Clarks Creek Watershed
Fecal Coliform Bacteria
Total Maximum Daily Load

Water Quality Implementation Plan

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Total Maximum Daily Load

Water Quality Implementation Plan

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Executive Summary

The Clarks Creek Watershed Fecal Coliform TMDL was completed in May 2008 and approved by EPA in June 2008. This WQIP will use an adaptive management approach to ensure the progress and overall success of the work being done.

Ecology conducted a TMDL study in this watershed because several datasets showed Clarks Creek and Meeker Creek do not meet water quality standards. They are:

- City of Puyallup data, 2002-2003.
- Puyallup Tribe of Indians data, 1998-2001.
- Clarks Creek working group data 1996-1997.

Clarks Creek and Meeker Creek were identified as being impaired by fecal coliform on the 1996 303(d) list. On the 1998 303(d) list, they were again listed for fecal coliform. Meeker Creek was also listed for pH, dissolved oxygen (DO), and temperature. In 2004, Ecology moved to a category system. The 2004 Water Quality Assessment Report identified Clarks Creek and Meeker Creek as listed for fecal coliform and pH under Category 5 (polluted waters that require a TMDL). The 2004 Water Quality Assessment Report also identified Meeker Creek as a Category 2 (water of concern) for DO and temperature. Clarks Creek was listed as a Category 2 for DO.

The Clean Water Act requires that a TMDL be developed for all water bodies assessed as Category 5. Ecology is not required to do a TMDL for those waters assessed as Category 2. However, the recommendations in this report should improve the Category 2 impairments.

Chinook salmon and steelhead using Clarks Creek are part of the *threatened* Puget Sound population designated by the National Marine Fisheries Service (NMFS) under the Endangered Species Act. From its mouth to Maplewood Springs, Clarks Creek is part of the species' *critical habitat*. Coho in the region also receive attention under ESA regulations. The Puget Sound/Georgia Basin coho population is a "species of concern" and the status of steelhead is under review.

Clarks Creek watershed lies within the Puget Sound uplands, an extensive plateau of glacial deposits that borders and underlies Puget Sound, extending south from British Columbia to the city of Olympia, west and east to the foothills of the Olympic and Cascade mountain ranges. The region is dissected by a dozen major rivers and numerous small creeks. Elevations range from sea level on Puget Sound to 400 feet on adjacent bluffs and 700-800 feet near the foothills.

The Clarks Creek watershed is located in the lower Puyallup River watershed in the southern part of the region. The Puyallup is the largest river in the South Puget Sound area, with a watershed of 970 square miles and an average flow of 3300 cubic feet per second (cfs). Clarks Creek has a watershed area of about 13 square miles and an average flow of roughly 60 cfs. Tributaries include Rody, Diru, Woodland, and Meeker Creeks.

Clarks Creek flows year-round out of Maplewood Springs, with summer base flows of 30-40 cfs. Tributaries flow primarily in the wet season in response to rain.[1] This study area is in water resource inventory area (WRIA) 10.

The upper, southern-most area of the watershed is a rolling terrain of low, north-trending ridges separated by swale- and wetland-dominated stream channels. North of this area, the watershed slopes down to the Puyallup River valley and streams have carved shallow ravines into hillsides. The lower, northern-most part of the watershed is flat, Puyallup River valley bottom. Soils in the watershed are dominated by the Kapowsin association. These soils formed in compacted glacial till that restricts infiltration, although they may include an overlay of well-drained outwash sands and gravel. In the upper and lower watershed, seasonal wetlands are common given the soils, stream gradients, and high or perched groundwater tables.

Land uses in the watershed are increasing, and vary from urban in the city of Puyallup to rural residential in the county. County planners estimate that the population in the Clear and Clarks Creek basins will increase by 15 percent (from 61,700 to 71,000), and at build out, effective impervious area could increase by 40 percent (from 25 percent of the basin presently to 35 percent) by 2020.

Rainfall is typical of the Puget Sound region, averaging about 40 inches per year. Most rain falls between October and April. Air temperatures measured at Sea-Tac Airport range from an average daily low of 32°F (0°C) in January and February to an average daily high of 77°F (25°C) in July and August.

The city of Puyallup, Washington State University Puyallup Research and Extension Center, and Pierce County Surface Water Management have the largest portion of implementation actions in the watershed. Other partners include the Puyallup Tribe, Tacoma Pierce County Health Department, Pierce Conservation District, Friends of Clarks Creek, Western Washington Fairgrounds, Pierce County Planning and Land Services, and Washington State Department of Fish and Wildlife.

DeCoursey Pond has been an issue due to high fecal coliform inputs. Washington State University Puyallup Research and Extension Center applied for and received a grant to do the following tasks: environmental assessment and project design; riparian buffer restoration, pathogen control at DeCoursey Pond; citizen science and engagement, restoration, and education; water quality monitoring and sediment assessment; and other best management practices for fecal coliform bacteria control. WSU will work cooperatively with the city of Puyallup to discourage waterfowl (determined to be one of the major sources of fecal coliform) from frequenting DeCoursey Pond.

[1] The groundwater discharge from Maplewood Springs does not occur in a single location; it occurs instead over a length of Clarks Creek in the vicinity of the state fish hatchery, above sampling station CCURS-4.

The city of Puyallup committed to working on issues in Clarks Creek and Meeker Creek. Some of the implementation items they will work on are waterfowl removal, signs prohibiting feeding waterfowl, and an education and outreach program using citizen action teams to discourage waterfowl feeding. They also planted native vegetation on the south side of Meeker Creek and are in search of additional locations for future plantings. They also have initiated a renewed emphasis on public education and outreach.

Pierce County Surface Water Management continues to implement their Clear/Clarks Creek Basin Plan, which identifies many implementation activities, as funding allows.

The Puyallup Tribe offered to assist in sampling those areas where implementation activities have occurred.

The goal of the Clarks Creek Watershed Water Quality Improvement Plan for fecal coliform bacteria is to enable the waters of the basin to meet the state's water quality standards. An interim target has been set to meet a 50 percent reduction in fecal coliform bacteria by 2012. The following rationale helps provide reasonable assurance that the nonpoint source TMDL goals will be met by 2015.

The following actions are completed or already underway:

- The city of Puyallup is currently increasing vactoring (storm sewer cleaning) and street sweeping to prevent fecal coliform bacteria from entering the creek via their stormwater collection system.

- The city of Puyallup planted areas along Clarks Creek and planted the south bank of Meeker Creek.

- The city of Puyallup began newsletter updates in the spring of 2007 reminding pet owners of their responsibility to dispose of pet waste properly, and set up waste collection stations in the city parks and trails. Pierce County Surface Water Management has been working on Rody Creek. The restoration will reduce sediments and improve water quality in this tributary that enters Clarks Creek.

- The Pierce Conservation District is working with a hobby farm to prevent their fecal coliform contamination from entering Rody Creek.

- The Tacoma Pierce Health Department conducted a sanitary survey on Rody Creek and was able to correct a septic failure as a result.

While Ecology is authorized under Chapter 90.48 RCW to impose strict requirements or issue enforcement actions to achieve compliance with state water quality standards, all participants in the Clarks Creek Watershed TMDL process prefer to achieve clean water through voluntary control actions.

