ($40,000)	$100,000		$140,000
	County	undetermined*	$300,000		$300,000
	District/Other				
2014	City	0.4 ($40,000)	$50,000		$90,000
	County	undetermined*	undetermined*		
	District/Other				
Total		**2.6 ($260,000)**	**$2.48 million**		**$2.74million**

Program Area: 2. Stormwater Management
Task: 2.4 Conduct Inspections and Assessments

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	City/County/SVCA	$1.1 million	Active	Indirect

Task Objective: Conduct daily stormwater inspections of active development projects and conduct regular site assessments throughout the watershed

Actions:

- County will continue year-round daily inspections of development projects in the watershed
- City will provide daily inspections during construction window and twice weekly inspections outside of window
- City and County will conduct routine surveillance for non-permitted actions in watershed in coordination with Lake Whatcom permit inspection program
- Sudden Valley will continue to require and inspect on-site infiltration systems and conduct regular erosion control inspections for new construction projects and additions
- Sudden Valley will continue to conduct on-site assessments and provide education for property modifications

Intended Lake Benefits: Phosphorus Reduction ☒ Fecal Coliform Reduction ☐ Sediment Reduction ☒ Other ☐

If other, please describe:

Performance Measures: Annual report to include:
1) Number of permit/non-permit related inspections conducted
2) Number of corrections notices and corrections made

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	1.0 ($100,000)			$100,000
	County	1.0 ($100,000)			$100,000
	District/Other	0.2 (SVCA) ($20,000)			$20,000
2011	City	1.0 ($100,000)			$100,000
	County	1.0 ($100,000)			$100,000
	District/Other	0.2 (SVCA) ($20,000)			$20,000
2012	City	1.0 ($100,000)			$100,000
	County	1.0 ($100,000)			$100,000
	District/Other	0.2 (SVCA) ($20,000)			$20,000
2013	City	1.0 ($100,000)			$100,000
	County	1.0 ($100,000)			$100,000
	District/Other	0.2 (SVCA) ($20,000)			$20,000
2014	City	1.0 ($100,000)			$100,000
	County	1.0 ($100,000)			$100,000
	District/Other	0.2 (SVCA) ($20,000)			$20,000
Total		**11.0 ($1.1 million)**			**$1.1 million**

Program Area: 2. Stormwater Management
Task: 2.5 Coordinate NPDES Phase II Implementation

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	City/County	$ 500,000	Active	Indirect

Task Objective: Coordination and implementation of NPDES Phase II stormwater requirements will demonstrate the ability to positively influence water quality to conform with TMDL and NPDES permit requirements

Actions:

- Share resources for the *Silver Beach Creek Pilot Project* (SBCP)
- Adopt required resolutions and ordinances as needed
- Continue to coordinate NPDES required programs: Illicit Discharge Detection, Construction Site Controls, Permanent Water Quality Facilities, Public Outreach, and Public Education
- Perform required public outreach activities and train staff for required duties to meet requirements

Intended Lake Benefits: Phosphorus Reduction ☒ Fecal Coliform Reduction ☒ Sediment Reduction ☒ Other ☒

If other, please describe: Remove pollutants e.g. oil, grease and metals

Performance Measures: Annual report to include:

1) Number of times and amount of resources shared
2) Regulations and ordinances adopted out of number needed
3) Dates and outcomes of NPDES program coordination efforts
4) Date, number of participants and purpose of public outreach events
5) Date, number of participants and purpose of training events
6) Number of permit requirements that are in compliance

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.5 ($50,000)			$50,000
	County	0.5 ($50,000)			$50,000
	District/Other				
2011	City	0.5 ($50,000)			$50,000
	County	0.5 ($50,000)			$50,000
	District/Other				
2012	City	0.5 ($50,000)			$50,000
	County	0.5 ($50,000)			$50,000
	District/Other				
2013	City	0.5 ($50,000)			$50,000
	County	0.5 ($50,000)			$50,000
	District/Other				
2014	City	0.5 ($50,000)			$50,000
	County	0.5 ($50,000)			$50,000
	District/Other				
Total		**5.0 ($500,000)**			**$500,000**

Program Area: 2. Stormwater Management
Task: 2.6 Restore Stream Riparian Areas

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	City/County	$70,000	Active	Direct

Task Objective: Stabilize and re-vegetate stream riparian areas to decrease sedimentation sources from eroding stream banks and poorly vegetated stream areas. Include instream features when appropriate.

Actions:

- Identify suitable sites for restoration of privately owned stream segments
- Contract with property owners to place projects on their properties

Intended Lake Benefits: Phosphorus Reduction ☒ Fecal Coliform Reduction ☒ Sediment Reduction ☒ Other ☒

If other, please describe: Remove pollutants e.g. oil, grease and metals

Performance Measures: Annual report to include:

1) Number of contracts for private property projects
2) Summary of upland acres restored
3) Linear feet of riparian restoration
4) Number and type of instream projects

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.1 ($10,000)			$10,000
	County	0.1 ($10,000)			$10,000
	District/Other				
2011	City	0.1 ($10,000)			$10,000
	County	0.1 ($10,000)			$10,000
	District/Other				
2012	City				
	County	0.1 ($10,000)			$10,000
	District/Other				
2013	City				
	County	0.1 ($10,000)			$10,000
	District/Other				
2014	City				
	County	0.1 ($10,000)			$10,000
	District/Other				
Total		**0.7 ($70,000)**			**$70,000**

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Program Area: 3. Urbanization & Land Development

Goal:

Prevent water quality degradation associated with urban development through zoning changes, development standards and density limits.

The Urbanization and Land Development Program Area aims to reduce water quality impacts resulting from residential and land use development activities. As areas are developed, land cover is often converted into less pervious surfaces that result in increased stormwater runoff going into the lake. The focus of this program area is to identify and adopt code changes that will result in reduced water quality impacts from residential uses. Another focus of this program area has been the improvement of data sharing between jurisdictions and the joint review of significant projects.

Notable Accomplishments:

In July 2009 the City adopted an amendment to the Lake Whatcom Reservoir Regulatory Chapter and Stormwater Regulations, making significant changes to the regulations for development and redevelopment, with a focus on eliminating phosphorus runoff. Methods to eliminate phosphorus include stormwater engineering, restoring and preserving forested conditions, or a combination of both of these methods.

In 2009, the City and County established a protocol for mutual review of proposals in the Lake Whatcom watershed that trigger a SEPA determination. This not only informs the jurisdictions of potential impacts to the watershed, but also allows for input on mitigation measures.

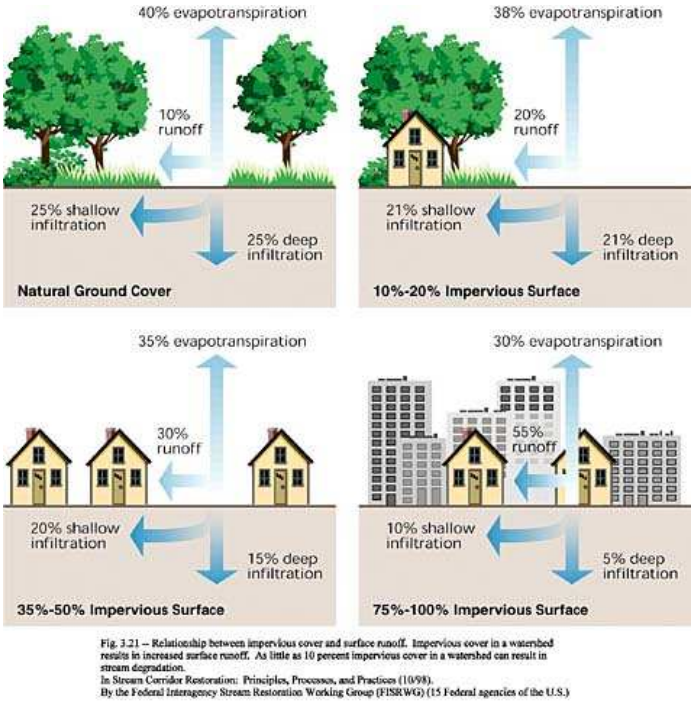

Fig. 3.21 – Relationship between impervious cover and surface runoff. Impervious cover in a watershed results in increased surface runoff. As little as 10 percent impervious cover in a watershed can result in stream degradation.
In Stream Corridor Restoration: Principles, Processes, and Practices (10/98).
By the Federal Interagency Stream Restoration Working Group (FISRWG) (15 Federal agencies of the U.S.)

In 2009, the County modified the dates of the seasonal restrictions on clearing activities, and the parameters regarding the date of development permit issuance within the regulated watersheds. The amended dates provide greater protection from soil erosion due to the reduction of antecedent soil moisture content during the construction season. Soil disturbance is regulated to no more than 500 square feet from October 1st through May 31st. Development permits are only issued up to two weeks prior to the seasonal closure to allow sufficient and reasonable time for applicants to complete permitted land disturbance activities within the months of June through September.

