Whatcom County 2015 Water Quality Report and Priority Areas

Fecal Coliform in Coastal Drainages

Whatcom County Public Works

June 2016

Executive Summary

Whatcom County Public Works (WCPW) uses water quality monitoring, priority area ranking, pollution source identification, community education, technical and financial assistance programs, and regulatory enforcement to protect public health and prevent pollution of surface waters.

This annual report summarizes Whatcom County's bacterial water quality concerns, outlines the routine monitoring program, characterizes the current status of water quality at each monitoring station based upon the last three years of data, prioritizes areas for water quality improvement projects, and describes the areas where Whatcom County will be focusing efforts in the next year.

WCPW coordinates regular monitoring of fecal coliform levels at a fixed-network of approximately 80 sites in county watersheds that discharge to marine waters. All samples are analyzed at Department of Ecology certified laboratories using standard methods for fecal coliform analysis. Quality control steps are used to measure variability due to sampling methods and conditions. Sampling events are pre-scheduled, typically at least a month in advance, and provide data from a broad spectrum of environmental conditions throughout the year.

The status of each drainage area was evaluated based upon the most current water quality data available. The criteria and associated scores are described below for the five categories analyzed: annual geometric mean, annual 90th percentile, three year geometric mean, three year geometric mean for the dry season, and three year geometric mean for the wet season. Additionally, each site was scored for current status of the shellfish growing area to which the waterbody discharges. Higher points indicate higher levels of bacterial impairment. The top ten ranked drainages based upon 2015 data and the above described ranking criteria and scores are:

1. CA14c- California Creek (36 points)
2. TribDak3- Dakota Creek (36 points)
3. F1- Fishtrap Creek (36 points)
4. CA1- California Creek (33 points)
5. F4- Fishtrap Creek (33 points)
6. S1- Scott Ditch (33 points)
7. CA9- California Creek (30 points)
8. S3- Scott Ditch (33 points)
9. TribDak2- Dakota Creek (27 points)
10. K1a- Kamm Creek (27 points)

Based upon this ranking and other considerations, WCPW will continue community engagement and landowner assistance programs for water quality improvement projects in the current Drayton Harbor Focus Areas (CA14c, TribDak3, CA1, CA9, TribDak2, TribDak4, NFDak2.5 and TribDakN2) through a partnership with the Whatcom Conservation District. Additionally, WCPW will continue work with the Whatcom Conservation District, North Lynden Watershed Improvement District and City of Lynden in the Fishtrap Creek subwatershed to monitor water quality and provide technical and financial assistance to landowners. As resources allow, programs will be extended into the Scott Ditch watershed and other drainages in the upper California Creek subwatershed (CA16, Cal6.2, CA6). WCPW will continue partnering with the Whatcom Clean Water Program to coordinate monitoring and landowner contacts. As resources allow, partnerships are formed, or water quality improves, additional focus areas will be addressed.

Introduction

Purpose

Whatcom County Public Works' (WCPW) Pollution Identification and Correction (PIC) Program includes water quality monitoring, follow up monitoring at sites with elevated bacteria levels, community outreach, and coordination with County departments and other agencies to identify and address potential bacteria sources.

Whatcom County's PIC Program includes an annual review of routine monitoring sites located throughout the county. This annual review helps characterize the current status of watershed health and associated public health threats, focus limited county resources on the areas that will most benefit from water quality improvement efforts, and engage landowners in community solutions.

Currently, Whatcom County Public Works (WCPW) monitors fecal coliform and other water quality parameters at approximately 80 stations on at least a monthly basis. Sample collection is conducted following standard protocols by trained staff, contractors, project partners, and volunteers (WCPW 2008, WCPW 2013). Sample analysis is conducted following standard methods and quality control and assurance measures at DOE-certified laboratories. Data from the routine monitoring program assist the County Health Department, County Planning and Development Services (PDS), and other agencies to identify sources of bacterial pollution.

The Whatcom County PIC Program builds off several elements of the Kitsap County PIC program (BKCHD, KCHD 2011). These are routine monitoring, annual review and ranking of drainages, and initial voluntary interactions with landowners to identify pollution sources and provide tools to help improve management practices that may be impacting water quality. The annual review and ranking of drainages focuses pollution prevention efforts in areas that have most consistently shown high bacteria counts.

This annual report summarizes Whatcom County's bacterial water quality areas of concern, outlines the routine monitoring program, characterizes the current status of water quality at each monitoring station, prioritizes areas for water quality improvement projects, and describes the areas where Whatcom County will be focusing efforts in the next year.

Fecal Coliform in Whatcom County Waters

Water Resource Inventory Area (WRIA) 1 is located in the northwest corner of Washington State and encompasses over 60 percent of Whatcom County which is the most populated portion (Blake and Peterson 2005). WRIA 1 also includes small portions of Skagit County and British Columbia. Since 1998 a variety of water resource management stakeholders, local and state agencies, and tribal governments have worked together under the Watershed Management Act to characterize issues related to water quantity, water quality, fish habitat, and instream flows as well as to identify potential management solutions. The characterization completed in 2005 found fecal coliform to be the predominant water quality issue in Whatcom County based upon 303(d) listings. Of the 274 individual 303(d) listings for WRIA 1 in 1998, 82 were for fecal coliform, while the next most frequent, dissolved oxygen, had 48 listings. In 2008, there were 253 individual Category 5 303(d) listings for water in WRIA 1. Sixty-six of these Category 5 listings were for fecal coliform and listings for dissolved oxygen increased to 106.

Continuation of this widespread problem of elevated fecal coliform in Whatcom County waters is illustrated by the WCPW routine monitoring program data, recurring shellfish harvest closures, and recent public health advisories. Of the 78 freshwater stations with at least three years of data, only 18 (23%) meet water quality standards for fecal coliform (Appendix A). Elevated bacteria levels in marine waters have led to the establishment of three shellfish protection districts in Whatcom County: Drayton Harbor, established in 1995, Portage Bay, established in 1998, and Birch Bay, established in 2009. While Portage Bay shellfish growing areas had been completely reopened in 2006, a reoccurrence of declining water quality in the Nooksack River and Portage Bay resulted in another shellfish downgrade of approximately 500 acres in 2015.

Drayton Harbor historically supported non-tribal commercial, tribal commercial, ceremonial, and subsistence harvests, and recreational shellfish harvesting. The harbor had been at the top of the Washington State Department of Health (DOH) Fecal Pollution Index (FPI) list for over 10 years. Water quality improvements led to upgrades of commercial harvest in portions of the harbor to Conditional Approval in 2004 and 2010. In 2015, DOH and the Washington State Department of Fish and Wildlife reopened the recreational shellfish beach on the southwest corner of Drayton Harbor between April and October. This was the first time the recreational beach had been open to recreational harvest in over 15 years. However, all harvests (commercial, tribal, and recreational) still have a seasonal closure from November to February and a large portion of the harbor remains prohibited year-round. The community is currently tackling the harder non-point sources in an effort to regain Approved status throughout the year and the entire harbor.