If the actions identified in this document do not produce the fecal coliform bacteria reductions needed to achieve water quality standards, the participants in the Clarks Creek Watershed TMDL will use adaptive management to develop additional implementation techniques and activities.

Ecology will consider and issue notices of noncompliance in accordance with the Regulatory Reform Act where appropriate, if the cause of noncompliance or contribution of cause of noncompliance with load allocations can be established.

What is a Total Maximum Daily Load (TMDL)

Federal Clean Water Act requirements

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

Every two years, states are required to prepare a list of water bodies – lakes, rivers, streams, or marine waters – that do not meet water quality standards. This list is called the 303(d) list. To develop the list, Ecology compiles its own water quality data along with data submitted by local state and federal governments, tribes, industries, and citizen monitoring groups. All data are reviewed to ensure that they were collected using appropriate scientific methods before the data are used to develop the 303(d) list. The 303(d) list is part of the larger water quality assessment.

The water quality assessment is a list that tells a more complete story about the condition of Washington's water. This list divides water bodies into five categories:

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

Category 2 – Waters of concern.

Category 3 – Waters with no data available.

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

- 4a. – Has a TMDL approved and it is being implemented
- 4b. – Has a pollution control plan in place that should solve the problem
- 4c. – Is impaired by a non-pollutant such as low water flow, dams, and culverts.

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

TMDL process overview

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. The TMDL identifies pollution problems in the watershed and then specifies how much pollution needs to be reduced or eliminated to achieve clean water. Then Ecology works with the local community to develop an overall approach to control the pollution, called the *implementation strategy*, and a monitoring plan to assess effectiveness of the water quality improvement activities. The allocations and implementation strategy are contained in the *water quality improvement report* and is submitted to EPA for approval. Once EPA approves the TMDL, a *water quality implementation plan* must be developed within one year. This plan identifies specific tasks, responsible parties, and timelines for achieving clean water.

Elements required in a TMDL

The goal of a TMDL is to ensure the impaired water will attain water quality standards. A TMDL includes a written, quantitative assessment of water quality problems and of the pollutant sources that cause the problem. The TMDL determines the amount of a given pollutant that can be discharged to the water body and still meet standards (the loading capacity) and allocates that load among the various sources.

If the pollutant comes from a discrete source (referred to as a point source) such as a municipal or industrial facility's discharge pipe, that facility's share of the loading capacity is called a wasteload allocation. If it comes from a set of diffuse sources (referred to as a nonpoint source) such as general urban, residential, or farm runoff, the cumulative share is called a load allocation.

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

Identification of the contaminant loading capacity for a water body is an important step in developing a TMDL. EPA defines the loading capacity as "the greatest amount of loading that a water body can receive without violating water quality standards" (EPA, 2001). The loading capacity provides a reference for calculating the amount of pollution reduction needed to bring a water body into compliance with standards. The portion of the receiving water's loading capacity assigned to a particular source is a load or wasteload allocation. By definition, a TMDL is the sum of the allocations, which must not exceed the loading capacity.

A TMDL targets a level of pollutant loading by adding up the pollutant sources, both point and nonpoint, and a margin of safety. A TMDL is typically expressed as:

$$TMDL = WLA + LA + Reserve + MOS$$

Where:

WLA = Waste load allocation – the portion of the loading to the water body assigned to each existing and future *point* source (identifiable as a discharge from a pipe) of the pollutant

LA = Load allocation – the portion of the pollutant loading assigned to existing and future *nonpoint* sources of the pollutant

Reserve – an allocation established for impairment caused by future development

MOS = Margin of safety – which accounts for the uncertainty of the pollutant load and the quality of the water body

What part of the process are we in?

Once EPA approves a TMDL, a water quality implementation plan (WQIP) is developed. This plan will identify specific tasks, responsible parties, and timelines for achieving clean water. EPA approved the TMDL for the Clarks Creek Watershed in June 2008. This WQIP will use an adaptive management approach to ensure the progress and overall success of the work being done.

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Why Ecology is Conducting a TMDL in this Watershed

Overview

Ecology conducted a TMDL study in this watershed because several datasets showed Clarks Creek and Meeker Creek do not meet water quality standards. They are:

- City of Puyallup data, 2002-2003.
- Puyallup Tribe of Indians data, 1998-2001.
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Clarks Creek and Meeker Creek were identified as being impaired by fecal coliform on the 1996 303(d) list. On the 1998 303(d) list, they were again listed for fecal coliform. Meeker Creek was also listed for pH, dissolved oxygen (DO), and temperature. In 2004, Ecology moved to a category system for identifying impairment level. The 2004 Water Quality Assessment Report identified Clarks Creek and Meeker Creek as listed for fecal coliform and pH under Category 5 (polluted waters that require a TMDL). The 2004 Water Quality Assessment Report also identified Meeker Creek as a Category 2 (water of concern) for DO and temperature. While the water quality implementation plan was being developed, the 2008 list was published. The 2008 list was not used in making recommendations in this document. Clarks Creek was listed as a Category 2 for DO.

The Clean Water Act requires that a TMDL be developed for all water bodies assessed as Category 5. Ecology is not required to do a TMDL for those waters assessed as Category 2. However, the recommendations in this report should improve the Category 2 impairments.

Impaired beneficial uses and water bodies

The main beneficial uses to be protected by this TMDL are recreation and aquatic habitat. The impairments listed on the 2004 WQ Assessment are summarized in Table 1. The tributaries that will be addressed in this report, but not on the assessment are summarized in Table 2.

Table 1. **Impairments (Category 5) and waters of concern (Category 2) from the 2004 Water Quality Assessment**

Category 5					
Water body	Parameter	Listing ID	Township	Range	Section
Clarks Creek	Fecal Coliform	7497	20N	04E	30
Clarks Creek	Fecal Coliform	7501	20N	04E	30
Meeker Creek	Fecal Coliform	7508	20N	04E	33
Clarks Creek	pH	7499	20N	04E	32
Meeker Creek	pH	7511	20N	04E	33
Category 2					
Meeker Creek	Dissolved Oxygen	7510	20N	04E	33
Meeker Creek	Temperature	7509	20N	04E	33
Clarks Creek	Dissolved Oxygen	35407	20N	04E	19
Meeker Creek	Fecal Coliform	7507	20N	04E	32

Table 2. Creek Watershed tributaries addressed in this report

Water body	Parameter	Township	Range	Section
Rody Creek	Fecal Coliform	20N	04E	30
Woodland Creek	Fecal Coliform	20N	04E	29
Diru Creek	Fecal Coliform	20N	04E	30

Watershed Description

The Clarks Creek watershed lies within the Puget Sound uplands, an extensive plateau of glacial deposits that borders and underlies Puget Sound, extending south from British Columbia to the city of Olympia, and west and east to the foothills of the Olympic and Cascade mountain ranges. The region is dissected by a dozen major rivers and by numerous small creeks. Elevations range from sea level on Puget Sound to 400 feet on adjacent bluffs and 700-800 feet near the foothills.