Reference Documents:

Bellingham Municipal Code (BMC) 16.80 (Lake Whatcom Reservoir Regulatory Chapter), 15.42 (Stormwater Regulations), 16.55 (Critical Areas Ordinance), Title 22 (Shoreline Master Program)

Whatcom County Code (WCC) 20.80.735, 16.16 (Critical Areas Ordinance), Title 23 (Shoreline Management Program)

Program Area: 3. Urbanization & Land Development
Task: 3.1 Maintain and improve permit tracking system

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	City/County/District	$26,000	Active/Hold*	Indirect

Task Objective: Improve the system for tracking building and development activities in the watershed and make accessible to City, County, and District

Actions:

- Continue using Tidemark in the City and County to track permits and other activities in the watershed and share data between jurisdictions
- Develop data summaries in response to identified reporting needs
- Enhance the capability to track progress achieved by phosphorus limiting facilities and practices on private and public properties
- Convene a Development Tracking Team as necessary

Intended Lake Benefits: Phosphorus Reduction ☐ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☒

If other, please describe: Track activities to identify trends that can be addressed through new policies or regulations

Performance Measures: Annual report to include:

1) Evaluation of progress limiting phosphorus due to facilities and practices on private and public properties
2) Current permit and development data from both jurisdictions updated monthly (for staff access and use)
3) Data summaries
4) Examples of standardized reporting on permits and activities for each jurisdiction
5) Outcomes of Development Tracking Team meetings

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.02 ($2,000)			$2,000
	County	0.1 ($10,000)			$10,000
	District/Other	0.01 ($1,000)			$1,000
2011	City	0.02 ($2,000)			$2,000
	County	0.1 ($10,000)			$10,000
	District/Other	0.01 ($1,000)			$1,000
2012	City	undetermined*			
	County	undetermined*			
	District/Other	undetermined*			
2013	City	undetermined*			
	County	undetermined*			
	District/Other	undetermined*			
2014	City	undetermined*			
	County	undetermined*			
	District/Other	undetermined*			
Total		**0.26 ($26,000)**			**$26,000**

Program Area: 3. Urbanization & Land Development
Task: 3.2 Maintain joint development review process

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 – 2014	City/County	$4,000	Active/Hold*	Indirect

Task Objective: Maintain the City/County joint development review process

Actions:

- Continue notification and joint review of development applications in the UGA portion of the watershed
- Continue notification between City and County of projects triggering SEPA
- Re-evaluate joint development review process as necessary

Intended Lake Benefits: Phosphorus Reduction ☐ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☒

If other, please describe: Coordinated review efforts result in improved outcomes for lake water quality

Performance Measures: Annual report to include:
1) Records of joint SEPA review
2) Summary of projected impact of each SEPA determination on Lake Whatcom TMDL targets

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other				
2011	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other				
2012	City	undetermined*			
	County	undetermined*			
	District/Other				
2013	City	undetermined*			
	County	undetermined*			
	District/Other				
2014	City	undetermined*			
	County	undetermined*			
	District/Other				
Total		**0.04 ($4,000)**			**$4,000**

Program Area: 3. Urbanization & Land Development
Task: 3.3 Continue to assess the effectiveness of regulations

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	City/County/SVCA	$45,000	Active/Hold*	Indirect

Task Objective: Continue to assess the effectiveness of regulations

Actions:

- County will expand its Low Impact Development Program through code amendments, permit process modifications, a technical assistance manual, and public education and outreach to accomplish TMDL and Phase II requirements (2010)
- City will revisit the 2009 code changes to the Lake Whatcom Reservoir Regulatory Chapter before Council and modify accordingly (2010)
- City will review the Silver Beach Neighborhood Plan (SBNP) (2010)
- Each jurisdiction will be updated on any proposed changes to regulations and BMPs
- Sudden Valley will modify portions of its existing guidelines to address problematic regulations and find areas where consistent regulations with other agencies can be adopted

Intended Lake Benefits: Phosphorus Reduction ☒ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☐

If other, please describe:

Performance Measures: Annual report to include:

1) Number of acres in Native Vegetation Protection Area (NVPA - forested) in City
2) Number of properties with engineered stormwater facilities in City and County
3) Summary of effectiveness of regulations at minimizing phosphorus runoff LID Program
4) Actions taken to accomplish TMDL and Phase II requirements (2010)
5) Modifications to Lake Whatcom Reservoir Regulatory Chapter 2009 code changes
6) SBNP recommendations presented to the Neighborhood Association and City Council
7) Interjurisdictional updates on proposed changes to regulations

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.05 ($5,000)			$5,000
	County	0.05 ($5,000)			$5,000
	District/Other	0.05 (SVCA) ($5,000)			$5,000
2011	City	0.05 ($5,000)			$5,000
	County	0.05 ($5,000)			$5,000
	District/Other	0.05 (SVCA) ($5,000)			$5,000
2012	City	undetermined*			
	County	undetermined*			
	District/Other	0.05 (SVCA) ($5,000)			$5,000
2013	City	undetermined*			
	County	undetermined*			
	District/Other	0.05 (SVCA) ($5,000)			$5,000
2014	City	undetermined*			
	County	undetermined*			
	District/Other	0.05 (SVCA) ($5,000)			$5,000
Total		**0.45 ($45,000)**			**$45,000**

Program Area: 4. Community Outreach

Goal:

Increase lake stewardship and reduce urban impacts through the provision of educational programs and materials to watershed residents, the general public and decision makers on topics related to water quality, source control, and land use and development regulations.

The Community Outreach Program Area aims to protect water quality by encouraging watershed residents and visitors to become stewards of the lake. The focus of this program is to provide stewardship tools that each individual can use to help protect Lake Whatcom. These tools range from lake-friendly gardening practices to picking up pet waste and encouraging people to engage in lake-friendly car washing and maintenance practices.

Notable Accomplishments:

In 2008, the Lake Whatcom Education Team, comprising staff from the City, County, Sudden Valley Community Association, and WSU Cooperative Extension, was re-established to coordinate and implement community outreach and education programs as part of the Lake Whatcom Management Program.

In 2009, the Lake Whatcom Education Team initiated work on the *Silver Beach Creek Pilot Project* (SBCP). Residents of the Silver Beach Creek watershed were engaged in mail and telephone surveys, focus groups, and community meetings. Results from these activities provided information on existing behaviors, attitudes, barriers, and possible incentives to be used to further develop the SBCP outreach/education program in coordination with members from the community.

For the past few years, the City has engaged in a very successful dog waste disposal campaign using education materials and incentives to encourage pet owners to pick up after their pets and engage in watershed-friendly pet waste disposal practices.

In 2009, WSU Extension conducted two successful pilot Sustainable Landscaping classes in the watershed. Participants in the class received training on a variety of watershed-friendly practices that can be implemented on their properties. In exchange for the free training, participants all implemented on-the-ground changes to improve water quality on their properties and provided various types of outreach to the broader community on water-friendly gardening.

Reference Documents:

Lake Whatcom Management Program
http://www.lakewhatcom.whatcomcounty.org/

City of Bellingham Lake Whatcom website
http://www.cob.org/services/environment/water-quality/lake-whatcom.aspx

Puget Sound Partnership Eco Net
http://www.psp.wa.gov/econet.php

Watershed Friendly Gardening website
http://www.lakewhatcom.whatcomcounty.org/asub_fldrs/gardenkit/INDEX.HTML

Program Area: 4. Community Outreach
Task: 4.1 Improve outreach and participation strategies through staff collaboration

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	Education Team	$30,000	Active	None

Task Objective: Improve lake stewardship by coordinating staff to deliver accurate and cohesive regional messaging, while increasing participation effectiveness through the sharing of information and resources

Actions:

- Coordinate with all partners on new programs to be implemented
- Share information and expertise about existing and new education programs
- Reduce conflicting program messaging to enhance outreach effectiveness
- Serve as a link to larger regional education efforts and resources
- Coordinate and implement education and outreach needs for all Program Areas with related staff and provide resources and materials as needed

Intended Lake Benefits: Phosphorus Reduction ☒ Fecal Coliform Reduction ☒ Sediment Reduction ☒ Other ☒

If other, please describe: Indirect pollution reduction through an improvement in program implementation, leading to more effective behavior change

Performance Measures: Annual report to include:

1) Activities/programs created or modified
2) Qualitative assessment of Program Area coordination efforts

Cost Estimates:

Year	Party	FTEs ($)	Other	Total
2010	City	0.02 ($2,000)		$2,000
	County	0.02 ($2,000)		$2,000
	SVCA/WSU	0.02 ($2,000)		$2,000
2011	City	0.02 ($2,000)		$2,000
	County	0.02 ($2,000)		$2,000
	SVCA/WSU	0.02 ($2,000)		$2,000
2012	City	0.02 ($2,000)		$2,000
	County	0.02 ($2,000)		$2,000
	SVCA/WSU	0.02 ($2,000)		$2,000
2013	City	0.02 ($2,000)		$2,000
	County	0.02 ($2,000)		$2,000
	SVCA/WSU	0.02 ($2,000)		$2,000
2014	City	0.02 ($2,000)		$2,000
	County	0.02 ($2,000)		$2,000
	SVCA/WSU	0.02 ($2,000)		$2,000
Total		**0.3 ($30,000)**		**$30,000**

Program Area: 4. Community Outreach
Task: 4.2 Educate and engage watershed residents and visitors

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	Education Team	$150,000	Active/Hold	Indirect

Task Objective: Improve lake stewardship by educating and engaging watershed residents and visitors

Actions:

- Maintain and improve Lake Whatcom Management Program website
- Provide opportunities for community engagement in program development
- Develop and disseminate quarterly e-newsletter with key messages about lake protection
- Produce and distribute Welcome Packet for new watershed residents
- Update informational signage throughout the watershed
- Identify effective ways to inform and engage watershed visitors
- Review and select applicable programs and materials from the Puget Sound Partnership Eco Net
- Participate in interjurisdictional community events
- Coordinate with local organizations to create appropriate public outreach materials

Intended Lake Benefits: Phosphorus Reduction ☒ Fecal Coliform Reduction ☒ Sediment Reduction ☒ Other ☒

If other, please describe: Improved lake stewardship by watershed residents and visitors

Performance Measures: 1) Timely and accurate information posted on Lake Whatcom Management website
2) Annual report to include:
Number of subscribers to e-newsletter, responses to surveys, focus group participants, participants in interjurisdictional community events, number of citizens involved in stewardship programs, type and number of education materials produced and disseminated.