Portage Bay supports commercial, ceremonial, and subsistence shellfish harvest for members of the Lummi Nation. Portions of the Portage Bay shellfish growing area were re-opened in 2003 and the remaining closed areas were reopened in 2006; however, starting in 2004 fecal coliform levels in the mainstem of the Nooksack River began increasing again. Between 2009 and 2012, the fecal coliform geometric mean at the mainstem site located at Marine Drive (M1) more than doubled. In 2015, portions of the Portage Bay shellfish growing areas were once again downgraded to a conditional approval management plan with spring and fall closures due to poor water quality.

Birch Bay is a large draw for recreational shellfish harvesters, including both locals and tourists. Birch Bay State Park has consistently been one of the top recreational shellfish areas of the state. The shellfish growing area around the mouth of Terrell Creek was downgraded to Prohibited in 2008 due to elevated levels of fecal coliform bacteria in the creek. Current fecal coliform levels in Terrell Creek are not as high as have been historically documented; however, several tributaries and the majority of coastal drainages discharging to the bay exceed both parts of the water quality standard for fecal coliform. In January 2014, there was a manure spill into Terrell Creek resulting in elevated bacteria levels at the mouth of the creek.

Northern Chuckanut Bay has been closed for recreational shellfish harvest since 1994 due to elevated bacteria levels and on-site sewage system (OSS) findings. Beginning in 2011, Wildcat Cove in Larrabee State Park was posted with a swimming advisory due to elevated bacteria levels. These advisories and closures are included in the *Whatcom County Fecal Coliform Levels and Shellfish Growing Area Status* map (Appendix B).

Sources of Fecal Coliform Water Pollution

The primary cause of pollution in Whatcom County's creeks and marine waters is nonpoint source pollution. Nonpoint source pollution is the term used to describe pollutants that come from many smaller sources, rather than a few large sources. This accumulation of pollutants often results from common activities in both urban and rural areas.

Although there are many types of water pollutants, Whatcom County focuses on fecal coliform bacteria as the primary indicator of surface water quality. Fecal coliform bacteria are found in the feces of human and warm-blooded animals. While most fecal coliform strains do not cause human illness, detection in a creek or bay do indicate that human and/or animal wastes and the associated harmful pathogens are present. Examples of pathogen-related illnesses are giardia, salmonella, viral gastroenteritis, hepatitis, and cholera. People are exposed to these pathogens through direct water contact, such as swimming, wading, or eating shellfish from waters with high bacteria levels.

The key potential sources of bacteria that have been identified in Whatcom County coastal drainages are (1) **animal waste** from agricultural operations, domestic pets, waterfowl, and urban wildlife, and (2) **human sewage**

from failing on-site sewage systems (OSS), leaking sewers, or cross-connections. Other potential bacteria sources continue to be investigated.

Water Quality Program

Water Quality Monitoring

WCPW conducts routine water quality monitoring to guide water quality improvement projects and meet the following goal and objectives.

Goal: Reduced fecal coliform levels at priority drainages to meet applicable water quality standards and support human health, recreational uses, animal health, and shellfish harvest.

Objectives:

- Assess surface water quality status and trends through long-term monitoring.
- Compare results against applicable standards.
- Prioritize hot spots for water quality improvement projects (both within the county and within a drainage areas).
- Identify public health concerns.
- Identify potential sources of bacteria and guide implementation of water quality improvement projects.
- Provide water quality data to the public and other interested parties.

Washington State Water Quality Standards

Table 1 lists water quality standards for fecal coliform bacteria at marine and freshwater sites in Whatcom County coastal drainages. These water quality standards that govern Whatcom County are established and regulated by the Washington State Department of Ecology and approved by the U.S. Environmental Protection Agency. They are described more fully in Chapter 173-201A of the Washington Administrative Code (WAC). The Lummi Nation has similar water quality standards for the Lummi Indian Reservation (Table 2). These standards apply to the Nooksack River downstream of Marine Drive and are monitored by the Lummi Natural Resources Department.

Table 1. Department of Ecology Water Quality Standards for coastal drainages.

Marine Water Standards	**Freshwater Standards**	**Freshwater Standards**
All Areas	Extraordinary Primary Contact Cain Creek, Birch Bay watershed	Primary Contact Nooksack, Drayton, and Chuckanut watersheds
• Geometric Mean- 14FC/100mL • Estimated 90th Percentile- 43 FC/100mL	• Geometric Mean- 50FC/100mL • Not more than 10% exceed 100 FC/100mL	• Geometric Mean- 100FC/100mL • Not more than 10% exceed 200 FC/100mL

Table 2. Lummi Nation Freshwater Water Quality Standards.

Freshwater Water Standards
Nooksack River (Downstream of Marine Drive)
• Geometric Mean- 50FC/100mL • Estimated 90th Percentile- 100 FC/100mL

Routine Monitoring

WCPW coordinates regular monitoring of fecal coliform levels at a fixed-network of approximately 80 sites in county watersheds that discharge to marine waters. Water samples are collected by WCPW staff, Washington Conservation Corps (WCC) crew members, Nooksack Salmon Enhancement Association (NSEA) staff, and trained community volunteers. Field teams are trained in sampling, storage, and lab delivery protocols. All samples are

analyzed at Department of Ecology-certified laboratories using standard methods for fecal coliform analysis. Quality control steps are used to measure variability due to sampling methods and conditions. Results are compared against data quality objectives to measure precision of results. Sampling events are pre-scheduled, typically at least a month in advance, and provide data from a broad spectrum of environmental conditions throughout the year. During some seasons, samples are unable to be collected due to no flow, tidal, or other environmental conditions. Water quality data are used to prioritize drainages for pollution identification and control projects and to characterize general patterns in declining and improving water quality. The WCPW staff coordinates with County Health, PDS, Whatcom Conservation District (WCD), State Departments of Agriculture (WSDA) and Ecology (DOE), and Watershed Improvement Districts (WIDs) to respond to drainages where elevated bacteria levels are consistently observed.

Data Quality Objectives

The various fecal coliform monitoring programs coordinated by Whatcom County include collection of field duplicates for 10% of the samples. For example, eight samples would require one field duplicate and fourteen samples would require two field duplicates. Field duplicates are collected immediately after the original sample in the same location. Precision of the field duplicates is evaluated in terms of relative standard deviation (RSD). The data quality objectives are 1) not more than 50% of duplicates have a RSD of greater than 20% and, 2) not more than 10% of duplicates have an RSD of greater than 50%. These data objectives are consistent with DOE objectives for bacteria Total Maximum Daily Load (TMDL) studies. Field duplicates with low bacteria levels (below 20FC/100mL) often show the higher variability and are analyzed separately from other duplicates for calculation of the RSD (Mathieu 2006). As summarized below, fecal coliform data collected over the last three years were compared to the data quality objectives for Drayton Harbor, Birch Bay, Portage Bay, and Coastal Drainage routine monitoring programs.