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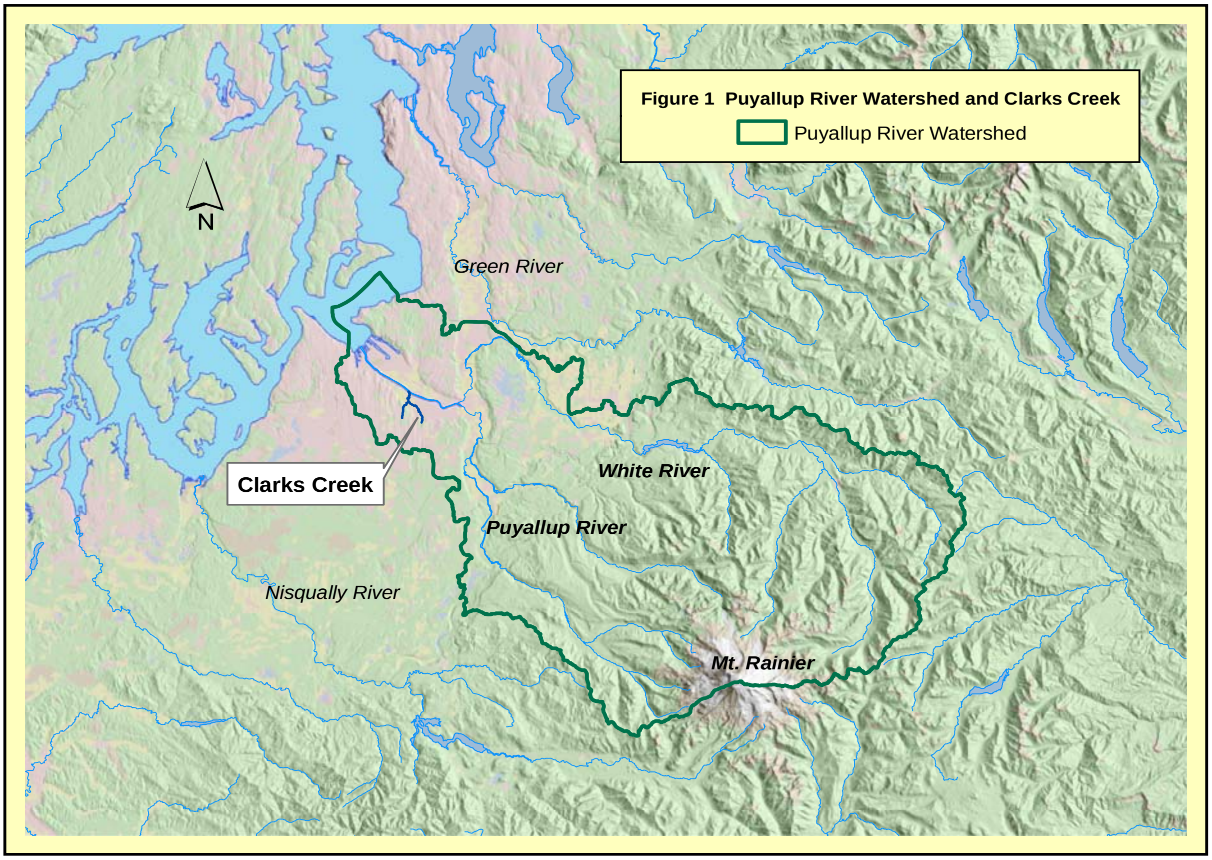

Figure 1. Puyallup River Watershed

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[2] The groundwater discharge from Maplewood Springs does not occur in a single location; it occurs instead over a length of Clarks Creek in the vicinity of the state fish hatchery, above sampling station CCURS-4.

Chinook salmon and steelhead using Clarks Creek are part of the threatened Puget Sound population designated by the National Marine Fisheries Service (NMFS) under the Endangered Species Act. From its mouth to Maplewood Springs, Clarks Creek is part of the species' critical habitat. Coho in the region also receive attention under ESA regulations. The Puget Sound/Georgia Basin coho population is a "species of concern" and the status of steelhead is under review.

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Rainfall is typical of the Puget Sound region, averaging about 40 inches per year. Most rain falls between October and April. Air temperatures measured at Sea-Tac Airport range from an average daily low of 32°F (0°C) in January and February to an average daily high of 77°F (25°C) in July and August.

Water pollution in Clarks Creek appears to be caused by nonpoint sources attributed to land uses. This includes urban stormwater runoff, agricultural land runoff, and human-influenced wildlife populations such as waterfowl and rodents.

Elodea (*Elodea canadensis*) appears annually in Clarks Creek. Native elodea grows well in Clarks Creek. As plant material dies off and settles to the bottom of the creek, its decomposition poses a problem by lowering dissolved oxygen, restricting stream flow, catching sediment, and destroying fish spawning beds.

Presently, the only portions free of elodea are the well-shaded areas at both ends of Clarks Creek. Each year, the city of Puyallup contracts to remove elodea within the creek. Pierce County Surface Water Management supports the on-going weed cutting by providing financial support in the amount of 50 percent of the annual cost. The cutting of this native weed is synchronized to precede the release of salmon from the nearby Puyallup Tribe's hatchery in June and the return of Chinook that spawn in September. It is only a temporary fix.

In areas where stream sediment has been removed, elodea is absent because its root system cannot get established. Therefore, reducing the amount of sediment in the creek may decrease the occurrence of elodea.

Clarks Creek is a salmon-bearing stream supporting Chinook, coho, and chum salmon, steelhead, and cutthroat trout. Spawning occurs primarily above the confluence with Meeker Creek because the substrate below the confluence is mostly sand. Rearing occurs throughout Clarks Creek and the lower reaches of its major tributaries.

Two fish hatcheries and a rearing pond discharge to Clarks Creek. The Washington State Department of Fisheries operates a hatchery at Maplewood Springs, and the Puyallup Tribe of Indians operates a hatchery on Diru Creek and a rearing pond that discharges to Clarks Creek. The state and the tribe are the only point-source dischargers to the creek; neither appears to cause a fecal coliform impairment. The tribal hatchery is smaller than the state facility. EPA (the permitting authority for tribal activities) has not required the Tribe to obtain a federal discharge permit. The tribal hatchery discharges to Diru Creek near Pioneer Way and the confluence with Clarks Creek. The satellite rearing pond discharges to Clarks Creek near 66th Avenue East.

The primary water pollution control issue at both facilities is organic fish waste, including uneaten food. Hatcheries typically have either a two-hour retention time in rearing ponds and allow solids to settle, or operators pump bottom solids to a waste pond. There is only a single, relatively large discharge from the rearing pond at the tribal hatchery. There is both a large rearing pond discharge and a very small waste pond flow at the state hatchery.

The state hatchery operates under NPDES permit number WA0039748 and uses a waste pond to treat organic solids. The flow rate from the raceways ranges between 8-18 cfs, but pollutant concentrations, as measured by total suspended solids, are negligible (Table 4). In contrast, the waste ponds have modest suspended solids concentration but negligible discharge. The combination results in a very small pollutant discharge from the waste ponds to Clarks Creek below Maplewood Springs.