Cost Estimates:

Year	Party	FTEs ($)	Other	Total
2010	City	0.1 ($10,000)		$10,000
	County	0.1 ($10,000)		$10,000
	SVCA/WSU	0.05 ($5,000)/ 0.05 ($5,000)		$10,000
2011	City	0.1 ($10,000)		$10,000
	County	0.1 ($10,000)		$10,000
	SVCA/WSU	0.05 ($5,000)/ 0.05 ($5,000)		$10,000
2012	City	0.1 ($10,000)		$10,000
	County	0.1 ($10,000)		$10,000
	SVCA/WSU	0.05 ($5,000)/ 0.05 ($5,000)		$10,000
2013	City	0.1 ($10,000)		$10,000
	County	0.1 ($10,000)		$10,000
	SVCA/WSU	0.05 ($5,000)/ 0.05 ($5,000)		$10,000
2014	City	0.1 ($10,000)		$10,000
	County	0.1 ($10,000)		$10,000
	SVCA/WSU	0.05 ($5,000)/ 0.05 ($5,000)		$10,000
Total		**1.5 ($150,000)**		**$150,000**

Program Area: 4. Community Outreach
Task: 4.3 Reduce pollution from animal waste

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	City/County/District	$30,200	Active/Hold	Direct

Task Objective: Reduce pollution resulting from improper disposal of animal waste in the watershed with particular emphasis on proper disposal of dog waste

Actions:

- Install additional dog waste bag dispensers in the Silver Beach Creek Watershed area to provide tools for proper handling of dog waste. Stations maintained by City staff and volunteer residents. Site selection will be determined by the results of water quality testing and resident support.
- Encourage proper pet waste disposal and reward behavior changes by offering incentives to dog owners
- Update information and resources for dog owners on the Lake Whatcom website
- Make video presentations available for interested residents
- Create and distribute informational packets to licensed dog owners (when renewing or new)
- Evaluate Bloedel-Donovan's off-leash dog program
- Explore options to reduce waste from waterfowl and hobby farms

Intended Lake Benefits: Phosphorus Reduction ☒ Fecal Coliform Reduction ☒ Sediment Reduction ☐ Other ☒

If other, please describe: Increased resident involvement in lake stewardship actions

Performance Measures: Annual report to include:

1) Number of packets distributed, videos watched, information updated, stations installed and maintained
2) Monitor lawns and public spaces for changes in the presence/absence of waste
3) Conduct survey of residents to gauge changes in waste disposal practices
4) Report on evaluation of off-leash program
5) Report on options to reduce waste from waterfowl and hobby farms

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.02 ($2,000)	$1,000	$3,200	$6,200
	County	0.01 ($1,000)		$1,200	$2,200
	District/Other	0.01 ($1,000)			$1,000
2011	City	0.02 ($2,000)			$2,000
	County	0.01 ($1,000)		$1,200	$2,200
	District/Other	0.01 ($1,000)			$1,000
2012	City	0.02 ($2,000)			$2,000
	County	0.01 ($1,000)		$1,200	$2,200
	District/Other	0.01 ($1,000)			$1,000
2013	City	0.02 ($2,000)			$2,000
	County	0.01 ($1,000)		$1,200	$2,200
	District/Other	0.01 ($1,000)			$1,000
2014	City	0.02 ($2,000)			$2,000
	County	0.01 ($1,000)		$1,200	$2,200
	District/Other	0.01 ($1,000)			$1,000
Total		**0.2 ($20,000)**	**$1,000**	**$9,200**	**$30,200**

Program Area: 4. Community Outreach
Task: 4.4 Reduce pollution from vehicle washing and maintenance practices

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	City	$18,400	Active/Hold	Indirect

Task Objective: Reduce the pollution from improper car washing and vehicle maintenance practices

Actions:

- Distribute 100 car wash coupons to residents who want to change their car washing habits
- Provide car washing workshop, in the watershed, to model pollution-reducing car washing and water conservation techniques
- Distribute video and follow up discussion questions to high school clubs, science classes and sports teams
- Publish spring newspaper advertisements for watershed friendly car washing and regulation reminder
- Update information and resources on the Lake Whatcom Management Program website
- Conduct survey to measure knowledge and behavior changes
- Explore opportunities for setting up a permanent vehicle washing station in watershed

Intended Lake Benefits: Phosphorus Reduction ☒ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☒

If other, please describe: Reduce toxins entering lake as a result of improper car washing and maintenance practices

Performance Measures: Annual report to include:

1) Number of coupons redeemed at car washing facilities
2) Number of people attending car washing workshops
3) Surveys to identify a reduction in at home car washes using improper car washing techniques, an increase in residents using environmentally preferable commercial car washes, and an increase in residential knowledge of proper car washing techniques
4) Results of effort to site a permanent vehicle washing station in the watershed

Cost Estimates:

Year	Party	FTEs ($)	Other	Total
2010	City	0.02 ($2,000)	$2,500	$4,500
	County	0.01 ($1,000)		$1,000
	District/Other		PSP Grant (2009) – Coupons purchased $900	$900
2011	City	0.02 ($2,000)		$2,000
	County	0.01 ($1,000)		$1,000
	District/Other			
2012	City	0.02 ($2,000)		$2,000
	County	0.01 ($1,000)		$1,000
	District/Other			
2013	City	0.02 ($2,000)		$2,000
	County	0.01 ($1,000)		$1,000
	District/Other			
2014	City	0.02 ($2,000)		$2,000
	County	0.01 ($1,000)		$1,000
	District/Other			
Total		**0.15 ($15,000)**	**$3,400**	**$18,400**

Program Area: 4. Community Outreach
Task: 4.5 Reduce pollution associated with landscape practices

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	WSU Extension	$15,900	Active/Hold*	Direct and Indirect

Task Objective: Increase community, elected officials, and managers' knowledge and use of sustainable landscape practices associated with runoff and phosphorus load reduction on properties.

Actions:

- Training: Expand existing and provide various training/education opportunities to residents, businesses and landscapers on sustainable landscape practices including follow-up and support to ensure on-ground changes (e.g. workshops, site visits).
- Demonstration Sites: Use various approaches to enable residents and businesses to see and share examples of sustainable practices (e.g. tours, demonstration sites, movable displays).
- Incentives/Resources: Encourage sustainable practices by promotion of existing and new incentives and resources to encourage use of sustainable practices.

Intended Lake Benefits: Phosphorus Reduction ☒ Fecal Coliform Reduction ☐ Sediment Reduction ☒ Other ☒

If other, please describe: Community- and environmental health-related benefits

Performance Measures: Annual report to include: 1) Results of all measures used to determine the success of the above actions**.** Measurement techniques will include: post event surveys, participant use of coupons and other incentives, attendance/participation in events, and observation. Not all measurement techniques will be used for all actions.
Criteria used to determine an action's success will include: 1) knowledge about how landscape practices can impact runoff and phosphorus loading to streams and Lake Whatcom and other benefits associated with sustainable landscape practices, 2) on-the-ground changes in landscape practices designed to reduce runoff and phosphorus loading to water bodies, and 3) awareness of and evaluation of the extent to which targeted programs have been implemented and possible changes that may increase program success.

Cost Estimates:

Year	Party	FTEs ($)	Other	Total
2010	City			
	County	0.01 ($1,000)		$1,000
	District/Other	0.05 ($5,000) (WSU Extension)	PSP Grant (2009) coupons $900	$5,900
2011	City			
	County	0.01 ($1,000)		$1,000
	District/Other	0.05 ($5,000) (WSU Extension)	undetermined*	$5,000
2012	City			
	County	0.01 ($1,000)		$1,000
	District/Other	undetermined*	undetermined*	
2013	City			
	County	0.01 ($1,000)		$1,000
	District/Other	undetermined*	undetermined*	
2014	City			
	County	0.01 ($1,000)		$1,000
	District/Other	undetermined*	undetermined*	
Total		**0.15 ($15,000)**	**$900**	**$15,900**

Program Area: 4. Community Outreach
Task: 4.6 Continue Residential Stormwater Retrofit Program

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2011	City/DOE	$338,471	Active	Direct

Task Objective: Decrease stormwater runoff from residential properties in the Lake Whatcom watershed by providing stormwater education and incentives to watershed residents as part of the Residential Stormwater Retrofit Program (RSRP)

Actions:

- Conduct stormwater education workshops for watershed residents as part of the Residential Stormwater Retrofit Program (RSRP)
- Eligible residents attending the workshops will qualify for free installation of 95-gallon rain barrels
- Create an informational video on program for advertising on BTV10 and at other events
- Update resources and information on stormwater incentives, codes, and regulations for residents

Intended Lake Benefits: Phosphorus Reduction ☒ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☒

If other, please describe: Water conservation

Performance Measures: Annual report to include:

1) Number of rain barrels installed on number of RSRP project area properties
2) Number of gallons of stormwater managed per year using rain barrels

Cost Estimates:

Year	Party	FTEs ($)	Other	Total
2010	City	1.15 ($115,000)	DOE Grant Funding $50,286	$165,286
	County		Grant dependent	
	District/Other			
2011	City	1.15 ($115,000)	DOE Grant Funding $58,185	$173,185
	County		Grant dependent	
	District/Other			
Total		**2.3 ($230,000)**	**$108,471**	**$338,471**

Program Area: 4. Community Outreach
Task: 4.7 Continue Water Conservation Outreach

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2011	City/District	$170,400	Active	None

Task Objective: Decrease city-wide water consumption through water conservation outreach program

Actions:

- Develop and implement water conservation education program
- Continue existing public outreach measures including: rain barrel program (workshops and general sales), voluntary metering program, water conservation kit distribution, video and public service announcements, and events.