Drayton Harbor Watershed (WCPW)

From 2013 through 2015, there were 35 sampling events in the Drayton Harbor routine monitoring program conducted by WCPW staff. Field duplicates were collected for over 10% of the samples. Approximately 5% had a RSD of greater than 50% and about 38% had a RSD of greater than 20%. These RSDs meet the data quality objectives listed above.

Birch Bay Watershed (WCPW)

From 2013 through 2015, there were 71 sampling events in the Terrell Creek/Birch Bay routine monitoring program conducted by WCPW and NSEA staff. Field duplicates were collected for 10% of the samples. Review of field duplicates show approximately 13% had a RSD of greater than 50% and 56% had a RSD of greater than 20%, exceeding both data objectives. When WCPW duplicates with low bacteria levels are separated, both data objectives are met with 50% of RSDs exceeding 20% and 8% of RSDs exceeding 50%. Removal of field duplicates with low bacteria levels follows the methodology described by Mathieu (2006) for replicate precision evaluation. These data are accepted as adequate for this water quality review.

Portage Bay Shellfish Protection District (WCPW, NWIC)

From 2013 through 2015, there were 72 sampling events in the Portage Bay Shellfish Protection District routine monitoring program conducted by WCPW and NWIC staff. Field duplicates were collected for 10% of the samples. For the NWIC samples (2013), about 15% had a RSD of greater than 50% and about 44% had a RSD of greater than 20%. These field duplicates meet the data quality objectives for the number of RSDs that exceed 20%, but exceeds the objectives for the number of RSDs that exceed 50%. Similarly, review of the WCPW samples show approximately 13% had a RSD of greater than 50% and 41% had a RSD of greater than 20%, slightly exceeding the 50 % data objective. Tributaries sampled for the Portage routine run are typically larger systems and may present greater variability in bacteria concentrations. These data have been combined for analysis in this report and are accepted as adequate for this water quality review.

Coastal Drainages (WCC, MRC volunteers)
From 2013 through 2015, there were 32 sampling events in the Coastal Drainage routine monitoring program conducted by the WCC crew, WCPW staff, and trained MRC volunteers. Birch Bay had 32 sampling events (14%FD). Drayton Harbor had 30 sampling events. Field duplicates were collected for 10% of the samples. Seventeen percent of the duplicates had a RSD of greater than 50% and about 49% had a RSD of greater than 20%. When duplicates with low bacteria levels are separated, the data objectives are met with 4.9% exceeding the 50% RSD objective. Overall, the coastal drainage RSDs are accepted as adequate for this water quality review.

Water Quality Status in Whatcom County Creeks and Rivers
The following table summarizes how 2014 fecal coliform results at each routine monitoring site compare to the state water quality standards. The total number of sites and the number of sites failing the standard, partially meeting the standard, and meeting the standard are summarized for each watershed. More specific details for each monitoring site are provided in Appendix A.

Table 2. Summary of monitoring sites within each watershed in comparison to fecal coliform standards in 2015.

Watershed	Number of Sites	Number of Sites Exceeding Both Parts of Standards[a]	Number of Sites Exceeding One Part of Standard[b]	Number of Sites Meeting Both Parts of Standards[c]
California Creek	13	6 (46%)	4 (31%)	3 (23%)
Dakota Creek	17	5 (29%)	8 (47%)	4 (24%)
Terrell Creek	15	6 (40%)	7 (47%)	1 (6%)
Portage SPD	13	8 (62%)	3 (23%)	2 (15%)
Birch Bay Coastal	14	3 (21%)	8 (57%)	3 (21%)
Drayton Coastal	5	0 (0%)	0 (100%)	5 (0%)
Chuckanut Coastal	3	0 (0%)	3 (100%)	0 (0%)
Totals	**80**	**28 (35%)**	**33 (41%)**	**18 (23%)**

a- Indicates frequent elevated fecal coliform levels.
b- Indicates occasional elevated fecal coliform levels (or spikes).
c- Indicates consistently lower fecal coliform levels.

Water Pollution Clean Up Programs
Through the enhanced PIC program, Whatcom County watersheds discharging to marine waters are ranked and drainage-specific water quality improvement strategies are developed and implemented through community outreach and engagement for the highest priority areas. Each year staff determines the extent of priority areas that can be targeted based upon staff and other resource availability. Whatcom County, in partnership with the Whatcom Conservation District, will work with landowners to identify and implement community solutions to elevated fecal coliform bacteria levels. Through community engagement, technical assistance, and incentive programs a community sense of ownership and stewardship will be developed for neighborhood creeks. A regulatory backstop will be utilized as a final tool when elevated fecal coliform levels remain in an area and where landowners have selected not to participate in the voluntary program and there are egregious or repeated violations of regulations.

Once high ranking drainages are identified through routine monitoring, bracketed monitoring is needed to help track down hot spots in the drainage and identify stretches of the creek to be targeted for outreach, technical assistance, and financial assistance programs. If landowners choose to participate in the monitoring program, it helps raise awareness of water quality problems and develop ownership in identifying solutions. Developing a framework for improving water quality is most effective when hot spots or areas of consistently high bacteria levels can be identified within the neighborhood creek. Microbial source tracking and monitoring surrogate parameters may be used to assist landowners in developing a greater understanding of the bacteria sources

within their neighborhood creek and where to focus best management practices. The use of this technique will be limited to areas where very specific questions about bacteria sources have been identified.

When landowners are asked to change their practices to improve water quality, it is important to make these changes as easy as possible to implement. Two key resources that assist landowners to implement new management practices and repairs to OSS are technical and financial assistance. County Health has partnered with the Industrial Credit Union to provide low-interest loans for landowners replacing or making repairs to their OSS. Agricultural Best Management Practices (BMP) technical assistance is provided by the WCD. A financial cost-share program for agricultural BMPs on small farms is available through a partnership between Whatcom County and the WCD.

Ranking Purpose, Criteria, and Methods

Through this program, watersheds in Whatcom County that discharge to marine waters have been ranked by order of priority for Whatcom County water quality improvement programs. Drainage-specific water quality improvement strategies are developed and implemented for the highest priority drainages first.

The following ranking methods are an adaptation of the ranking methods used for the Kitsap County PIC Program (KCHD 2011). They consider water quality status (short and moderate-term) and potential public health threats. The application of the ranking methods to the routine monitoring stations identifies priority areas for water quality improvement projects. Some routine monitoring sites did not have three years of data as of December 2015 and thus were not included in the 2015 ranking process.

The water quality status category evaluated waterbodies based upon the most current water quality data available. Water quality data were evaluated for the most recent calendar year and the previous three years (Appendix A). The data objective was a minimum of monthly sampling; however, some sites were not able to be sampled every month due to no or low flow conditions. Data for each site were compared to applicable standards for that waterbody.