Table 3. Washington State Dept of Fish and Wildlife Puyallup Hatchery Permit No. WA0039748 Discharge Data

	Flow (cfs)		Total Suspended Solids (mg/L)	
	Average	Range	Average	Range
Raceways	11	8 – 18	0.6	0 – 4
Waste Pond	0.005	0.001 – 0.009	15	1 – 140

Implementation approach (summary of actions)

The Clarks Creek watershed has a large portion of its waterways located in the city of Puyallup. The city of Puyallup is a NPDES Phase II community. Many implementation activities will overlap with requirements of the Phase II permit.

The tributaries are located mainly in unincorporated Pierce County. Pierce County is an NPDES Phase I community and has completed a basin plan for the Clear/Clarks Creek Basin. Many implementation activities for Pierce County will overlap with both the basin plan and the Phase I permit.

Please refer to the section *Performance Measures and Targets* to see activities already underway or completed during the writing of this implementation plan.

Priority has been assigned to Implementation Activities, summarized in the table below. Those items with priority 1 are the first actions that the partner must complete. Those items with a priority 2 are important, but can be completed as time and funding are available.

Table 4. Implementation Activities

Entity	Priority	Action	Completion Date
Friends of Clarks Creek	2	Work with neighborhood streamside owners to educate citizens about the importance of good streamside BMPs. Encourage them to plant trees. Remove invasive plants.	**ongoing**
	1	Coordinate with streamside neighbors willing to plant riparian plantings along streams in the Clarks Creek watershed	**As needed**
Pierce Conservation District	2	Promote and/or administer financial assistance programs for implementing riparian livestock, exclusion fencing and plantings	**ongoing**
	1	Work with individual property owners in the development and implementation of farm plans and water quality BMPs	**ongoing**
Pierce County (Water Programs)	1	Complete Rody Creek Restoration – all phases including construction	**2011**
	2	Implement BMPs through the requirements of the NPDES Stormwater permit.	**2013**

Entity	Priority	Action	Completion Date
	2	Implement BMPs and other measures in the Clear Creek Clarks Creek Basin Plan as funding allows	**ongoing**
Pierce County (Planning & Land Services)	1	Enforce Critical Areas Ordinance and other Pierce County land use regulations. Apply TMDL recommendations through SEPA reviews and comments.	**As needed**
City of Puyallup	2	Establish Friends of Parks volunteers who would help enforce park rules that may affect the water quality issue at DeCoursey Pond	**2009**
	1	Place an education kiosk at DeCoursey Pond to discourage feeding of waterfowl	**June 2009**
	1	Work in partnership with Washington State University (WSU) in an effort to use emerging technologies to control and reduce the waterfowl population within the Clarks Creek basin as specified in the WSU's 319 grant from Ecology.	**Beginning July 2009**
	2	Remove weir gates on DeCoursey Pond after pollution sources are removed.	**After pollution sources are controlled**
	2	Perform source identification sampling on Meeker Creek	**2011**
	2	Develop and implement a Pet Waste Program	**February 2009**
	2	Develop and plan for strategic shoreline purchases	**As opportunity arises**
	1	Waterfowl removal in DeCoursey Pond and Clarks Creek area.	**yearly**
	1	Increased education and outreach activities regarding prohibition of feeding waterfowl (i.e., newsletters, brochures, staff/citizen interaction)	**August 2009**
	2	Issue tickets to offenders pending city manager/council approval if education efforts fail	**If education program fails**

Entity	Priority	Action	Completion Date
Puyallup Tribe of Indians	1	Sampling on Clarks Creek to assist with "hot spot" identification and compliance assurance	**ongoing**
Tacoma Pierce County Health Department (Environmental Health)	2	Provide educational materials in areas where failing on-site systems have been identified.	**as needed**
	1	Investigate referrals from citizens/local governments where there is evidence of suspected on-site sewage failures.	**as needed**
Washington State Department of Ecology	2	Investigate non-dairy agriculture complaints brought to our attention by complaints or other contacts.	**Ongoing**
	2	When requested, assist in the review of quality assurance project (QAPP) plans for non-Ecology water quality monitoring efforts	**Ongoing**
	2	Assist stakeholder with identification of pollution sources	**Where needed**
	1	Enforce the Water Pollution Control Act (Ch. 90.48 RCW) requirements	**Ongoing**
	2	Perform inspections of construction stormwater sites and other permitted facilities.	**Ongoing**
	2	Conduct TMDL effectiveness monitoring when water quality standards are achieved.	**2015**
Washington State Department of Fish and Wildlife	1	Apply for funding to assist in sediment removal from the ponds and to keep gravel at optimum spawning quality.	**ongoing**
Washington State University Puyallup Research and Extension Center	1	Riparian buffer restoration: Perform various plantings along Clarks Creek.	**June 2012**
	2	Complete an environmental Assessment and Project Design for 319 project.	**March 2010**
	1	Initiate project to control pathogens at DeCoursey Pond	**June 2012**
	2	Complete citizen Science and Engagement Restoration and Education Task as listed in the upcoming 319 grant.	**June 2012**

Entity	Priority	Action	Completion Date
	2	Perform water quality monitoring and sediment assessment	**June 2012**
	1	Installations of waterfowl deterrents at DeCoursey Pond	**June 2012**
Western Washington Fairgrounds	1	Monitor discharge from the fairgrounds for fecal coliform bacteria.	**December 2010**

Adaptive management

An annual meeting of the stakeholders and partners will be held each year beginning in 2010 facilitated by Ecology. During this meeting, a review of completed implementation activities and monitoring results will be reported and recorded by Ecology. If water quality standards are achieved but wasteload and load allocations are not, the TMDL will be considered satisfied.

Partners will work together to monitor progress towards these goals, evaluate successes, obstacles, and changing needs, and make adjustments to the cleanup strategy as needed. Partners with a significant obligation to implement the plan include the city of Puyallup, Washington State University Puyallup Research and Extension Center, and Pierce County Surface Water Management. Other partners include the Puyallup Tribe, Tacoma Pierce County Health Department, Pierce Conservation District, Friends of Clarks Creek, Western Washington Fairgrounds, Pierce County Planning and Land Services, and Washington State Department of Fish and Wildlife.

It is ultimately Ecology’s responsibility to assure that cleanup is being actively pursued and water standards are achieved.

Funding Opportunities

Multiple sources of financial assistance for water cleanup activities are available through Ecology's grant and loan programs, local conservation districts, and other sources. The following table shows some of the potential sources of water cleanup funding.

Table 5. Possible Funding Sources to Support TMDL Implementation

Sponsoring Entity	Funding Source	Uses to be Made of Funds
Department of Ecology, Water Quality Programs (WQP)	Centennial Clean Water Fund, Section 319, and State Revolving Fund http://www.ecy.wa.gov/programs/wq/funding/funding.html	Facilities and water pollution control-related activities; implementation, design, 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 wastewater.
Puget Sound Partnership	Public Involvement and Education grants http://www.psat.wa.gov/Programs/Pie_Ed/round_14/02_intro_funding.htm	Project priorities include: reduce harmful impacts from stormwater; prevent contamination from public/private sewer systems and other nonpoint sources.
Pierce Conservation District	Federal Conservation Reserve Enhancement Program http://www.fsa.usda.gov/FSA/webapp?area=home&subject=prod&topic=cep	Conservation easements; cost-share for implementing agricultural/riparian best management practices (BMPs)
Natural Resources Conservation Service	Environmental Quality Incentive Program http://www.nrcs.usda.gov/programs/eqip/	Voluntary conservation program for farmers and ranchers that promotes agricultural production and environmental quality as compatible national goals; includes cost-share funds for farm BMPs.
Natural Resources Conservation Service	Emergency Watershed Protection http://www.nrcs.usda.gov/programs/ewp/index.html	NRCS purchases land vulnerable to flooding to ease flooding impacts.
Natural Resources Conservation Service	Wetland Reserve Program http://www.wa.nrcs.usda.gov/programs/wrp/wrp.html	Landowners may receive incentives to enhance wetlands in exchange for retiring marginal agricultural land.

