Whatcom County
Grant No. G1000002

GRANT TITLE: Northwest Straits Project: Marine Resources Committee Administration and Action Projects

TASK NO: 4.2 Water Quality Monitoring

(__) ANNUAL REPORT
(__) WORK PLAN
(__) PROGRESS REPORT No. 1 ☐ No. 2 ☐ No. 3
(__) FINAL PROGRESS REPORT
(__) PROJECT COMPLETION REPORT
(__) SUMMARY REPORT
(X) TECHNICAL REPORT
(__) PROTOCOL
(__) QUALITY ASSURANCE/QUALITY CONTROL

PERIOD COVERED: July 1, 2009 – June 30, 2010

DATE SUBMITTED: June 18, 2010

This report was funded in part through a cooperative agreement with the National Oceanic and Atmospheric Administration.

Water Quality Monitoring Project
5/24/06 through 5/26/10
Technical Report

Whatcom County Public Works- Natural Resources

June 18, 2010

For

Whatcom County Marine Resources Committee

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Introduction

Recreational and commercially harvested shellfish, specifically clams and oysters, are an important resource in Whatcom County. Areas of harvest in Drayton Harbor, Chuckanut Bay, and Birch Bay are either closed or partially closed due to fecal coliform pollution, limiting the number of publicly accessible beaches for safe and healthy shellfish harvest. The east side of Lummi Island is a small but popular clamming destination that is currently unclassified by the Washington Department of Health due to limited fecal coliform data. The Whatcom County Marine Resources Committee (MRC) has highlighted recreational clamming opportunities as a priority issue, and works with Whatcom County Public Works – Natural Resources (Natural Resources) staff to monitor the water quality of coastal drainages into these important regions. These data are used to supplement Natural Resources water quality monitoring programs to establish priority areas for outreach, education, and programs aimed at restoring water quality.

In 2006, the MRC developed a water quality monitoring project to collect information at freshwater discharges to Drayton Harbor, Birch Bay and Chuckanut Bay. In 2009, the east side of Lummi Island was added as a location to sample, while Birch Bay monitoring was covered by Whatcom County through a different grant source. The goals of the water quality monitoring project are:

- to collect fecal coliform bacteria data and loading estimates at priority freshwater inputs around the southern shore of Drayton Harbor, eastern side of Lummi Island, and at Chuckanut Bay in order to augment data collected by other programs;
- to involve volunteers in the collection of water quality data;
- to complement and enhance water quality monitoring efforts by other agencies throughout the County, including the City of Bellingham, Whatcom County Public Works, Washington Department of Health, and the Nooksack Salmon Enhancement Association;
- to assist in community outreach efforts emphasizing the need for clean marine waters for safe shellfish harvesting; and
- to assist in the selection of future clam enhancement project locations.

This report describes the procedures used to collect water quality data and presents a review of data collected from May 2006 through May 2010.

Background

In 2006, the MRC began a volunteer water quality monitoring project at Drayton Harbor, Birch Bay, and Chuckanut Bay. MRC members, Natural Resources staff, and volunteers were trained to collect grab samples of surface water for fecal coliform analysis and to estimate stream flow by the time of travel or catchment method. The eastern side of Lummi Island was added in late 2009 as a sampling location, and Birch Bay sampling continues through a different funding source. Sample collection and flow measurement occurs monthly during a low tide at up to five sites in Drayton Harbor, 18 in Birch Bay, four on Lummi Island, and four in Chuckanut Bay, depending on flow and tidal conditions. Fecal coliform bacteria results are compared to state water quality criteria to determine water quality status. Flow data can be used to estimate fecal coliform loads to the marine systems.

Samplers
From July 2009 through May 2010, the following community volunteers assisted Natural Resources staff with sample collection:

- Terry Sullivan (Birch Bay Village)
- Lynn Trzynka (Chuckanut Bay)
- Wanda Cucinotta (Lummi Island)

In January 2009, Washington Conservation Corps (WCC) crewmembers stationed with the Nooksack Salmon Enhancement Association (NSEA) began sampling in Drayton Harbor and at most Birch Bay locations, while volunteers continue sampling at the other locations. This change in procedure was ideal to streamline procedures and reduce coordination time. Although Birch Bay sampling and analysis is currently funded through a different source, data obtained from Birch Bay is included in this report to keep consistent between different years of MRC-supported water quality monitoring.

Sample dates, number of volunteers per event, and estimated volunteer hours from July 2009 through May 2010 are presented in Table 1 below. While NSEA is reimbursed for the WCC crewmembers time to collect samples, those six people are serving through Americorps and are considered volunteers to the organization. Their volunteer status is not considered in the table below.

Table 1. Water Quality Volunteer Information – WCC crew includes up to 6 people.

Sample Date	Number of Volunteers	Estimated Volunteer Hours
July 22, 2009	1 + WCC crew	2
August 20, 2009	2 + WCC crew	4
September 16, 2009	2 + WCC crew	4
October 14, 2009	3 + WCC crew	6
November 16, 2009	3 + WCC crew	6
December 22, 2009	2 + WCC crew	4
January 21, 2010	3 + WCC crew	6
February 18, 2010	3 + WCC crew	8
March 30, 2010	3 + WCC crew	6
April 28, 2010	3 + WCC crew	6
May 26, 2010	3 + WCC crew	6
June 24, 2010	*2 + WCC crew*	*4*
Total Estimated Hours:	*June hours are an estimate.*	**62**

Methods

Sample collection and flow measurement occur at freshwater tributaries and drainages to Drayton Harbor, Birch Bay, Lummi Island, and Chuckanut Bay. A description of the sample locations is provided in Table 2.