The criteria and associated scores are described below for the five categories analyzed: annual geometric mean, annual 90th percentile, three year geometric mean, three year geometric mean for the dry season, and three year geometric mean for the wet season. Additionally, each site was scored for current status of the shellfish growing area to which the waterbody discharges. For each monitoring site, points were assigned for each of these five categories and the sum of the five scores was multiplied by the shellfish growing area score. The scores for each monitoring site are included in Appendix C.

Scoring Formula:

Total Water Quality Score = (12month GM score + 12month %score + 3year GM score + 3yeardry GMscore + 3yearwet GMscore)* shellfish growing area score

Twelve Month (2015) Geometric Mean:

- Creek meets the appropriate standard for FC geometric mean during most recent calendar year – 0 points.
- Creek 2015 geometric mean is 1 to 5 times the appropriate standard – 2 points.
- Creek 2015 geometric mean is over 5 times the appropriate standard – 4 points.

Twelve Month (2015) 90th Percentile:

- Creek meets the appropriate standard for FC 90th percentile during most recent calendar year – 0 points.
- Creek 2015 90th percentile is 1 to 5 times the appropriate standard – 2 points.
- Creek 2015 90th percentile is over 5 times the appropriate standard – 4 points.

Three Year Geometric Mean:

- Creek FC three-year geometric mean meets the appropriate standard– 0 points.
- Creek FC three-year geometric mean is 1 to 2 times the appropriate standard – 1 point.
- Creek FC three-year geometric mean is 2 to 5 times the appropriate standard – 2 points.
- Creek FC three-year geometric mean is 5 to 10 times the appropriate standard – 4 points.
- Creek FC three-year geometric mean is greater than 10 times the appropriate standard – 6 points.

Three Year Geometric Mean for Dry Season:

- Creek FC three-year geometric mean for the dry season (May-September) meets the appropriate standard– 0 points.
- Creek FC three-year geometric mean for the dry season (May-September) is 1 to 2 times the appropriate standard – 1 point.
- Creek FC three-year geometric mean for the dry season (May-September) is 2 to 5 times the appropriate standard – 2 points.
- Creek FC three-year geometric mean for the dry season (May-September) is 5 to 10 times the appropriate standard – 4 points.
- Creek FC three-year geometric mean for the dry season (May-September) is greater than 10 times the appropriate standard – 6 points.

Three Year Geometric Mean for Wet Season:

- Creek FC three-year geometric mean for the wet season (October- April) meets the appropriate standard– 0 points.
- Creek FC three-year geometric mean for the wet season (October- April) is 1 to 2 times the appropriate standard – 1 point.
- Creek FC three-year geometric mean for the wet season (October- April) is 2 to 5 times the appropriate standard – 2 points.
- Creek FC three-year geometric mean for the wet season (October- April) is 5 to 10 times the appropriate standard – 4 points.
- Creek FC three-year geometric mean for the wet season (October- April) is greater than 10 times the appropriate standard – 6 points.

Shellfish Growing Area Score:

- Recreational, tribal, and commercial shellfish growing area with no advisory or closure – 1 point.
- Closed recreational shellfish growing area. – 2 points.
- Threatened tribal or commercial shellfish growing area – 2.5 points.
- Closed or conditionally approved tribal or commercial shellfish growing area – 3 points.

Ranking Results

The water quality scores were calculated for all monitoring stations that had three years of data (Appendix C). Higher points indicate higher levels of bacterial impairment. The top ten ranked drainages for Whatcom County water quality improvement projects based upon 2015 data and the above described ranking criteria and scores are:

1. CA14c- California Creek (36 points)
2. TribDak3- Dakota Creek (36 points)
3. F1- Fishtrap Creek (36 points)
4. CA1- California Creek (33 points)
5. F4- Fishtrap Creek (33 points)
6. S1- Scott Ditch (33 points)
7. CA9- California Creek (30 points)
8. S3- Scott Ditch (33 points)
9. TribDak2- Dakota Creek (27 points)
10. K1a- Kamm Creek (27 points)

Discussion

California Creek

The California Creek watershed is one of the two major areas discharging to Drayton Harbor. Drayton Harbor currently has a seasonal closure to shellfish harvesting from November through January. Three of thirteen routine sites monitored in the California Creek watershed ranked in the top ten priority drainages for the PIC Program: CA14c, CA1, and CA9. CA1 is a small perennial creek in the lower portion of the watershed. While bacteria concentrations at this site have been declining, the three-year geometric mean for CA1 was over two times the standard and the dry season three-year geometric mean is over five times the standard. CA14c and CA9 are seasonal creeks located in the upper portion of the watershed above Cal 6.5. This area was identified as being in most need of fecal coliform reductions through the *Draft Drayton Harbor Watershed Fecal Coliform Total Maximum Daily Load: Water Quality Improvement Report* (Hood and Mathieu 2010). CA14c has shown consistently high bacteria levels since 2006 when the creek was first monitored. Three three-year geometric mean and three-year wet season geometric mean are both over three times the standard (Appendix A). In 2015, over 70% of samples collected at CA14c exceeded 200cfu/100mL. The three-year geometric mean for CA9 was over two times the standard and the dry season three-year geometric mean is nearly five times the standard. Over 30% of the 2015 samples exceeded 200cfu/100mL at CA9.

Dakota Creek

The Dakota Creek watershed is the other of the two major areas discharging to Drayton Harbor. Two of seventeen routine sites monitored in the Dakota Creek watershed ranked in the top ten priority drainages for the PIC Program. TribDak3 and TribDak2 are located in the lower portion of the Dakota Creek watershed and are perennial creeks. TribDak3 had a 2015 geometric mean two times the standard and a dry season three-year geometric mean nearly four times the standard. Seventy-five percent of samples collected at TribDak 3 in 2015 exceeded 200 cfu/100mL. TribDak2 had a three-year geometric mean r two times the standard and dry season three-year geometric mean over four times the standard.

Portage Bay Shellfish Protection District (SPD)

Five of thirteen routine sites in the Portage Bay Shellfish Protection District ranked in the top ten priority areas for the PIC Program. F1 and F4 are located on Fishtrap Creek, one of the two largest creeks entering the lower Nooksack River. The 2015 geometric means for F1 and F4 were nearly two times the standard. F1 (the mouth of Fishtrap) has fairly consistent three-year geometric means across both the dry and wet season. F4 (at Main Street) has a higher three-year dry season geometric mean which is nearly four times the standard. S1 and S3 are located on Scott Ditch. Both sites had2015 geometric means two times the standard and over 50 % of samples exceed 200 cfu/100mL. K1a is a small creek that discharges into Kamm directly upstream of the bridge at Hampton Road. The three-year dry season geometric mean is over three times the standard.

Recommendations

The following are recommendations for 2015 County water quality improvement programs in the priority areas described above.

- Priority Areas 1,2 &3- In 2016, Continue PIC work in the Brown Malloy (CA14c, Lower Dakota (TribDak3 &TribDak2), and Loomis Trail (CA1) drainages. This includes enhanced water quality monitoring and landowner communication. Water quality has improved in the Lower Dakota drainage over 2015. This was the first PIC focus area.