Sponsoring Entity	Funding Source	Uses to be Made of Funds
Department of Ecology, Shore lands and Environmental Assistance (SEA)	Coastal Zone Protection Fund http://www.ecy.wa.gov/programs/sea/czm/309-improv.html	Some funding is available through a program that uses penalty monies collected by the WQP.
Office of Interagency Committee, Salmon Recovery Board	Salmon Recovery Funding Board http://www.iac.wa.gov/srfb/grants.asp	Provides grants for habitat restoration, land acquisition and habitat assessment.

Ecology will work with stakeholders to identify funding sources and prepare appropriate scopes of work that will help implement this TMDL.

Measuring Progress toward Goals

Performance measures and targets

TMDL reductions should be achieved by 2015. An interim target of 50 percent reduction will be achieved by 2012. This reduction should be achieved by the following implementation actions:

- The city of Puyallup is currently increasing vactoring and street sweeping to reduce fecal coliform bacteria entering the creek via their stormwater collection system.
- The city of Puyallup planted areas along Clarks Creek and the south bank of Meeker Creek.
- The city of Puyallup began newsletter updates in spring 2007 reminding pet owners of their responsibility, and has prepared a pet education program.
- The city of Puyallup will continue its ongoing program to remove residence waterfowl at strategic locations within the basin. The primary area of concern is DeCoursey Pond.
- The city of Puyallup will increase its education and outreach activities to include information about the negative impacts of waterfowl feeding. Anticipated education and outreach activities can include newsletters, brochures, and formation of a citizen action team that could monitor feeding activity.
- If removal and education are not successful, the city of Puyallup will be required to increase enforcement prohibiting feeding and may include ticketing offenders.
- The city of Puyallup will work with Washington State University on waterfowl deterrents in key locations, and riparian plantings.
- Pierce County Storm Water Management is working on Rody Creek. The restoration will reduce sediments and improve water quality in this tributary of Clarks Creek.
- The Washington State University Puyallup Research and Extension Center has applied for and been awarded a grant for $250,000. The grant is titled *Washington State University Puyallup Research and Extension Center Clarks Creek Water Quality Science, Restoration and Education Implmentation Program* and will help with restoration and fecal reduction along Clarks Creek.

Effectiveness monitoring plan

Effectiveness monitoring determines if the interim targets and water quality standards have been met after the in-stream water quality monitoring (the water quality implementation plan) is finished. These activities are usually conducted by Ecology's Environmental Assessment Program. Additionally, effectiveness monitoring is a part of the Washington State University Puyallup Research and Extension Center grant. The monitoring will determine if the best management practices (BMPs) being used are effective at reducing pollution. The Puyallup Tribe has agreed to assist Ecology in monitoring the implementation actions and how they are achieving reductions.

Reasonable Assurances

When establishing a TMDL, reductions of a particular pollutant are allocated among the pollutant sources (both point and nonpoint sources) in the water body – for the Clarks Creek Watershed for fecal coliform bacteria TMDL, both point and nonpoint sources exist. TMDLs (and related action plans) must show "reasonable assurance" that these 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 water cleanup plan are met.

Ecology believes that the activities described below already support this TMDL and add to the assurance that Clarks Creek Watershed will meet conditions provided by state water quality standards for fecal coliform bacteria. This assumes that these activities are continued and maintained.

The goal of the Clarks Creek Watershed water quality improvement plan for fecal coliform bacteria is for the waters of the basin to meet the state's water quality standards. The following rationale helps provide reasonable assurance that the nonpoint source TMDL goals will be met by 2015.

The following actions are completed or already underway:

- The city of Puyallup is currently increasing vactoring and street sweeping to eliminate reduce fecal coliform bacteria from entering the creek via their stormwater collection system.

- The city of Puyallup has planted areas along Clarks Creek and planted the south bank of Meeker Creek.

- The city of Puyallup began newsletter updates in spring of 2007 reminding pet owners of their responsibility and has prepared a pet education program.

- Pierce County Surface Water Management has been working on Rody Creek. The restoration will reduce sediments and improve water quality in this tributary that enters Clarks Creek.

- The Pierce Conservation District is working with a hobby farm to correct fecal coliform contamination that has been entering Rody Creek.

- The Tacoma Pierce Health Department conducted a sanitary survey on Rody Creek and corrected a septic failure as a result.

- The city of Puyallup is developing an updated shoreline master program (SMP) that will provide regulations intended to affect no net loss of shoreline functions and values. The SMP includes a restoration plan that addresses a range of projects to enhance the Clarks Creek and Puyallup River shorelines, consistent with the TMDL.

While Ecology is authorized under Chapter 90.48 RCW to impose strict requirements or issue enforcement actions to achieve compliance with state water quality standards, it is the goal of all participants in the Clarks Creek Watershed TMDL process to achieve clean water through voluntary control actions.

As discussed previously, if the actions in this document do not achieve the needed reductions in fecal coliform bacteria to meet water quality standards, we will use adaptive management to choose more implementation activities.

Ecology will consider and issue notices of noncompliance in accordance with the Regulatory Reform Act in situations where the cause or contribution of cause of noncompliance with load allocations can be established.

Summary of Public Involvement Methods

A presentation was made to the Puyallup River Watershed Council on July 22, 2009, discussing the upcoming comment period. The public comment period ran from November 2 through December 2, 2009. An announcement of the public comment period was placed on the Clarks Creek TMDL project website during the comment period. A display ad was placed in the Puyallup Herald and the News Tribune on November 4, 2009.

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Appendices

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Appendix A. Letters of commitment

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City of Puyallup
Engineering Services Support
333 South Meridian, Puyallup, WA 98371
Mark Higginson, P.E.
P 253.841.5559 F 253.840.6678
mhigginson@ci.puyallup.wa.us

MAR 27 2009

March 23, 2009

Cindy James
Department of Ecology
PO Box 47600
Olympia, WA 98504-7600

SUBJECT: Clarks Creek TMDL

Dear Ms. James:

In regards to our recent meeting concerning the Clarks Creek TMDL, the City would like to take this opportunity to further clarify our efforts to date and prioritize the following program activities.

The City will continue to seek grant opportunities which may provide funding of Clarks Creek TMDL activities.

The City will continue its ongoing program to remove residence waterfowl at strategic locations within the basin. The first primary area of concern is DeCoursey Pond. Physical removal of waterfowl at DeCoursey Pond is limited due to a large part of the population consisting of mallards which are a protected species.