Intended Lake Benefits: Phosphorus Reduction ☒ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☒

If other, please describe: Water conservation

Performance Measures: Annual report to include:
1) Number of rain barrels and water conservation kits distributed
2) Number of participants in voluntary metering program

Cost Estimates:

Year	Party	FTEs ($)	Other	Total
2010	City	0.62 ($62,000)	$19,700	$81,700
	County			
	District/Other	0.01 ($1,000)	$2,500	$3,500
2011	City	0.62 ($62,000)	$19,700	$81,700
	County			
	District/Other	0.01 ($1,000)	$2,500	$3,500
Total		**1.26 ($126,000)**	**$44,400**	**$170,400**

Program Area: 4. Community Outreach
Task: 4.8 Report Toxic Algal Blooms

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	Data & Educ. Teams	$15,000	Active	None

Task Objective: Alert the public to the presence of toxic algal blooms to avoid harm to recreational users

Actions: **As needed**

- Relay information from LWMP monitoring programs, water treatment plant staff or other sources to the general public regarding toxic algal blooms that are potential health hazards

Intended Lake Benefits: Phosphorus Reduction ☐ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☒

If other, please describe: Improved tracking and reporting of toxic algal blooms reduces harm to recreational users of the lake

Performance Measures: Annual report to include (as needed):
1) Timeliness of public information announcements
2) Number of algae related health incidents reported

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)			$1,000
2011	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)			$1,000
2012	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)			$1,000
2013	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)			$1,000
2014	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)			$1,000
Total		**0.15 ($15,000)**			**$15,000**

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Program Area: 5. Data Management & Information

Goal:

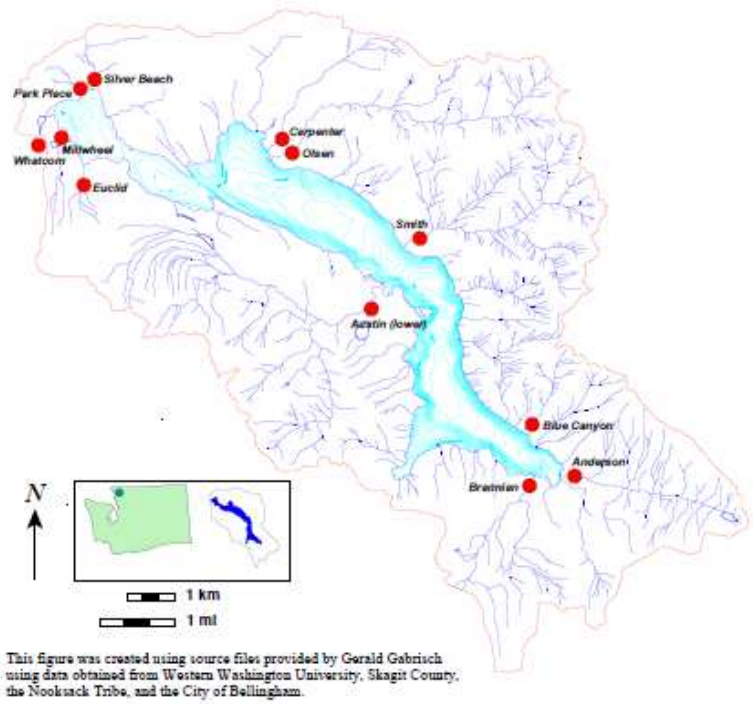
Maintain and enhance databases sufficient for detection of water quality and quantity trends, assessment of problems, evaluation and selection of management actions, and monitoring of action effectiveness.

The Data and Information Management Program Area aims to collect and manage data to increase our understanding of water quality, pollution source, and land use trends over time and to guide management decisions accordingly. This Program Area is administered by a Data Management Team composed of staff from the City, County, District, WWU's Institute for Watershed Studies, and the Department of Ecology.

Notable Accomplishments:

City and County staff worked together to compile and update the Lake Whatcom Data Catalog, an Access database containing over 290 titles, summaries, and document locations of Lake Whatcom related studies and reports.

In 2009, the first phase of the Lake Whatcom Tributary Monitoring Program was completed. Findings from the study, conducted by Brown and Caldwell, were evaluated by the Data Management Team who recommended that a second phase of monitoring at new and existing tributaries be conducted.



This figure was created using source files provided by Gerald Gabrisch using data obtained from Western Washington University, Skagit County, the Nooksack Tribe, and the City of Bellingham.

The Lake Whatcom Data Management Team continues to work closely with WWU's Institute for Watershed Studies to collect and manage Lake Whatcom monitoring data.

Reference Documents:

Lake Whatcom Data Catalog

Copies of the documents are available at the Whatcom County Public Works Water Resources Library and the Bellingham Public Library

Lake Whatcom Monitoring Reports

http://www.ac.wwu.edu/~iws/

Program Area: 5. Data Management & Information
Task: 5.1 Continue Lake Whatcom water quality monitoring

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	Data Team	$1.23 million*	Active/Hold*	Indirect

Task Objective: Continue long-term baseline water quality monitoring in Lake Whatcom and selected tributary streams

Actions:

- Contract with Institute for Watershed Studies
- Create annual monitoring report

Intended Lake Benefits: Phosphorus Reduction ☐ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☒

If other, please describe: Information/data used to improve water quality policies and management actions

Performance Measures: 1) Distribute monthly progress reports to Data Team
2) Annual monitoring reports

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City			$226,963	$226,963
	County				
	District/Other				
2011	City			$236,031	$236,031
	County				
	District/Other				
2012	City			$245,472	$245,472
	County				
	District/Other				
2013	City			$255,000*	$255,000*
	County				
	District/Other				
2014	City			$265,000*	$265,000*
	County				
	District/Other				
Total				**$1.23 million***	**$1.23 million***

Program Area: 5. Data Management & Information
Task: 5.2 Update tributary loading models

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	Data Team	$362,000	Active/Hold*	Indirect

Task Objective: Provide data and oversee tributary pollutant loading model updates

Actions:

- Refine the tributary monitoring project to more precisely determine phosphorus loading sources

Intended Lake Benefits: Phosphorus Reduction ☒ Fecal Coliform Reduction ☒ Sediment Reduction ☒ Other ☐

If other, please describe:

Performance Measures: 1) End of study report of phosphorus loading sources with water quality and quantity data for specified tributaries integrated into loading models

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City			$80,000	$80,000
	County	0.03 ($3,000)		$80,000	$83,000
	District/Other			$18,000	$18,000
2011	City			$80,000	$80,000
	County	0.03 ($3,000)		$80,000	$83,000
	District/Other			$18,000	$18,000
2012	City				
	County	undetermined*		undetermined*	
	District/Other				
2013	City				
	County	undetermined*		undetermined*	
	District/Other				
2014	City				
	County	undetermined*		undetermined*	
	District/Other				
Total		**0.06 ($6,000)**		**$356,000**	**$362,000**

Program Area: 5. Data Management & Information
Task: 5.3 Review and summarize monitoring studies and reports

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	Data Team	$10,000	Active	None

Task Objective: Review and summarize monitoring studies and reports to determine policy implications

Actions:

- Read, discuss and summarize reports
- Provide summaries to ICT

Intended Lake Benefits: Phosphorus Reduction ☐ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☒

If other, please describe: New information/data used to improve water quality policies and management actions

Performance Measures: Annual report to include:
1) Summary of water quality issues identified by monitoring studies and reports
2) Policy recommendations in response to reports
3) Tasks that are modified or new in response to reports

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other				
2011	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other				
2012	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other				
2013	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other				
2014	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other				
Total		**0.1 ($10,000)**			**$10,000**

Program Area: 5. Data Management & Information
Task: 5.4 Maintain and update Data Catalog

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	Data Team	$5,000	Active	None

Task Objective: Maintain and update data records

Actions:

- Add entries into the Lake Whatcom Data Catalog for all Lake Whatcom research, monitoring and reports published in the prior year

Intended Lake Benefits: Phosphorus Reduction ☐ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☒

If other, please describe: Data Catalog acts as an information source for the public to improve lake stewardship

Performance Measures: 1) Annual update of Lake Whatcom Data Catalog

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City				
	County	0.01 ($1,000)			$1,000
	District/Other				
2011	City	0.01 ($1,000)			$1,000
	County				
	District/Other				
2012	City				
	County	0.01 ($1,000)			$1,000
	District/Other				
2013	City	0.01 ($1,000)			$1,000
	County				
	District/Other				
2014	City				
	County	0.01 ($1,000)			$1,000
	District/Other				
Total		**0.05 ($5,000)**			**$5,000**

Program Area: 5. Data Management & Information
Task: 5.5 Establish new monitoring programs

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	Data Team	As needed*	Hold	Indirect

Task Objective: Continue to improve detection of water quality and quantity trends by establishing new monitoring programs as needed

Actions:

- Respond to data needs identified by staff and/or consultants by initiating new monitoring programs

Intended Lake Benefits: Phosphorus Reduction ☐ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☒

If other, please describe: New information/data used to improve water quality policies and management actions

Performance Measures: 1) Annual review of identified data needs and update of monitoring program

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City				
	County	undetermined*		undetermined*	
	District/Other				
2011	City				
	County	undetermined*		undetermined*	
	District/Other				
2012	City				
	County	undetermined*		undetermined*	
	District/Other				
2013	City				
	County	undetermined*		undetermined*	
	District/Other				
2014	City				
	County	undetermined*		undetermined*	
	District/Other				
Total					

Program Area: 6. Spill Response & Hazardous Materials

Goal:

Prevent water quality degradation due to hazardous material spills through spill prevention and response programs, and continual improvement of communication network to handle spill response.

The Spill Response and Hazardous Materials Program Area aims to prevent water quality impacts associated with improper storage and handling of hazardous materials within the watershed and to ensure that spill prevention and response programs adequately protect water quality. The current focus of this program area is to improve spill response time to water quality threats by coordinating spill response reporting and information sharing between jurisdictions.

Notable Accomplishments:

In May of 2008, the City of Bellingham and Whatcom County held a watershed-wide household hazardous waste collection event and collected 22,482 pounds of household hazardous waste from 278 residents. Waste collected included a ton of fertilizers containing phosphorus, 4,219 pounds of pesticides and poisons, 110 pounds of fluorescent lamps, and 5,900 pounds of oil based paints.