- Priority Area 4- In 2016, continue work with the North Lynden Watershed Improvement District (NLWID) and City of Lynden to identify bacteria hot spots, conduct bracket monitoring, and support community engagement through partnerships.
- Other Areas-As resources allow, pursue partnership/communication with the South Lynden WID to identify hot spots and potential sources of bacteria in Scott Ditch. Continue work with partners to evaluate the K1a drainage and offer technical support to landowners.

References

BKCHD (Bremerton-Kitsap County Health District). *Manual of Protocol: Fecal Coliform Bacteria Pollution Identification and Correction Projects.* Kitsap County Surface and Storm Water Program.

Blake, S. and B. Peterson. 2005. *WRIA1 Watershed Management Plan- Phase 1.* WRIA1 Watershed Management Project.

Hood, S. and N. Mathieu. 2010. *Draft Drayton Harbor Watershed Fecal Coliform Total Maximum Daily Load: Water Quality Improvement Report*. Washington State Department of Ecology.

KCHD (Kitsap County Health District). 2011. *2011 Priority Area Work List Fecal Pollution Identification and Correction*. Kitsap County Surface and Storm Water Program.

Mathieu, N. 2006. Replicate Precision for 12 TMDL Studies and Recommendations for Precision Measurement Quality Objectives for Water Quality Parameters. Washington State Department of Ecology. Publication No. 06-03-044.

WCPW (Whatcom County Public Works) 2008. *County Response Strategy for High Bacteria Counts in Shellfish Protection Districts*. Whatcom County Public Works- Natural Resources.

WCPW (Whatcom County Public Works) 2009. *Standard Operating Procedures: Direct Grab Sample Collection with Sample Bottle for Fecal Coliform or Nutrient Analysis.* Whatcom County Public Works-Natural Resources.

WCPW (Whatcom County Public Works) 2013. *Whatcom County Water Quality Monitoring: Fecal Coliform Quality Assurance Project Plan.* Whatcom County Public Works- Natural Resources.

Appendix A: Water Quality Review by Monitoring Station

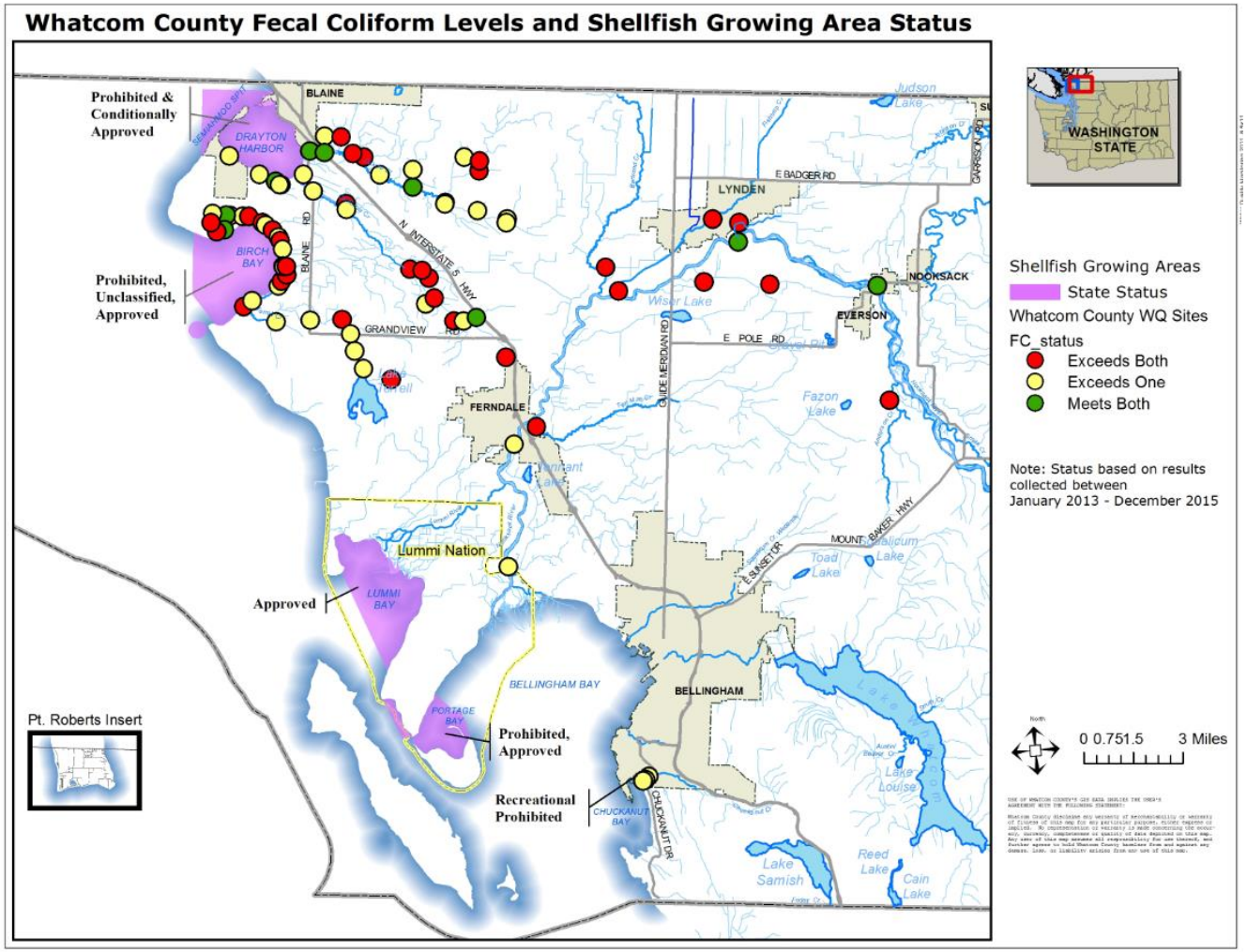
		2015				2013-2015 GMV		
Project Area	Station	#	GMV	%>200*	2015 Meets Stnd?	All	Wet	Dry
BB Coastal	BB4	7	24.3	14.3	Exceeds One	78.6	31.0	563.7
BB Coastal	BB6	8	17.6	12.5	Exceeds One	55.5	64.7	41.7
BB Coastal	BB8	9	71.5	44.4	Exceeds Both	115.4	91.2	124.9
BB Coastal	BB11	6	37.6	16.7	Exceeds Both	67.9	40.5	355.4
BB Coastal	BB16	3	95.1	66.7	Exceeds Both	93.5	100.4	46.0
BB Coastal	BB21	3	37.5	0.0	Meets Both	84.1	84.1	
BB Coastal	BB22	6	25.5	16.7	Exceeds One	42.2	26.3	190.7
BB Coastal	BB3	8	11.2	12.5	Exceeds One	19.9	16.9	23.6
BB Coastal	BB5	5	23.1	20.0	Exceeds One	37.7	14.4	379.8
BB Coastal	BB7	7	21.2	14.3	Exceeds One	38.0	21.5	370.7
BB Coastal	BB20	3	27.5	0.0	Meets Both	33.9	32.1	58.0
BB Coastal	BB15	3	22.8	33.3	Exceeds One	6.1	5.3	23.0
BB Coastal	BB18	3	17.2	0.0	Meets Both	11.8	11.8	
BB Coastal	BB19	3	11.9	33.3	Exceeds One	12.6	12.6	
California	Cal 5.0	12	89.5	16.7	Exceeds One	125.5	85.2	224.3
California	Cal 6.2	12	112.0	25.0	Exceeds Both	134.5	78.7	300.8
California	CA1	12	137.8	33.3	Exceeds Both	205.2	108.5	574.6
California	CA6	12	110.3	33.3	Exceeds Both	131.5	97.7	205.3
California	CA8	9	36.8	11.1	Exceeds One	75.8	62.3	123.6
California	CA9	9	201.8	33.3	Exceeds Both	257.2	205.8	486.0
California	CA14c	7	272.7	71.4	Exceeds Both	352.3	399.3	224.7
California	CA16	10	114.0	30.0	Exceeds Both	162.9	87.9	479.0
California	Cal 0.1	12	29.1	8.3	Meets Both	29.8	31.8	27.1
California	Cal 0.8	11	57.0	9.1	Meets Both	57.2	54.8	61.2
California	Cal 1.9	12	86.4	16.7	Exceeds One	90.6	64.1	158.5
California	Cal 7.5	12	77.9	16.7	Exceeds One	96.0	72.8	162.8
California	CA15	6	33.9	0.0	Meets Both	35.6	31.8	61.1
Coastal	CB1	9	54.6	33.3	Exceeds One	18.1	3.9	119.3
Coastal	CB3	17	83.6	29.4	Exceeds One	63.2	31.5	113.9
Coastal	CB4	17	68.6	29.4	Exceeds One	46.1	27.9	65.9
Coastal	DH14	3	6.5	0.0	Meets Both	23.8	11.0	200.5
Coastal	DH2	8	12	0.0	Meets Both	22.2	8.5	123.6
Coastal	DH3	11	17	9.1	Meets Both	20.4	13.0	38.8
Coastal	DH4	9	10	0.0	Meets Both	7.6	6.7	10.4
Coastal	DH5	6	13.7	0.0	Meets Both	41.3	17.6	348.6
Dakota	NFDak2.5	12	182.1	41.7	Exceeds Both	167.1	109.5	315.1