In addition to the waterfowl removal, the City has previously posted signs prohibiting the feeding of waterfowl, but this action has met with limited success. As a result, the City will increase its education and outreach activities to include information which outlines the negative impacts associated with waterfowl feeding. Anticipated education and outreach activities can include such items as newsletters, brochures, staff-citizen interaction, as well as the formation of a Citizen Action Team(s) that could monitor the feeding activity.

If physical removal and the education program appear to be ineffective, the City will be required to increase enforcement prohibiting feeding and may include authorization for City personnel to issue tickets to offenders. Ticketing can be a politically sensitive and highly charged issue requiring City Manager and City Council approval.

In addition to the above noted activities, the City will continue to work with Washington State University, a regionally renowned research institution, in an effort to use emerging

Cc: CHarris RDannenberg MHoppen RAndreotti File technologies to control and reduce the waterfowl population within the Clarks Creek basin. This can include, but not necessarily limited to, unique riparian plantings, methods to reduce takeoff and landing patterns, and created wetlands technology. The goal of these emerging technologies is to measure the success of an activity, yet maintain the character of the park.

The City also intends to remove the weir gates which were installed to prevent planted fish from escaping from the pond. Since the pond is no longer utilized as a youth fishing pond, the gates are no longer required. As TMDL actions are implemented and fecal coliform bacteria counts are reduced to acceptable limits, the City will seek permits from Authorities Having Jurisdiction to remove these gates.

Finally, as a last resort of action associated with DeCoursey Pond, it may be necessary to drain the pond and remove the built-up sediment. If this action is necessary, arrangements will be made to legally dispose of any water and sediment which exceeds appropriate limits. The pond will be re-constructed to incorporate any actions noted above which proved to be successful in the reduction of waterfowl residence and fecal coliform bacteria.

Other actions the City will take include the following:

City staff is aware of a citizen who encourages duck residence along Meeker Creek by providing feed. Staff will attempt to discourage this activity through the City's outreach efforts. If the outreach proves unsuccessful, staff will work with the City Manager's Office to determine appropriate follow-up actions, including code provisions to support enforcement options.

The City will continue to maintain the riparian plantings that were placed along Meeker Creek between 9th Street SW and 14th Street SW in addition to the plantings placed at DeCoursey Park. Invasive weeds will be cut, or pulled, until the plantings are well established. Any plantings inadvertently injured or destroyed will be replaced. The City will also continue to seek additional locations along Clarks Creek and Meeker Creek for future plantings. This effort will be coordinated by the NPDES Coordinator.

Also, the City will test the discharge pipe from the North Meeker Creek Pump Station to confirm the City's original finding of iron bacteria. Iron bacteria is a naturally occurring microorganism that is prevalent in the Puyallup Valley due to the valley's iron rich soil. The bacteria are not harmful to the environment or waterways.

The City will supplement its existing Pet Waste Program with a renewed emphasis on public education and outreach. Information reminding residents to properly dispose of pet waste at home, as well as use established waste collector stations within City parks, will be provided in the City's newsletter, posted on the City website, and discussed in various public forums.

The City will continue implementation of the twice yearly catch basin vactoring in the basin as suggested during our TMDL planning sessions.

Lastly, the Operations group has hired a Water Quality Specialist whose responsibilities will include TMDL activities such as monitoring, inspections, illicit discharge detection, as well as assisting with public education and outreach. In addition, this position will assist directly with water sampling, source identification, and our source reduction efforts.

We hope this information satisfactorily meets your needs. We look forward to working with Ecology in our mutual efforts to achieve the highest possible water quality standards in Meeker Creek and Clarks Creek. If you have any further questions, please feel free to contact me at 253.841.5559.

Sincerely,

Mark Higginson, P.E.
Development Engineer

WASHINGTON STATE UNIVERSITY

Puyallup Research and Extension Center

18 June, 2009

Cindy James
Washington State Department of Ecology
South Puget Sound TMDL Coordinator
Southwest Regional Office
P.O. Box 47775
Olympia, WA 98504-7775

Dear Ms. James

The renewed emphasis on restoring Puget Sound has helped to bring focus to the issue of nonpoint source pollution of Washington's waters. Recognizing that nonpoint source pollution is strongly linked to local land uses and individual actions, Washington State University will combine science in action with education and demonstration strategies to reduce fecal coliform and sediments in Clarks Creek. The Washington State University Puyallup Research and Extension Center has begun restoration work along its Clarks Creek property buffer analyzing groundwater moving through planted stands of alder and poplar, and will daylight the mouth of the WSU Woodland Creek culvert in conjunction with Pierce County in the summer of 2009. As the Water Quality Implementation Plan is actualized for Clarks Creek, Washington State University, in partnership with the city of Puyallup, Pierce County, the Puyallup Tribe and Friends of Clarks Creek, will contribute to restoring Clarks Creek through the following tasks:

1) Riparian buffer restoration – demonstrate to property owners attractive streambank landscapes that are beneficial for stream health.
2) Pathogen control at DeCoursey Pond – install pilot-scale biofiltration cells to treat pond outflow prior to entering Clarks Creek and monitor field strategies to lower waterfowl density at pond.
3) Citizen science and engagement, restoration and education – create educational programs with the community that develop interest and results in restoration, suitable riparian habitats, and the value of clean water.
4) Best management practice implementation across the watershed - Best management practice (BMP) implementation will be stressed to provide reductions in fecal coliform loads and improve water quality in the Clarks Creek Watershed.
5) Water quality monitoring and sediment assessment – monitor Clarks Creek and tributaries to establish baseline conditions, as well as characterize spatial and temporal changes.

The Center has provided information, demonstrations, and education to the region since 1894 and will continue to use its science faculty and extension specialists to address the critical issues of water quality for the region.

Sincerely,

John D. Stark

John Stark, Director
Washington State University Puyallup Research and Extension Center

2606 W Pioneer, Puyallup, WA 98371-4998
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Serving People and Industries through: Instruction, Research, and Extension

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Appendix B. Response to comments

Comment from R. Peters by email

If by "Meeker creek" you are referring to the water course between the fairgrounds and Clarks creek, I have lived in Puyallup since 1949 and I have never heard it referred to as a "creek".   My understanding is that Meeker Ditch is a man made drainage ditch that helps drain Southwest Puyallup.   It may have been a WPA project (?).   I don't know when it was dug.

Maybe it's still a "creek", but not to most people in Puyallup.

Until about the mid 1950s, there was a Clark's Creek Drainage District.   Under that entity, the creek was dredged in the mid 1950s, and some of the residents attempted to improve drainage in SW Puyallup by removing snags, logs, etc. that were impairing water flow.   Some of the residents were irritated that they were required to help fund the dredging operation and the drainage district was dismantled.   After the cleanup and dredging, It was interesting to watch a sandbar about a foot deep move down the creek at the rate of about 1 or 2 feet per day from the maplewood springs area.

We used to live along the creek and if you pulled elodea out of the creek with a hoe, it was amazing how many small critters lived in it: small eels, tiny fish, etc.   You'd never see these creatures while the elodea is in the stream.