Reference Documents:

Washington Toxics Coalition
www.watoxics.org

City of Bellingham Emergency Operations Plan
Annex 6 – Hazardous Materials

Whatcom County Emergency Management
http://www.whatcomcounty.us/dem/prepare/hazmaterial.jsp

Program Area: 6. Spill Response & Hazardous Materials
Task: 6.1 Amend local Emergency Operations Plans

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010	ICT	$3,000	Active	None

Task Objective: Amend local Emergency Operations Plans (EOPs) to include a chapter on Lake Whatcom-specific responses

Actions:

- Work with emergency management staff from each jurisdiction to amend Emergency Operations Plans to include a Lake Whatcom Chapter

Intended Lake Benefits: Phosphorus Reduction ☐ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☒

If other, please describe: Improved local emergency response plan to respond to Lake Whatcom-specific emergencies

Performance Measures: 1) Local Emergency Operations Plans amended to include Lake Whatcom Chapter
2) Summary of amendments to be included in annual report

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)			$1,000
Total		**0.03 ($3,000)**			**$3,000**

Program Area: 6. Spill Response & Hazardous Materials
Task: 6.2 Coordinate spill response reporting among all jurisdictions

Period	Responsible Party	Cost Estimate	Status	P Reduction
2011 and 2014	ICT	Staff	Hold	None

Task Objective: Coordinate spill response reporting among all jurisdictions (Fire, LWWSD, DOE)

Actions:

- Convene a Spill Response Team to review and report on spill response procedures and reporting protocols (Convene in 2011 and 2014 or after significant spill incidents)

Intended Lake Benefits: Phosphorus Reduction ☐ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☒

If other, please describe: Coordinated response reporting has the potential to improve clean-up efforts and provide greater transparency between jurisdictions

Performance Measures: Annual report to include (as needed):
1) Findings of reviews and amendments made to spill response procedures and reporting protocols per recommendations of Spill Response Team

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2011	City				
	County				
	District/Other				
2014	City				
	County				
	District/Other				
Total					

Program Area: 6. Spill Response & Hazardous Materials
Task: 6.3 Conduct hazardous waste collection events

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010, 2013	ICT	$56,000	Active	Indirect

Task Objective: Conduct hazardous waste collection events at locations in the watershed

Actions:

- Work with Moderate Risk Waste Facility staff to plan and implement events

Intended Lake Benefits: Phosphorus Reduction ☒ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☒

If other, please describe: Removal of all lawn, garden, and household hazardous products

Performance Measures: Annual report for years 2010 to 2013 to include the following:
1) Summary of event (location, # participants, # staff)
2) Pounds of waste collected

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.01 ($1,000)		$25,000	$26,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)			$1,000
2013	City	0.01 ($1,000)		$25,000	$26,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)			$1,000
Total		**0.06 ($6,000)**		**$50,000**	**$56,000**

Program Area: 7. Forestry/Fish/Wildlife

Goal:

Develop and maintain a comprehensive watershed forest management plan that minimizes impacts to water quality, and promotes actions and programs that protect and enhance fish and wildlife habitat.

The Lake Whatcom watershed provides habitat for a wide variety of fish and wildlife species. Most of the land in the watershed is in a forested condition and is managed by the State Department of Natural Resources, timber management companies, or private landowners. The Forestry/Fish/Wildlife Program Area aims to protect the clean water functions provided by forests located in the Lake Whatcom watershed.

Notable Accomplishments:

Over the past few years, the City and County have continued to monitor forestry activities in the watershed to ensure that any adverse water quality impacts are minimized.

In 2005, the City of Bellingham adopted a Critical Areas Ordinance and the County adopted an updated version of their Critical Areas Ordinance. These ordinances outline the specific rules and regulations regarding development near wetlands, streams and other environmentally sensitive areas.

Reference Documents:

City of Bellingham Critical Areas Ordinance (BMC 16.55)
http://www.cob.org/documents/planning/comprehensive-plan-code-amendments/critical-area-ordinance/2005-12-06-final-cao.pdf

City of Bellingham Shoreline Master Program (BMC Title 22)
http://www.cob.org/documents/planning/shoreline-master-program/november-final-draft-cc.pdf

Whatcom County Critical Areas Ordinance (WCC 16.16)
http://www.whatcomcounty.us/pds/naturalresources/criticalareas/index.jsp

Whatcom County Shoreline Management Program (WCC Title 23)
http://www.whatcomcounty.us/pds/naturalresources/shorelines/regulations/codeandmaps/pdf/SMP_CountyApproved_EcologyApproved_090323_clean_000.pdf

Interjurisdictional Committee (IJC) Reports

Program Area: 7. Forestry/Fish/Wildlife
Task: 7.1 Review IJC reports of DNR activities

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	ICT	$15,000	Active	None

Task Objective: Promote actions and programs that protect and enhance fish and wildlife habitat by reviewing the Interjurisdictional Committee's (IJC) reports of DNR activities

Actions:

- Set up annual meeting to review IJC reports
- Incorporate review findings into work plan and present recommendations to Management Committee
- Provide recommendations to the IJC when appropriate

Intended Lake Benefits: Phosphorus Reduction ☐ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☐

If other, please describe:

Performance Measures: Annual report to include:

1) Annual meeting schedule developed and implemented (2010)
2) Work plan updates based on IJC reports
3) Conclusions and recommendations presented to Management Committee

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)			$1,000
2011	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)			$1,000
2012	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)			$1,000
2013	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)			$1,000
2014	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)			$1,000
Total		**0.15 ($15,000)**			**$15,000**

Program Area: 7. Forestry/Fish/Wildlife
Task: 7.2 Enforce water quality assurances

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	ICT	$25,000	Active	Indirect

Task Objective: Promote actions and programs that protect and enhance fish and wildlife habitat by advocating for stricter Department of Ecology (DOE) enforcement of water quality assurances

Actions:

- Advocate for strict DOE enforcement of water quality assurances

Intended Lake Benefits: Phosphorus Reduction ☒ Fecal Coliform Reduction ☐ Sediment Reduction ☒ Other ☐

If other, please describe:

Performance Measures: 1) Annual evaluation of logging operations adherence to assurances
2) Propose and advocate for stricter assurances as warranted

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.25 ($25,000)			$25,000
	County				
	District/Other				
2011	City				
	County				
	District/Other				
2012	City				
	County				
	District/Other				
2013	City				
	County				
	District/Other				
2014	City				
	County				
	District/Other				
Total		0.25 ($25,000)			$25,000

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Program Area: 8. Transportation

Goal:

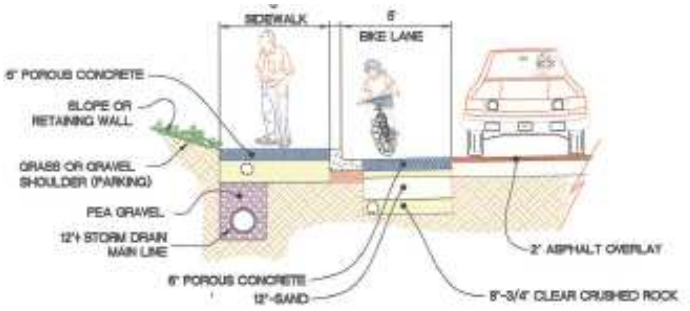
Design and develop transportation systems that include alternatives to automobiles, locate "through" routes away from the lakeshore, ensure treatment of runoff before entering the lake and otherwise protects water quality.

Motorized vehicles are a source of a variety of pollutants found in stormwater runoff. Pollutants such as oil, antifreeze, rubber, heavy metals, transmission and brake fluid can be deposited and accumulate on roadway surfaces through normal vehicle use. These pollutants can be carried during rain events to storm drains and ditches and eventually end up in our streams and lakes. The Transportation Program Area aims to limit transportation-related impacts to water quality by encouraging watershed residents to use alternative transport and to limit the number of vehicle mile trips being made in the watershed.

Notable Accomplishments:

In September of 2008, the City completed the Northshore Drive Roadway and Drainage Improvement Project. The project included installing new stormwater-main piping, porous concrete sidewalks, street lighting, and porous concrete bike lanes, in conjunction with rehabilitating and resurfacing the existing roadway. The design retrofitted the entire street to meet requirements for both enhanced phosphorus treatment of stormwater runoff, as well as completing the gap in the sidewalk between Dakin Street and the Silver Beach Store making it easier and safer for watershed residents to commute by bike.

The City of Bellingham Public Works Department received Project of the Year from the Washington State Chapter of the American Public Works Association (APWA) for the Northshore Drive Roadway and Drainage Improvement Project.



Reference Documents:

City of Bellingham Comprehensive Plan Ch. 3 Transportation Element
TG 38 and TG 39

Whatcom County Comprehensive Plan Ch. 6 Transportation Element

Smart Trips – Whatcom County
http://www.whatcomsmarttrips.org/

Program Area: 8. Transportation
Task: 8.1 Improve transportation planning

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010-2012	City/County	$2,000	Active	None

Task Objective: Protect water quality from transportation-related activities by improving transportation planning coordination in a manner consistent with water quality protection goals

Actions:

- Evaluate cost and method for road design standards impacts to water quality including road dimensions, road surface and shoulder, and ditch design
- Determine implementation schedule for Transportation Comp Plan's traffic routing objectives
- Amend 2011 Transportation Comp Plans to minimize water quality impacts in the watershed (as needed)

Intended Lake Benefits: Phosphorus Reduction ☐ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☒

If other, please describe: Potential reduction in transportation-related lake water quality impacts

Performance Measures: 1) Report on results of road design standards evaluation
2) Report on results of traffic flow routing evaluation
3) Amend road design standards as needed to respond to evaluation
4) Amendments to Comp Plans to include any revisions to goals and policies pertaining to water quality impacts associated with transportation

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other				
Total		0.02 ($2,000)			$2,000

Program Area: 8. Transportation
Task: 8.2 Reduce vehicle mile trips (VMT) in watershed

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	City/County	$5,000	Active	None

Task Objective: Protect water quality from transportation-related activities by reducing vehicle mile trips (VMT) in the watershed

Actions:

- Coordinate with WTA to identify and implement strategies to increase transit ridership in watershed (e.g. Explore options for installing high-visibility bus shelters at all WTA bus stops in Sudden Valley and Geneva)
- Coordinate with neighborhood groups, associations and schools to promote commute trip reduction
- Plan and design bike/pedestrian facilities along major transportation routes (e.g. Expand Euclid Park Trail connection to Old Lakeway to increase ridership in Geneva, improve bike/bus access to North Shore Park Trail.)
- Coordinate with Education Team to create public outreach materials and encourage watershed residents to reduce vehicle mile trips in the watershed
- Implement plan to reduce "through traffic" use of streets near the lake as shortcuts to destinations outside of watershed.