		2015				2013-2015 GMV		
Project Area	Station	#	GMV	%>200*	2015 Meets Stnd?	All	Wet	Dry
Dakota	TribDak2	12	156.2	41.7	Exceeds Both	201.6	117.1	455.5
Dakota	TribDak3	12	227.7	75.0	Exceeds Both	275.5	217.7	392.2
Dakota	TribDak4	12	85.5	16.7	Exceeds One	192.4	134.3	329.6
Dakota	TribDakN1	6	22.7	0.0	Meets Both	53.4	63.1	33.2
Dakota	TribDakN2	12	101.2	41.7	Exceeds Both	186.0	97.4	490.8
Dakota	TribDakS2	8	34.5	12.5	Exceeds One	89.8	55.1	218.6
Dakota	TribDak1	8	83.5	25.0	Exceeds One	101.6	99.4	110.6
Dakota	TribDak5	12	140.5	50.0	Exceeds Both	82.5	49.6	177.2
Dakota	TribDakS1	10	63.7	30.0	Exceeds One	66.4	40.6	150.7
Dakota	SFDak2.2	12	68.9	16.7	Exceeds One	97.1	80.1	129.2
Dakota	Dak 0.1	12	41.1	0.0	Meets Both	42.6	45.5	38.6
Dakota	Dak 0.6	9	64.1	0.0	Meets Both	56.5	77.6	32.7
Dakota	Dak 3.1	12	67.1	16.7	Exceeds One	71.8	62.6	89.6
Dakota	Dak 6.8	12	50.1	0.0	Meets Both	59.7	55.6	66.5
Dakota	NFDak0.1	12	69.9	16.7	Exceeds One	84.0	71.1	107.9
Dakota	SFDak0.2	12	83.7	25.0	Exceeds One	64.4	44.2	113.4
Portage	S1	19	200.8	52.6	Exceeds Both	221.1	186.5	283.4
Portage	S3	24	215.3	62.5	Exceeds Both	158.3	133.5	200.9
Portage	K1	24	153.3	33.3	Exceeds Both	167.5	139.9	213.5
Portage	K1a	23	123.4	30.4	Exceeds Both	220.7	161.2	328.4
Portage	F1	23	196.6	56.5	Exceeds Both	245.1	232.1	264.0
Portage	F4	24	171.3	62.5	Exceeds Both	204.3	140.2	359.4
Portage	B1	24	77.3	29.2	Exceeds One	134.4	88.6	204.7
Portage	T1	24	77.0	29.2	Exceeds Both	101.4	48.5	264.7
Portage	AND	24	108.4	33.3	Exceeds Both	116.9	66.4	257.9
Portage	M5	24	16.5	8.3	Meets Both	18.9	9.9	46.5
Portage	M4	22	12.8	4.5	Meets Both	17.1	9.8	37.6
Portage	M2	24	48.2	16.7	Exceeds One	51.6	4.7	67.3
Portage	M1	23	37.2	17.4	Exceeds One	42.7	34.4	57.1
Terrell	Ter1.9	23	99.0	39.1	Exceeds Both	80.1	32.9	298.1
Terrell	Ter1.6	24	49.0	20.8	Exceeds One	55.4	32.6	123.4
Terrell	TribTerLP1	23	98.7	45.8	Exceeds Both	76.5	25.7	269.7
Terrell	TribTerBC1	10	58.5	18.2	Exceeds Both	82.8	78.8	141.8
Terrell	TribTerBC2	11	48.3	27.3	Exceeds One	57.2	40.3	225.1
Terrell	TribFERN1	11	56.3	18.2	Exceeds Both	63.6	60.2	117.6
Terrell	Ter7.8	13	58.2	38.5	Exceeds Both	43.9	29.3	154.0
Terrell	Ter3.3	12	20.1	16.7	Exceeds One	31.5	24.9	76.5
Terrell	Ter0.7	24	42.6	12.5	Exceeds One	41.4	32.8	50.3
Terrell	Ter0.1*	24	25.1	4.2	Meets Both	32.7	37.2	27.8

		2015				2013-2015 GMV		
Project Area	Station	#	GMV	%>200*	2015 Meets Stnd?	All	Wet	Dry
Terrell	Ter0.1	23	38.7	17.4	Exceeds One	43.7	35.4	61.7
Terrell	Ter8.4	13	33.1	15.4	Exceeds One	21.1	17.7	29.3
Terrell	Ter5.0	14	47.0	21.4	Exceeds One	47.5	38.6	85.3
Terrell	Ter6.9	15	23.2	13.3	Exceeds One	28.7	24.2	57.0
Terrell	Ter6.3	15	54.2	33.3	Exceeds Both	51.3	53.3	54.5

* Greater than 100FC/100mL in Birch Bay and Terrell Creek.