The water table is so high in the winter time in properties within a block or 2 of Clark's Creek, I'm surprised septic tanks work at all. Under part of the property we owned, you didn't have to dig more than 1-1/2 to 2 feet deep to hit blue clay.

Response

The name Meeker Creek was adopted by the city of Puyallup to help with restoration efforts. Thank you for the information on elodea and septic systems. We will be looking to remove elodea permanently from the stream and the Tacoma-Pierce County Health Department will assist us in any septic failures now and in the future.

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Appendix C. Tables of listings, wasteload and load allocations, and water bodies

Impaired beneficial uses and water bodies

The main beneficial uses to be protected by this TMDL are recreation and aquatic habitat. The impairments listed on the 2004 WQ Assessment are summarized in Table 1. The tributaries that will be addressed in this report, but not on the assessment are also summarized in Table 2.

Table 6. Impairments (Category 5) and waters of concern (*Category 2) from the 2004 Water Quality Assessment*

Category 5					
Water body	Parameter	Listing ID	Township	Range	Section
Clarks Creek	Fecal Coliform	7497	20N	04E	30
Clarks Creek	Fecal Coliform	7501	20N	04E	30
Meeker Creek	Fecal Coliform	7508	20N	04E	33
Clarks Creek	pH	7499	20N	04E	32
Meeker Creek	pH	7511	20N	04E	33
Category 2					
Meeker Creek	Dissolved Oxygen	7510	20N	04E	33
Meeker Creek	Temperature	7509	20N	04E	33
Clarks Creek	Dissolved Oxygen	35407	20N	04E	19
Meeker Creek	Fecal Coliform	7507	20N	04E	32

Table 7. Creek Watershed tributaries addressed in this report

Water body	Parameter	Township	Range	Section
Rody Creek	Fecal Coliform	20N	04E	30
Woodland Creek	Fecal Coliform	20N	04E	29
Diru Creek	Fecal Coliform	20N	04E	30

Concentration-based evaluation
Ecology evaluated data collected from August 2002 to September 2003 as combined data sets because not enough data points are available to evaluate separate wet and dry seasons. A valid statistical analysis of fecal coliform data requires a minimum of 10 data points. In addition, the samples that exceeded the water quality standards occurred throughout the year. The results do not indicate a "critical condition" attributed to rainfall or a particular season.

Table 7 presents the results of the analysis described in the section titled "Analytical Process." The table identifies the percent reductions needed (reserve included) for each creek to achieve compliance with the water quality standard.

Table 8. Percent reduction to meet fecal coliform water quality standard

Stream	N	Geometric Mean (cfu/100 mL)	90th Percentile (cfu/100 mL)	Percent Reduction to Meet Geometric Mean	Percent Reduction to Meet 90th Percentile	Target Capacity Geometric Mean (cfu/100 mL)*
Clarks Creek 1-3	32	132	402	34	57	57
Clarks Creek 4	11	20	68	none	none	20
Clarks Creek 5	11	21	211	none	18	17
Clarks Creek 6	10	107	301	18	42	62
Meeker Creek	11	725	2823	88	94	44
Rody Creek	10	496	3420	82	95	25
Diru Creek	10	23	158	none	none	23

*target capacity includes 13 percent reduction

The target reductions necessary to comply with the water quality standard are calculated using both the geometric mean (100 cfu/100 mL) and the 90th percentile value (200 cfu/100 mL). These reductions are presented, respectively in the Table 7 (Target Capacity Geometric Mean) in columns labeled "Percent Reduction to Meet Geometric Mean" and "Percent Reduction to Meet 90th Percentile." The most restrictive reduction becomes the target reduction.

The creeks in the TMDL that were not in compliance with the "90th Percentile" component of the state water quality standard will require greater reduction in fecal coliform bacteria. The necessary reductions are presented in the last column of Table 7. If the fecal coliform bacteria concentrations meet the respective target geometric mean then the water will be in compliance with both parts of the water quality standard.

Four samples were collected for Woodland Creek, but the number of samples was too low to allow valid statistical analysis. Clarks Creek 5 and Clarks Creek 6 each had a single sample in each data set that caused the data set to exceed the water quality standard. More data should be collected from these sampling locations to determine if reduction efforts are necessary.

The analyses indicate two streams (Meeker Creek and Rody Creek) and a segment of lower Clarks Creek (which is partly influenced by Meeker Creek and Rody Creek) have the most serious fecal coliform bacteria challenges. The percent reductions needed to achieve water quality standards are the more conservative values and are used to establish the load allocations.

The percent reductions calculated in these evaluations are goals. The final standard for achieving the TMDL is to comply with the water quality standard in Clarks Creek and its tributaries. This TMDL will be achieved when water quality standard is met throughout the Clarks Creek watershed.

Mass-based evaluation

Statistical evaluation of fecal coliform concentration data is required to evaluate compliance with the water quality standard. Fecal coliform mass loadings (number of organisms/day), although not applicable to evaluate compliance with the standard, can provide additional information to evaluate sources, dispersion, and transport mechanisms.

Ecology calculated the mass loadings of fecal coliforms in Meeker Creek, Rody Creek, and lower Clarks Creek using the stream flows measured during the sampling events and the respective fecal coliform concentrations using this formula:

> Mass Loading = stream flow · bacteria concentration • conversion factor (0.0245)
>
> Stream flow units are cubic feet per second (cfs) and bacteria concentration units are colony forming units (cfu).
>
> The conversion factor of 0.0245 converts flow units and bacteria concentration to billion (10^9) fecal coliforms per day.

A waterbody's hypothetical target load capacity for that same day is calculated in a similar manner using the flow data and the water quality standard for the 90th percentile value of 200 cfu/100 mL (the value equivalent to "not more than 10 percent of the samples").

Table 7 presents the calculated mass loadings of fecal coliforms and the corresponding loading capacity for that particular measured stream flow for Meeker Creek, Rody Creek, and the lower Clarks Creek. The measurements for both fecal coliforms and stream flow are instantaneous values. These values would actually vary throughout the 24-hour period. However, due to sampling and testing constraints, Ecology used the collected data to estimate a daily loading for the three streams and compare those loadings to the corresponding load capacity based on 200 cfu/100 mL allowed by the standards.

The mass loading evaluations do not provide additional information about compliance with the water quality standard. If the sample exceeds 200 cfu/100 mL, then the mass loading will exceed the mass-based load capacity of the stream.