Intended Lake Benefits: Phosphorus Reduction ☐ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☒

If other, please describe: Potential reduction in transportation-related lake water quality impacts

Performance Measures: 1) Use WTA tracking system to monitor increase in transit ridership in watershed
2) Annual report of increase in non-vehicular transportation opportunities in watershed to include linear feet of new trails, new trail connections, new bus stops, new park and ride spaces, etc.

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.01 ($1,000)			$1,000
	County				
	District/Other				
2011	City	0.01 ($1,000)			$1,000
	County				
	District/Other				
2012	City	0.01 ($1,000)			$1,000
	County				
	District/Other				
2013	City	0.01 ($1,000)			$1,000
	County				
	District/Other				
2014	City	0.01 ($1,000)			$1,000
	County				
	District/Other				
Total		**0.05 ($5,000)**			**$5,000**

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Program Area: 9. Recreation

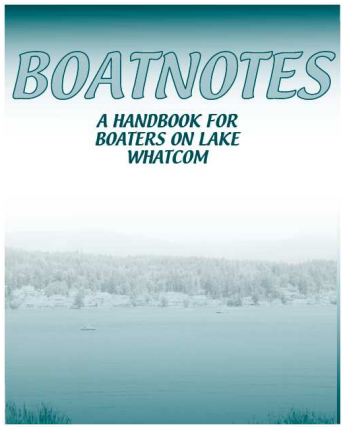
Goal:

Promote recreational opportunities that do not degrade water quality, and improve on ways to reduce impacts of existing activities.

The Lake Whatcom watershed is a popular recreational site for local residents and visitors. Recreational opportunities in the watershed include boating, swimming, fishing, hiking, biking, and horseback riding. Some of these activities have the potential to adversely impact the watershed and water quality through the release of pollutants, the destruction of wildlife habitat, and the spread of invasive species. The Recreation Program Area focuses on promoting recreational opportunities that minimize impacts to water quality while reducing the impacts of existing recreational activities.

Notable Accomplishments:

In 2005, the City and County banned the use of boats with carbureted 2-stroke engines on Lake Whatcom.



In 2006, a revised version of *Boatnotes: A handbook for boaters on Lake Whatcom* was distributed to educate boaters on ways to engage in boating activities that do not adversely impact the watershed or water quality.

In 2009, the County initiated the process to reconvey approximately 8,000 acres from DNR to Whatcom County for Park purposes.

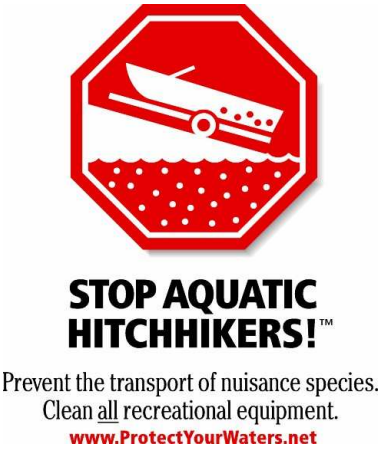
Reference Documents:

Boatnotes Handbook
http://www.cob.org/documents/pw/environment/Boatnotes-Handbook_2006_6.pdf

Washington Invasive Species Council
Annual Report 2009
http://www.invasivespecies.wa.gov

100th Meridian Initiative
http://www.100thmeridian.org

Protect Your Waters
http://www.protectyourwaters.net



Program Area: 9. Recreation
Task: 9.1 Prevent aquatic invasive species infestations

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	ICT	$14,000	Active	None

Task Objective: Work with state and regional efforts to avoid aquatic invasive species infestations that can occur as a result of improperly regulated recreational activities such as boating and/or fishing

Actions:

- Contact state and regional organizations for information and assistance in preventing aquatic invasive species infestations
- Monitor spread of aquatic invasive species as well as any new prevention and control efforts
- Create an Aquatic Nuisance Species Action Plan to prevent aquatic invasive species infestations
- Include feasible prevention program strategies such as implementing a watercraft inspection program, requiring permits for access to lake, and other options
- Begin implementation of feasible prevention program strategies

Intended Lake Benefits: Phosphorus Reduction ☐ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☒

If other, please describe: Preventative measures result in avoided ecosystem, health, and economic costs

Performance Measures:

1) Evaluate the benefits and costs of a watercraft inspection program (2010)
2) Implement the watercraft inspection program if approved (2011)
3) Annual report to include:
   - List of contacts at state and regional level working on invasive species
   - Local and regional aquatic invasive species status and prevention and control efforts
   - Aquatic Nuisance Species Action Plan for Lake Whatcom
   - If permit program implemented, number of permits issued/revenue collected

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.05 ($5,000)			$5,000
	County	0.01 ($1,000)			$1,000
	District/Other				
2011	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other				
2012	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other				
2013	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other				
2014	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other				
Total		0.14 ($14,000)			$14,000

Program Area: 9. Recreation
Task: 9.2 Design recreational opportunities to protect water quality

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	ICT	$13,000	Active	Indirect

Task Objective: Participate in the design of recreational opportunities that protect water quality

Actions:

- Work with City and County Park Departments to establish water quality protection as a primary criterion in the design of recreational projects
- Coordinate with County Park Departments to modify park plan and downgrade North Shore trail status to reduce vehicle mile trips in the watershed

Intended Lake Benefits: Phosphorus Reduction ☒ Fecal Coliform Reduction ☒ Sediment Reduction ☒ Other ☒

If other, please describe: Hydrocarbon pollution and litter

Performance Measures: 1) Annual report to include recreational project design features that affect water quality

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)			$1,000
2011	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)			$1,000
2012	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)			$1,000
2013	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other				
2014	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other				
Total		**0.13 ($13,000)**			**$13,000**

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Program Area: 10. Utilities & Waste Management

Goal:

Promote conservation of water resources and provision of city sewer to areas with on-site treatment.

The Utilities and Waste Management Program Area aims to promote water-use efficiency by residential, industrial, and commercial users. This program area also strives to minimize water quality impacts associated with on-site waste systems by ensuring existing on-site septic systems and sewers are working effectively and by advocating for the provision of city sewer to areas with on-site treatment.

Notable Accomplishments:

The City's water conservation program has been active since the early 1990s. Reducing outdoor water use during peak demand periods has been promoted through education and outreach, and through a rain barrel program. Reductions in indoor water usage have been encouraged through distribution of water conservation kits that contain a low-flow showerhead, faucet aerators, a toilet displacement bag, and water conservation information. A Voluntary Metering Program was established that encourages water conservation and accountability. The City also conducts scheduled annual leak detection of water system zones to ensure efficiency and accountability.

The City continues to contract with the Whatcom County Health Department (WCHD) to inspect and maintain on-site sewage systems in the City's portion of the watershed. On-site sewage system inspections are performed in the Lake Whatcom watershed on a routine basis and repairs to failing systems are completed in a timely manner.

At the request of the City the WCHD is taking part in the *Silver Beach Pilot Project* (SBCP) and has been collecting surface water samples from designated sites along Silver Beach Creek on a bi-weekly basis. The WCHD participates on the Lake Whatcom Education Team, collaborating on joint education and outreach projects in the watershed.

WCHD and the City recently completed work on an educational folder entitled *Homeowners Guide to On-site Sewage Systems*. These folders are distributed to OSS owners during service visits within the Lake Whatcom watershed.

Reference Documents:

Washington State 2003 Municipal Water Supply-Efficiency Requirements Act
http://www.doh.wa.gov/ehp/dw/Programs/wue.htm

City of Bellingham's Water Use Efficiency Program
http://www.cob.org/documents/pw/utilities/2008-water-use-efficiency-program.pdf

On-Site Sewage System Rules and Regulations
Whatcom County Health Department
Chapter 24.05 WCC
http://www.co.whatcom.wa.us/health/pdf/oss_regulations.pdf

City of Bellingham Municipal Code Amendments
Ordinance 2007-04-031
16.80.080 - Development Standards For Residential Single Development

Program Area: 10. Utilities & Waste Management
Task: 10.1 Continue OSS contract with County Health Department

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2011	City	$195,040	Active	Indirect

Task Objective: Continue onsite septic system (OSS) contract with the County Health Department (current through 2011)

Actions:

- Work with County Health Department to continue contract including enforcement of septic system operation and maintenance regulations, updated database of septic systems, response to failing septic systems, and homeowner education
- Create reports summarizing results of on-site septic system surveys, water quality monitoring and follow-up actions

Intended Lake Benefits: Phosphorus Reduction ☒ Fecal Coliform Reduction ☒ Sediment Reduction ☐ Other ☐

If other, please describe:

Performance Measures: 1) Annual report of compiled quarterly progress reports on contract tasks

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City			$97,520	$97,520
	County				
	District/Other				
2011	City			$97,520	$97,520
	County				
	District/Other				
Total				$195,040	$195,040

Program Area: 10. Utilities & Waste Management
Task: 10.2 Promote water conservation