Appendix B: Whatcom County 2015 Fecal Coliform Levels and Shellfish Growing Area Status Map



This map illustrates water quality status for sites sampled through the County's routine monitoring program. Red dots indicate fecal coliform results exceed both parts of the water quality standard, yellow dots indicate results exceed one part of the standard, and green dots indicate results meet both parts of the water quality standard. Areas highlighted in purple are shellfish growing areas monitored by the Washington State Department of Health.

Appendix C: 2015 Water Quality Scores by Station

Stream	Station	12 Month GM	12 Month % > 200	3 Year GM	3 Year Wet Season GM	3 Year Dry Season GM	Shellfish Area Multiplier*	Total Score**	Comments
California	CA14c	2	4	2	2	2	3	36	WC Focus Area, Seasonal
Dakota	TribDak3	2	4	2	2	2	3	36	WC Focus Area, Perennial
Portage	F1	2	4	2	2	2	3	36	WC Focus Area/ North Lynden WID
California	CA1	2	2	2	1	4	3	33	WC Focus Area, Perennial
Portage	F4	2	4	2	1	2	3	33	WC Focus Area/ North Lynden WID
Portage	S1	2	4	2	1	2	3	33	DOE focus area
California	CA9	2	2	2	2	2	3	30	Seasonal,Upper California Creek
Portage	S3	2	4	1	1	2	3	30	DOE focus area
Dakota	TribDak2	2	2	2	1	2	3	27	WC Focus Area, Perennial
Portage	K1a	2	2	2	1	2	3	27	DOE focus area
Dakota	NFDak2.5	2	2	1	1	2	3	24	
Portage	K1	2	2	1	1	2	3	24	DOE focus area
California	CA16	2	2	1	0	2	3	21	
California	Cal 6.2	2	2	1	0	2	3	21	
California	CA6	2	2	1	0	2	3	21	
Dakota	TribDakN2	2	2	1	0	2	3	21	
Portage	AND	2	2	1	0	2	3	21	
Dakota	TribDak4	0	2	1	1	2	3	18	WC Focus Area, Perennial
Terrell	TribTerLP1	2	2	1	0	4	2	18	
Terrell	Ter1.9	2	2	1	0	4	2	18	
Terrell	TribFERN1	2	2	1	1	2	2	16	
Terrell	TribTerBC1	2	2	1	1	2	2	16	
California	Cal 5.0	0	2	1	0	2	3	15	
Dakota	TribDak5	2	2	0	0	1	3	15	
Portage	B1	0	2	1	0	2	3	15	DOE focus area

Stream	Station	12 Month GM	12 Month % > 200	3 Year GM	3 Year Wet Season GM	3 Year Dry Season GM	Shellfish Area Multiplier*	Total Score**	Comments
Portage	T1	0	2	1	0	2	3	15	
Dakota	TribDakS2	0	2	0	0	2	3	12	
Dakota	TribDak1	0	2	1	0	1	3	12	
Terrell	Ter7.8	2	2	0	0	2	2	12	
Terrell	TribTerBC2	0	2	1	0	2	2	10	
BB Coastal	BB8	2	2	2	1	2	1	9	2013/2014 WC Focus Area, BBWARM, Seasonal
BB Coastal	BB4	0	2	1	0	6	1	9	
BB Coastal	BB16	2	4	1	2	0	1	9	
California	Cal 7.5	0	2	0	0	1	3	9	
California	Cal 1.9	0	2	0	0	1	3	9	
California	CA8	0	2	0	0	1	3	9	
Dakota	SFDak2.2	0	2	0	0	1	3	9	
Dakota	NFDak0.1	0	2	0	0	1	3	9	
Dakota	TribDakS1	0	2	0	0	1	3	9	
Dakota	SFDak0.2	0	2	0	0	1	3	9	
Terrell	Ter1.6	0	2	1	0	1	2	8	
BB Coastal	BB11	0	2	1	0	4	1	7	
BB Coastal	BB7	0	2	0	0	4	1	6	
BB Coastal	BB5	0	2	0	0	4	1	6	
Coastal	DH5	0	0	0	0	2	3	6	
Coastal	CB3	0	2	0	0	1	2	6	
Dakota	Dak 3.1	0	2	0	0	0	3	6	
Portage	M1	0	2	0	0	0	3	6	
Portage	M2	0	2	0	0	0	3	6	
Terrell	Ter5.0	0	2	0	0	1	2	6	
Terrell	Ter0.1	0	2	0	0	1	2	6	
Terrell	Ter3.3	0	2	0	0	1	2	6	

Stream	Station	12 Month GM	12 Month % > 200	3 Year GM	3 Year Wet Season GM	3 Year Dry Season GM	Shellfish Area Multiplier*	Total Score**	Comments
Terrell	Ter0.7	0	2	0	0	1	2	6	
BB Coastal	BB6	0	2	1	1	0	1	4	
BB Coastal	BB22	0	2	0	0	2	1	4	
BB Coastal	BB3	0	2	0	0	0	2	4	
Coastal	CB1	0	2	0	0	0	2	4	
Coastal	CB4	0	2	0	0	0	2	4	
Terrell	Ter8.4	0	2	0	0	0	2	4	
Coastal	DH14	0	0	0	0	1	3	3	
Coastal	DH2	0	0	0	0	1	3	3	
BB Coastal	BB19	0	2	0	0	0	1	2	
BB Coastal	BB15	0	2	0	0	0	1	2	
BB Coastal	BB21	0	0	1	1	0	1	2	
BB Coastal	BB20	0	0	0	0	1	1	1	
BB Coastal	BB18	0	0	0	0	0	1	0	
California	CA15	0	0	0	0	0	3	0	
California	Cal 0.8	0	0	0	0	0	3	0	
California	Cal 0.1	0	0	0	0	0	3	0	
Coastal	DH3	0	0	0	0	0	3	0	
Coastal	DH4	0	0	0	0	0	3	0	
Dakota	TribDakN1	0	0	0	0	0	3	0	
Dakota	Dak 0.1	0	0	0	0	0	3	0	
Dakota	Dak 0.6	0	0	0	0	0	3	0	
Dakota	Dak 6.8	0	0	0	0	0	3	0	
Portage	M4	0	0	0	0	0	3	0	
Portage	M5	0	0	0	0	0	3	0	
Terrell	Ter0.1*	0	0	0	0	0	2	0	

*Shellfish growing area score = 1 for open area, 2 for closed recreational area, 2.5 for threatened tribal/commercial area, 3 for closed or CA tribal/commercial area