Table 9. Fecal coliform mass loadings for Meeker Creek, Rody Creek, and lower Clarks Creek

	Meeker Creek					Rody Creek					Lower Clarks Creek				
Sampling Date	Fecal Count (cfu/100 mL)	Flow (cfs)	Fecal Loading (10^9/day)	Fecal Load Capacity (10^9/day)[3]	Exceed Load Capacity?	Fecal Count (cfu/100 mL)	Flow (cfs)	Fecal Loading (10^9/day)	Fecal Load Capacity (10^9/day)	Exceed Load Capacity?	Fecal Count (cfu/100 mL)	Flow (cfs)	Fecal Loading (10^9/day)	Fecal Load Capacity (10^9/day)	Exceed Load Capacity?
8/20/2002	360	1.2	10.6	5.87	yes						180	45.9	202	225	no
9/18/2002	5600	1.1	151	5.38	yes	260	0.7	4.45	3.43	yes	152	43.0	160	210	no
11/14/2002	100	3.5	8.56	17.1	no	44	0.7	0.7	3.43	no	80	49.3	96.5	241	no
12/10/2002	1200					2600	1.3				106	63.1	164	309	no
1/31/2002	1800	34.3	1510	168	yes	1020	9.9	247	48.4	yes	220	99.5	536	487	yes
3/12/2002	1060	15.6	405	76.3	yes	1260	1.7	52.4	8.32	yes	440	53.8	579	263	yes
4/17/2003	540	1.8	23.8	8.81	yes	7000					108	50.4	133	247	no
5/15/2003	860	6.4	135	31.3	yes	106	1.5	3.89	7.34	no	106	81.0	210	396	no
6/26/2003	1140	1.6	44.6	7.83	yes	260	0.7	4.45	3.43	yes	84	36.0	74.0	176	no
8/5/2003	300	1.6	11.7	7.83	yes	320	0.8	6.26	3.91	yes	40	31.9	31.2	156	no
9/12/2003	400	1.0	9.79	4.89	yes	380	0.7	6.51	3.43	yes	280	35.4	243	173	yes

Blank spaces indicate data not available

[3] Fecal Load capacity is the maximum mass fecal coliform loading in the stream that would not exceed the water quality standard.

Figure 14 shows the averages of the mass-based loadings of the data in Table 8 compared to the average load capacity based on the 90th percentile water quality standard and stream flows. While not applicable for evaluating compliance with the water quality standard, the mass-based evaluations provide another indication of the streams that could benefit from a TMDL and corrective action.

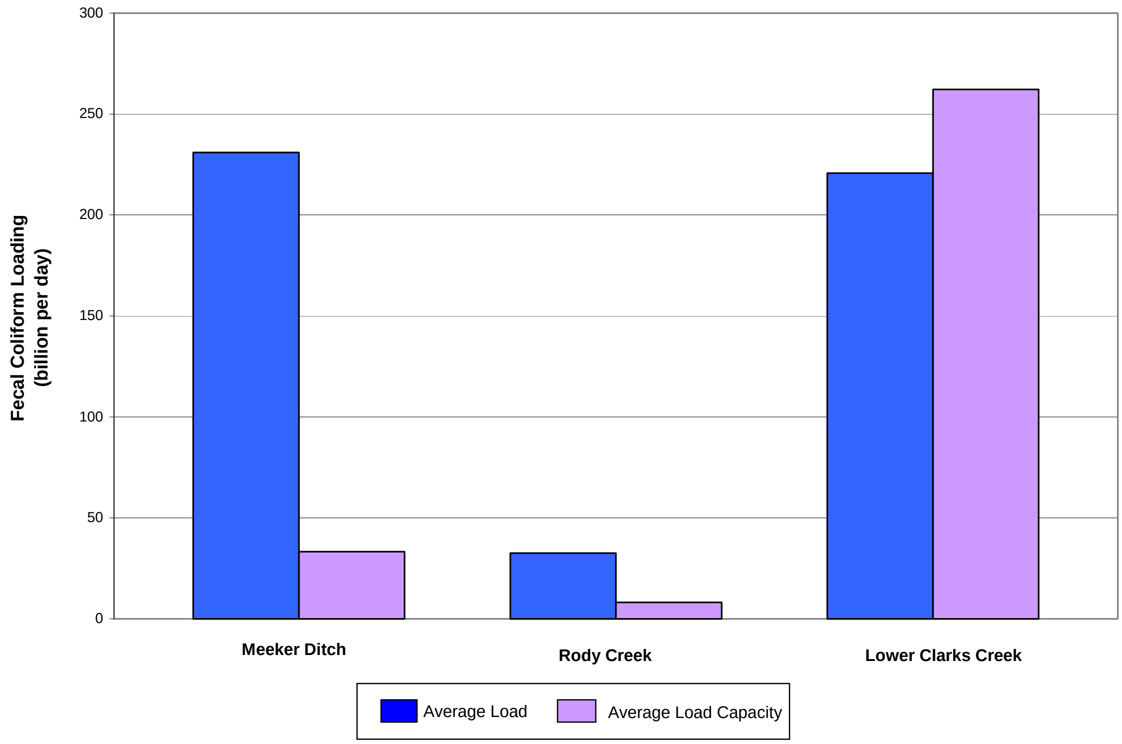

Figure 2. Average fecal coliform mass loadings and corresponding average load capacities

Appendix D. Glossary and acronyms

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 designated uses of the water – such as for drinking, recreation, aquatic habitat, and industrial use – are impaired by pollutants. These are water quality limited 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, and/or operational practices that, when used singularly or in combination, prevent or reduce pollutant discharges.

Char: Char (genus *Salvelinus*) are distinguished from trout and salmon by the absence of teeth in the roof of the mouth, presence of light colored spots on a dark background, absence of spots on the dorsal fin, small scales, and differences in the structure of their skeleton. (Trout and salmon have dark spots on a lighter background.)

Clean Water Act (CWA): Federal Act passed in 1972 that contains provisions to restore and maintain the quality of the nation's waters. Section 303(d) of the CWA 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 of whether or not the uses are currently attained.

Enterococci: A subgroup of the fecal streptococci that includes *Streptococcus faecalis, S. faecium, S. gallinarum,* and *S. avium*. The enterococci are differentiated from other streptococci by their ability to grow in 6.5% sodium chloride, at pH 9.6, and at 10^{o} C and 45^{o} C.

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. FC 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 (an 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 regular average (arithmetic mean) were calculated. This is helpful when analyzing bacteria concentrations because levels may vary anywhere from ten-fold to 10,000-fold over a given period. The calculation is performed by either: (1) taking the n^{th} root of a product of n factors, or (2) taking the antilogarithm of the arithmetic mean of the logarithms of the individual values.

Load allocation (LA): 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 (MOS): 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, storm water, 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, modifying, revoking and reissuing, terminating, monitoring, and enforcing permits, and imposing and enforcing pretreatment requirements under the Clean Water Act. The NPDES 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 forestlands, subsurface or underground sources, or discharges from boats or marine vessels not otherwise regulated under the NPDES program. Generally, it is any unconfined and diffuse source of contamination. Legally, it is any source of water pollution that does not meet the legal definition of "point source" in section 502(14) of the Clean Water Act.

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

Phase I stormwater permit: The first phase of stormwater regulation required under the federal Clean Water Act. The permit is issued to medium and large municipal separate storm sewer systems (MS4s) and construction sites of five or more acres.

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 with one or more acres of soil disturbance.

Point source: Sources of pollution that discharge at a specific location, generally 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 one acre 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, or (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.

Salmonid: Any fish that belong to the family *Salmonidae*. Basically, it refers to 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 snowmelt. 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, saltwater, wetlands and all other surface waters and watercourses within the jurisdiction of the state of Washington.

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 (WLAs) for point sources, 2) the load allocations (LAs) 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.

Wasteload allocation (WLA): The portion of a receiving water's loading capacity allocated to existing or future point sources of pollution. WLAs 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.

WQP: Water Quality Program