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	City	$1.43 million	Active	None

Task Objective: Promote the conservation of water resources in the Lake Whatcom watershed

Actions: City will:

- Initiate toilet retrofit program for single residential, multi-family, and commercial water utility customers
- Develop high-efficiency fixture program
- Develop future water rate structures with an emphasis on water conservation
- Upgrade city parks to high-efficiency irrigation systems
- Conduct water audits, monitor water meters, and number of rain barrels used to calculate water savings
- Partner with District to promote water conservation in watershed

Intended Lake Benefits: Phosphorus Reduction ☐ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☒

If other, please describe: Water conservation

Performance Measures:

1) Report on number of toilet retro fit kits distributed (2010)
2) Report on high efficiency fixture program (2012)
3) Report on conservation focused water rate structure (2011)
4) Percentage of city parks with high efficiency irrigation systems (2012)
5) Include per capita (for metered customers) and city wide water savings in Consumer Confidence reports
6) Estimate of annual water savings as a result of program implementation

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	1.0 ($100,000		$80,000	$180,000
	County				
	District/Other				
2011	City	1.5 ($150,000)		$175,000	$325,000
	County				
	District/Other				
2012	City	1.5 ($150,000)		$175,000	$325,000
	County				
	District/Other				
2013	City	1.5 ($150,000)		$150,000	$300,000
	County				
	District/Other				
2014	City	1.5 ($150,000)		$150,000	$300,000
	County				
	District/Other				
Total		**7.0 ($700,000)**		**$730,000**	**$1.43 million**

Program Area: 10. Utilities & Waste Management
Task: 10.3 Protect lake from wastewater pollution

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	District	$4.08 million	Active	Direct/Indirect

Task Objective: Protect the Lake by removing sewage from the watershed

Actions: District will:

- Maintain and replace sanitary sewer infrastructure to efficiently move effluent to treatment plant
- Continue to manage I & I
- Continue to prevent overflows
- Continue mandatory connection to sewer when available and within 200 feet of property
- Not allow extension of Water service without sewer connection
- Only allow approval of on-site septic systems when sewer is not currently available and when economically feasible
- Work with City and County with regard to new development subject to District's sewer and water extension policies
- Complete capital projects

Intended Lake Benefits: Phosphorus Reduction ☒ Fecal Coliform Reduction ☒ Sediment Reduction ☒ Other ☐

If other, please describe:

Performance Measures:

1) Annual expenditure per Capital Improvement Plan
2) Report annually on District activities outlined above

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City				
	County				
	District/Other	undetermined		$538,327	$538,327
2011	City				
	County				
	District/Other	undetermined		$808,536	$808,536
2012	City				
	County				
	District/Other	undetermined		$995,186	$995,186
2013	City				
	County				
	District/Other	undetermined		$836,454	$836,454
2014	City				
	County				
	District/Other	undetermined		$907,726	$907,726
Total				**$4.08 million**	**$4.08 million**

Program Area: 11. Administration

Goal:

Administer and coordinate ICT and committee activities to support Management Plan implementation.

The Administration Program Area aims to effectively administer and coordinate the Interjurisdictional Coordinating Team (ICT) and Program Area Committee activities to support the successful implementation of the Lake Whatcom Management Plan.

Notable Accomplishments:

Since 2000 the Interjurisdictional Coordinating Team (ICT) has served to coordinate staff from the City, County, Water and Sewer District, as well as several partner organizations. The ICT's administration and coordination efforts have resulted in the successful implementation of two Lake Whatcom Management Program five-year work plans, each with numerous tasks and actions. The second five-year work plan has now been completed.

In 2008, the Lake Whatcom Joint Policy Working Group was formed as a subcommittee of the Joint Councils/Commissioners. Several Lake Whatcom Joint Policy Group subcommittee meetings have been held to discuss the status of Lake Whatcom Management Program, regulations, land use and other issues.

During 2009, Sudden Valley Community Association staff were invited to participate in ICT meetings and work product development. SVCA is now also actively participating in work plan implementation.

Reference Documents:

1992 Lake Whatcom Joint Resolution
http://lakewhatcom.org/cc10resolution1992.htm

Program Area: 11. Administration
Task: 11.1 Staff the ICT, Management Committee, and Joint Council meetings

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	ICT	$185,000	Active	None

Task Objective: Support Lake Whatcom Management Program (LWMP) implementation by staffing the Interjurisdictional Coordinating Team (ICT), the Management Committee, and Joint Council meetings

Actions:

- Produce agendas, minutes, research, presentations and other work products for all LWMP meetings
- ICT members attend and participate in all LWMP meetings

Intended Lake Benefits: Phosphorus Reduction ☐ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☐

If other, please describe:

Performance Measures: 1) Report location of agendas, minutes and presentations for all LWMP meetings

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.16 ($16,000)			$16,000
	County	0.16 ($16,000)			$16,000
	District/Other	0.05 ($5,000)			$5,000
2011	City	0.16 ($16,000)			$16,000
	County	0.16 ($16,000)			$16,000
	District/Other	0.05 ($5,000)			$5,000
2012	City	0.16 ($16,000)			$16,000
	County	0.16 ($16,000)			$16,000
	District/Other	0.05 ($5,000)			$5,000
2013	City	0.16 ($16,000)			$16,000
	County	0.16 ($16,000)			$16,000
	District/Other	0.05 ($5,000)			$5,000
2014	City	0.16 ($16,000)			$16,000
	County	0.16 ($16,000)			$16,000
	District/Other	0.05 ($5,000)			$5,000
Total		**1.85 ($185,000)**			**$185,000**

Program Area: 11. Administration
Task: 11.2 Establish funding needs and strategy

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	ICT	$45,000	Active	None

Task Objective: Establish work plan funding needs and strategy to support work plan implementation

Actions:

- Represent funding needs in City/County/District budget processes
- Identify and seek grant funding to support implementation of work plan tasks

Intended Lake Benefits: Phosphorus Reduction ☐ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☐

If other, please describe:

Performance Measures: 1) Annual report to include percentage of tasks that are funded by budgets, grants or other sources

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.04 ($4,000)			$4,000
	County	0.04 ($4,000)			$4,000
	District/Other	0.01 ($1,000)			$1,000
2011	City	0.04 ($4,000)			$4,000
	County	0.04 ($4,000)			$4,000
	District/Other	0.01 ($1,000)			$1,000
2012	City	0.04 ($4,000)			$4,000
	County	0.04 ($4,000)			$4,000
	District/Other	0.01 ($1,000)			$1,000
2013	City	0.04 ($4,000)			$4,000
	County	0.04 ($4,000)			$4,000
	District/Other	0.01 ($1,000)			$1,000
2014	City	0.04 ($4,000)			$4,000
	County	0.04 ($4,000)			$4,000
	District/Other	0.01 ($1,000)			$1,000
Total		**0.45 ($45,000)**			**$45,000**

Program Area: 11. Administration
Task: 11.3 Coordinate Program Area committees

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	ICT	$15,000	Active	None

Task Objective: Support management plan implementation by coordinating Program Area committees

Actions:

- Facilitate meeting, discussion and issue resolution by key program area staff and members of ICT
- Coordinate stormwater management with transportation planning and other Program Areas
- Identify task implementation issues that require participation by key staff working in a Program Area

Intended Lake Benefits: Phosphorus Reduction ☐ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☐

If other, please describe:

Performance Measures: Annual report to include:

1) Joint Program Area tasks identified and implemented
2) Changes made to Program Area planning and processes as a result of ICT recommendations

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)			$1,000
2011	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)			$1,000
2012	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)			$1,000
2013	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)			$1,000
2014	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)			$1,000
Total		**0.15 ($15,000)**			**$15,000**

Program Area: 11. Administration
Task: 11.4 Maintain contact with regulatory agencies

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	ICT	$15,000	Active	None

Task Objective: Support Management Plan implementation by maintaining information exchange with agencies

Actions:

- Receive and respond to communication from regulatory agencies regarding lake water quality, natural resources, and lake watershed land use

Intended Lake Benefits: Phosphorus Reduction ☐ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☐

If other, please describe:

Performance Measures: 1) Annual report on significant regulatory issues resolved or left outstanding

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)			$1,000
2011	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)			$1,000
2012	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)			$1,000
2013	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)			$1,000
2014	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)			$1,000
Total		**0.15 ($15,000)**			**$15,000**

Program Area: 11. Administration
Task: 11.5 Oversee contracts and work products

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	ICT	$47,000	Active	None

Task Objective: Oversee variety of consultant and contractor projects, contracts and work products

Actions:

- Provide administration oversight for contracts including: Institute for Watershed Studies, Conservation Contracting, Brown and Caldwell, Whatcom County Health Department and others (2010)
- Sudden Valley staff will increase monitoring of capital projects and ensure consultant planning and construction work meets all jurisdictional regulations and requirements

Intended Lake Benefits: Phosphorus Reduction ☐ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☐

If other, please describe:

Performance Measures: 1) Annual report to include status of projects and contracts

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.02 ($2,000)			$2,000
	County	0.02 ($2,000)			$2,000
	District/Other	0.01 ($1,000)/0.05 (SVCA) ($5,000)			$6,000
2011	City	0.02 ($2,000)			$2,000
	County	0.02 ($2,000)			$2,000
	District/Other	0.01 ($1,000)/0.05 (SVCA) ($5,000)			$6,000
2012	City	0.02 ($2,000)			$2,000
	County	0.02 ($2,000)			$2,000
	District/Other	0.05 (SVCA) ($5,000)			$5,000
2013	City	0.02 ($2,000)			$2,000
	County	0.02 ($2,000)			$2,000
	District/Other	0.05 (SVCA) ($5,000)			$5,000
2014	City	0.02 ($2,000)			$2,000
	County	0.02 ($2,000)			$2,000
	District/Other	0.05 (SVCA) ($5,000)			$5,000
Total		**0.47 ($47,000)**			**$47,000**

Program Area: 11. Administration
Task: 11.6 Integrate Lake Whatcom Management Program goals into Comp Plans

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010-2011	City/County	$2,000	Hold	None

Task Objective: Support Management Plan implementation by integrating the Lake Whatcom Management Program goals into 2011 Comprehensive Plan updates

Actions:

- Review existing comprehensive plans for consistency with Lake Whatcom goals
- Amend comprehensive plans to reference TMDL and NPDES Phase II Permit

Intended Lake Benefits: Phosphorus Reduction ☐ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☐

If other, please describe:

Performance Measures: 1) Annual report to include citations of Comprehensive Plans updates that incorporate Lake Whatcom Management Program goals and TMDL and NPDES references

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other				
2011	City				
	County				
	District/Other				
Total		0.02 ($2,000)			$2,000

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Program Area: 12. Enforcement

Goal:

Improve City and County enforcement of regulations aimed at protecting lake water quality.