** Total Score= (12GM score + 12%score + 3yr GM score + 3yrdry GMscore + 3yrwet GMscore)* shellfish growing area score

Appendix D: Routine Sampling Stations in Whatcom County

Watershed	Project Site ID	Site Location
Terrell	Ter 0.1	Mouth of Terrell Creek
Terrell	Ter 0.1*	Mouth of Terrell Creek, upstream of confluence with Leisure Park
Terrell	TribTer LP1	Leisure Park Tributary, East of Birch Bay Drive
Terrell	TribTer BC2	Birch Creek @Leeside
Terrell	TribTer BC1	Birch Creek @Morrison/Wooldridge
Terrell	Ter 0.7	Lower Terrell Creek @ Jackson Road
Terrell	Ter 1.6	Terrell Creek @Birch Bay State Park Bridge
Terrell	Ter 1.9	Terrell Creek @ Helwig Bridge (State Park)
Terrell	Ter 3.3	Terrell Creek @ Jackson Road, North of Grandview
Terrell	Ter 5.0	Terrell Creek @ Blaine Road
Terrell	Ter 7.8	Terrell Creek @Brown Road
Terrell	Ter 8.4	Terrell Creek @Aldergrove Road
Terrell	Trib FERN1	North Star Road, South of Aldergrove
California	Cal 0.1 (C1)	Mouth of California Creek at Drayton Harbor Road Bridge
California	Cal 0.8 (C2)	California Creek at Blaine Road Bridge
California	Cal 1.9	California Creek at Kickerville Bridge
California	CA1 (TribCal-2)	Downstream side of cross-culvert at Kickerville, west of Cal Creek
California	Cal 5.0 (C3)	California Creek at Valley View, downstream bridge
California	CA6	Upstream side of cross culvert at Arnie Road, west of Bruce
California	CA16 (TribCal-5)	Main Street Custer at dead end
California	Cal 6.2	California Creek at Bruce Road
California	CA8 (TribCal-4)	Upstream side of cross culvert at Bay Road, west of Bruce Road
California	CA9	Upstream side of cross culvert at Fox and Vista
California	Cal 7.5	California Creek at Fox Road, east of Vista
California	CA15	Upstream side of cross culvert at Portal, south of Farris
California	CA14c	Cross culvert at Brown Road, west of railroad
Dakota	Dak 0.1 (D1)	Dakota Creek at Blaine Road Bridge
Dakota	TribDak1	Downstream end of cross culvert at Sweet Road, east of Odell
Dakota	TribDak2	Upstream of cross culvert at Sweet Road, west of Harvey
Dakota	TribDak4	Upstream of cross culvert at Hoier Road, east of Harvey
Dakota	TribDak3	Downstream end of cross culvert at Rogers Road, south of Hoier
Dakota	Dak3.1 (DG)	Dakota Creek at Giles Road
Dakota	TribDak5	Bridge at Valley View, south of McGee
Dakota	Dak6.8 (D2)	Dakota Creek at Valley View and Behme Roads
Dakota	NFDak0.1 (D3)	NF Dakota at Custer School Road (upstream of bridge)
Dakota	SFDak0.2 (D4)	SF Dakota at Custer School Road (downstream of bridge)
Dakota	TribDakN1	Downstream end of cross culvert at Haynie Road, east of Stein
Dakota	NFDak2.5	NF Dakota Creek at Delta Line Road, south of Haynie
Dakota	TribDakN2	Upstream side of cross culvert at Delta Line, north of Badger
Dakota	TribDakS1	Downstream of 2nd culvert @ Delta Line, south of Loomis Trail
Dakota	SFDak2.2	Upstream side of bridge for SF Dakota at Sunrise Road
Dakota	TribDakS2	Downstream side of bridge at Sunrise Road, north of SF Dakota
Chuckanut	CB1	Small Woodstock Farm creek at culvert below dam structure
Chuckanut	CB2	Chuckanut Creek at Arroyo Park- near stream gage station
Chuckanut	CB3	Chuckanut Creek 18th Street Alley Bridge
Chuckanut	CB4	Mouth of Chuckanut Creek @ end of the footpath from Woodstock
Birch Bay	BB3	Birch Bay Golf Club, 7900 BB. Dr.

Watershed	Project Site ID	Site Location
Birch Bay	BB4	8036 BB Dr., Mariners Cove 24" concrete pipe on shoreline
Birch Bay	BB5	24"concrete pipe on shoreline across BB Dr. from Century Realty
Birch Bay	BB6	Outfall across from old Thai Steakhouse. Concrete culvert.
Birch Bay	BB7	8178 BB Dr. & Beach Way
Birch Bay	BB8	Shoreline outfall @ 8208 Birch Bay Dr. (Cedar)
Birch Bay	BB11	Deer Trail, Birch Point Rd., 1/2 submerged, 12" metal pipe.
Birch Bay	BB12	5216 Birch Point Rd. & Shintaffer, shoreline pipe.
Birch Bay	BB15	BB Village, structure draining "Big Lake" detention pond to marina
Birch Bay	BB16	BB Village, Beaver Pond inlet structure to marina @ Comox&Chehalis
Birch Bay	BB18	BB Village, ditch just east of 5550 Salish Road on north side of road
Birch Bay	BB19	BB Village, ditch running perpendicular to Salish @ Cowichan
Birch Bay	BB20	BB Village, inlet to Roger's Slough, located near "old" BB Village gate
Birch Bay	BB21	BB Village, Northeast corner of Skeena Way and Quinault Rd.
Birch Bay	BB22	Culvert under Birch Point Rd. into BB Village (speed limit sign)
Drayton	DH2	Outfall at shoreline at junction of Harborview & Drayton Harbor Rds
Drayton	DH3	24" cement pipe 10 m west of DH2 outfall
Drayton	DH4	24" cement pipe 20 m west of DH3 near 4985 DH Rd.
Drayton	DH5	Harbor Hillside Phase 1, 8" PVC pipe via public trail below bioswale
Drayton	DH14	1565 DH Rd., ditch @ property corner between driveway and DH Rd.
Nooksack	M5	Mainstem Nooksack River at Everson @ E.Pole Rd
Nooksack	M4	Mainstem Nooksack River at Lynden @ Hannegan Rd
Nooksack	M2	Mainstem Nooksack River at Ferndale @ Axton Rd
Nooksack	M1	Mainstem Nooksack River at Marietta @ Marine Dr
Nooksack	AND	Anderson Creek @ Roberts
Nooksack	S1	Scott @ Blysma Rd
Nooksack	S3	Scott @ Thiel Rd
Nooksack	K1	Kamm @ Hampton Rd
Nooksack	K1a	Side tributary to Kamm upstream of bridge at Hampton Road
Nooksack	B1	Bertrand Creek @ Rathbone Rd
Nooksack	T1	Tenmile Creek @ Barrett Rd
Nooksack	F1	Fishtrap Creek @ River Rd
Nooksack	F4	Fishtrap Creek @ E. Main (7th)

(Data collected by WCPW, NWIC, NSEA, MRC volunteers, and WCC crew in 2013-2015)