The Enforcement Program Area aims to support enforcement of land use, development and other associated regulations to protect the water quality of Lake Whatcom. An enforcement team was convened by the Interjurisdictional Coordinating Team (ICT) in 2008 to improve enforcement actions in the watershed.

Notable Accomplishments:

Both the City and County have enforcement staff patrolling the watershed on a daily basis. Enforcement staff are responsible for inspecting both permitted and non-permitted activities in the watershed and reporting any activities that are in violation of the City and County stormwater codes.

Reference Documents:

BMC 15.42 subsections 070-110

Whatcom County Comprehensive Stormwater Plan

Program Area: 12. Enforcement
Task: 12.1 Improve enforcement capabilities

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	ICT/City/County/SVCA/District	$265,000	Active	Indirect

Task Objective: Improve enforcement coordination and cross-training

Actions:

- Convene Enforcement Team to assess and improve current watershed-wide enforcement capabilities and organize cross-training opportunities
- Monitor enforcement actions to determine if enforcement capabilities have improved as a result of changes to procedures and from participation in training events
- Sudden Valley will modify portions of its existing guidelines to address problematic enforcement areas

Intended Lake Benefits: Phosphorus Reduction ☐ Fecal Coliform Reduction ☐ Sediment Reduction ☐ Other ☒

If other, please describe: More effective enforcement of measures to protect lake water quality

Performance Measures: Annual report to include:

1) Number of participants and departments in cross-training events
2) Measured or observed improvements to communication feedback, response to public complaints, and permit compliance (2010, 2012, 2014)
3) Number and types of enforcement actions taken
4) Record of changes made to SVCA enforcement guidelines

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)/ 0.5 (SVCA) ($50,000)			$51,000
2011	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)/ 0.5 (SVCA) ($50,000)			$51,000
2012	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)/ 0.5 (SVCA) ($50,000)			$51,000
2013	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)/ 0.5 (SVCA) ($50,000)			$51,000
2014	City	0.01 ($1,000)			$1,000
	County	0.01 ($1,000)			$1,000
	District/Other	0.01 ($1,000)/ 0.5 (SVCA) ($50,000)			$51,000
Total	**2.65 ($265,000)**				**$265,000**

Program Area: 12. Enforcement
Task: 12.2 Improve reporting of enforcement actions

Period	Responsible Party	Cost Estimate	Status	P Reduction
2010 - 2014	City/County/SVCA	$80,000	Active	Indirect

Task Objective: Improve City and County reporting of enforcement actions in the watershed

Actions:

- Sudden Valley will continue to report watershed and critical area violations to the County and improve follow-up on compliance issues
- Evaluate reporting (internal and to the public) of enforcement actions, recommend changes as needed to increase internal communication and public awareness
- City will provide education for citizens on how to report violations of water quality rules

Intended Lake Benefits: Phosphorus Reduction ☒ Fecal Coliform Reduction ☒ Sediment Reduction ☒ Other ☐

If other, please describe:

Performance Measures: Annual report to include:

1) Change in unpermitted activities in watershed
2) Change in citizen reporting of water quality violations

Cost Estimates:

Year	Party	FTEs ($)	Capital Costs	Other	Total
2010	City	0.1 ($10,000)			$10,000
	County	0.1 ($10,000)			$10,000
	District/Other	0.1 (SVCA) ($10,000)			$10,000
2011	City				
	County	0.1 ($10,000)			$10,000
	District/Other	0.1 (SVCA) ($10,000)			$10,000
2012	City				
	County				
	District/Other	0.1 (SVCA) ($10,000)			$10,000
2013	City				
	County				
	District/Other	0.1 (SVCA) ($10,000)			$10,000
2014	City				
	County				
	District/Other	0.1 (SVCA) ($10,000)			$10,000
Total		0.8 ($80,000)			$80,000

Appendices

Appendix A - Clean Water Act – Total Maximum Daily Load Response Strategy for Lake Whatcom Total Phosphorus and Bacteria

Appendix B - Funding Sources

Appendix C - Acronyms

Appendix A
Clean Water Act – Total Maximum Daily Load
Response Strategy for
Lake Whatcom Total Phosphorus and Bacteria

Lake Whatcom is the subject of a Federal Clean Water Act process known as a Total Maximum Daily Load which is administered by the State of Washington Department of Ecology. In 1998 the lake was included in a list of polluted water bodies due to low dissolved oxygen levels in the water. In 2004 Total Phosphorus was added to the list of pollutants affecting lake water quality. Several other pollutants have been found in fish tissue samples, these include mercury, PCB, Dieldrin, and others.

Every TMDL submitted by the State of Washington includes a *Summary Implementation Strategy* (SIS) and a final *Detailed Implementation Plan* (DIP) . These companion documents to the TMDL are described in a Memorandum of Agreement between EPA and Ecology, view the MOA at this link: http://www.ecy.wa.gov/programs/wq/tmdl/303moa12.pdf.

The *Lake Whatcom Watershed Total Phosphorus and Bacteria Total Maximum Daily Load, Water Quality Study Findings* (TMDL Study) was completed in November 2008 by Ecology. This document identifies pollutant sources, pollutant loading amounts, load reduction requirements and suggested response strategies.

In preparation for submitting a TMDL plan to EPA for approval, Ecology develops a (SIS) which includes the pollutant source, loading and reduction requirements and additional information from the TMDL Study as well as a concise, description of activities planned or underway to implement the TMDL, as provided in the *2010-2014 Lake Whatcom Management Program Work Plan* (2010-2014 Work Plan).

After EPA approves the SIS, Ecology, in cooperation with local interests, will develop a DIP, which describes specific strategies and timelines to meet reduction targets, as well as identifying the responsible entities. The DIP also includes a detailed monitoring plan that sets monitoring guidelines to evaluate the TMDL's effectiveness, describes funding sources and establishes funding commitments.

In addition to the public process provided for in the 2010-2014 Work Plan, there will also be opportunities for public comment during development of the DIP.

Appendix B
Funding Sources

Adequate funding is essential to successful implementation of the 2010-2014 Lake Whatcom Management Program Work Plan. Funding sources include:

1) Lake Whatcom Property Acquisition Fee
2) Bellingham Stormwater Utility
3) Bellingham Water Utility
4) Bellingham Street Utility
5) Bellingham General Fund
6) Whatcom County General Fund
7) Whatcom County Flood Control Zone fee
8) Real Estate Excise Tax
9) Lake Whatcom Water and Sewer District Utility
10) Sudden Valley Community Association
11) Grants

Funding for implementation of activities varies both in the types of funding sources and the certainty of the funding. The funding indicated in the Cost Estimates table of each task is actual funding available from one or more of the listed funding sources **as of the date of this draft plan**. An account of the funding that supports each task will be available as an addendum to this Appendix B in the Fall of 2010. Since most tasks are implemented by more than one jurisdiction, those tasks have more than one funding source, at least one per jurisdiction. Some tasks are funded by more than one source within a jurisdiction e.g. Task 4.2 is partly funded by the Bellingham Stormwater Utility and the Bellingham Water Utility.

Funding sources that are derived from an ongoing dedicated source such as the Property Acquisition fee have greater certainty than those that are derived from a General Fund or other non-dedicated source.

The Cost Estimates table for each Task includes information for each year of the recommended duration of the Task. When the funding is certain an amount is entered for that period in the appropriate column, however, when the recommended duration of the Task extends beyond which funding is now known and dedicated then the Cost Estimates table will indicate “undetermined” funding for the years with undesignated funding. Future budget recommendations and grant applications will then focus on funding Tasks with ”undetermined” funding.

Funding issues will be further clarified during the development of the *Detailed Implementation Plan*, when the final project list is developed with timelines, funding needs, and funding sources identified. That process will include opportunities for the public to comment on the long term funding strategy for the TMDL. Decisions and commitments to funding and project implementation will also be incorporated into the NPDES permits for the city and county.

Appendix C
Acronyms

APWA: American Public Works Association

BMC: Bellingham Municipal Code

BMP: Best Management Practice

CE: Conservation Easement

CIP: Capital Improvement Project

DIP: Detailed Implementation Strategy

DNR: Washington Department of Natural Resources

DOE: Washington Department of Ecology

EOP: Emergency Operations Plan

ICT: Interjurisdictional Coordinating Team

IJC: Interjurisdictional Committee

LWMP: Lake Whatcom Management Program

NPDES: National Pollution Discharge Elimination System

NVPA: Native Vegetation Protection Area

OSS: Onsite Septic System

RSRP: Residential Stormwater Retrofit Program

SBCP: Silver Beach Creek Pilot Project

SEPA: State Environmental Protection Act

SIS: Summary Implementation Strategy

SVCA: Sudden Valley Community Association

TMDL: Total Maximum Daily Load

UGA: Urban Growth Area

WCC: Whatcom County Code

WCHD: Whatcom County Health Department

WTA: Whatcom Transportation Authority

WWU: Western Washington University

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