Procedures for sample collection and flow measurements are contained in the *Quality Assurance Project Plan Update-Whatcom County Volunteer Monitoring Program for Drayton Harbor, Birch Bay, and Chuckanut Bay Watersheds* (Hirsch Consulting Services, 2006). This document is available on the MRC website or in hard copy at the Natural Resources office. Care is taken to collect samples that represent flowing conditions; therefore, samples are not collected if water is stagnant or flowing upstream due to tidal influence. Water samples are collected directly into 100ml sterile plastic bottles by hand dipping the sample bottle 6 inches below the surface with the bottle opening facing upstream. Samples are stored on ice in a dark cooler and delivered to a state certified laboratory within 8 hours of sampling. Fecal coliform is measured using the standard membrane filtration technique.

At the majority of sites, stream flow is estimated using the time of travel method, which uses area and velocity to calculate flow. Area is determined by measuring stream segment length, width, and depth. Velocity is estimated by timing a floatable object between two points. At some sites, piped flow measurements are estimated using the catchment method (time it takes to collect a known volume of water) or, if possible, time of travel through the culvert.

Table 2. Sample Point Descriptions

Watershed	Site Id	Location	Description	Water Quality	Flow	Flow Method*
Drayton Harbor	DH2	Harborview & Drayton Harbor Rd. (E)	Outfall	✓	✓	TT
	DH3	Harborview & Drayton Harbor Rd. (W)	Outfall	✓	✓	TT
	DH4	Across from ~ 4985 Drayton Harbor Rd.	Outfall	✓	✓	TT
	DH5	Semiahmoo Trail	Creek	✓	✓	TT
	DH14	Ditch running under the driveway at 1565 Drayton Harbor Rd.	Ditch	✓	✓	TT
Birch Bay	BB1	Intersection of Woolrich & Morrison	Creek	✓	✓	TT
	BB2	Leisure Park	Creek	✓	✓	TT
	BB3	Golf Course	Culvert on Beach	✓	✓	TT
	BB4	Mariner's Cove	Culvert on Beach	✓	✓	TT
	BB5	8045 Birch Bay Dr	Culvert on Beach	✓	✓	TT
	BB6	8124 Birch Bay Dr	Culvert on Beach	✓	✓	TT
	BB7	Beach Way & Birch Bay Dr.	Culvert on Beach	✓	✓	TT
	BB8	Cedar St. & Birch Bay Dr.	Culvert on Beach	✓	✓	TT
	BB11	Deer Trail Rd. & Birch Bay Dr.	Ditch	✓	✓	TT

Watershed	Site Id	Location	Description	Water Quality	Flow	Flow Method*
Birch Bay, cont.	BB12	Shintaffer Rd. & Birch Bay Dr.	Channel	✓	✓	TT
	BB17	Birch Bay State Park	Terrell Creek	✓	✓	TT
	BB22	Birch Point Rd.	Creek	✓	✓	TT
Birch Bay Village	BB15	Marina pond	Outflow	✓		
	BB16	Beaver pond	Outflow	✓		
	BB18	N of Selder Rd.	Ditch	✓		
	BB19	Selder Rd.	Ditch	✓		
	BB20	Rogers Slough	Creek	✓		
	BB21	Skeena Way	Ditch	✓		
Chuckanut Bay	CB1	Woodstock Farm	Outfall	✓	✓	CM
	CB2	Arroyo Park	Upper Chuckanut Creek	✓	✓	TT
	CB3	18th St Alley	Chuckanut Creek	✓	✓	TT
	CB4	Chuckanut Bay	Lower Chuckanut Creek	✓	✓	TT
Lummi Island	LI1	~2183 Nugent Rd.	Creek	✓		
	LI2	Pocket beach immediately north of Ferry Terminal	Saltwater	✓		
	LI3	Outfall draining Ferry Terminal parking lot	Outflow	✓		
	LI4	~ 2038 Nugent Rd.	Creek	✓		
	LI5	"Donna's Beach"	Saltwater	✓		

*TT = Time of travel
CM = Catchment

Water Quality Criteria

The Washington State Department of Ecology has classified freshwater tributaries discharging to Drayton Harbor and Chuckanut Bay as primary contact recreation areas and those discharging to Birch Bay as an extraordinary primary contact recreation area (WAC 173-201A).

The Water Contact Recreation Bacteria Criteria in Fresh Water (WAC 173-201A-200 (2)(b)) are:

- *Extraordinary Primary Contact Recreation* - Fecal coliform organism levels must not exceed a geometric mean value of 50 colonies/100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 100 colonies/100 mL.

- *Primary Contact Recreation* - Fecal coliform organism levels must not exceed a geometric mean value of 100 colonies /100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 200 colonies /100 mL.

The Washington State Department of Ecology has classified marine waters of Lummi Island as primary contact recreation areas (WAC 173-201A).

The Water Contact Recreation Bacteria Criteria in Marine Water (WAC 173-201A-210 (3)(a)) are:

- Fecal coliform organism levels must not exceed a geometric mean value of 14 colonies/100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 43 colonies/100 mL.

Results

A review of the water quality results is provided in this section. A comparison of the water quality data to the Water Contact Recreation Bacteria Criteria in Freshwater and Marine Water is presented in Table 3.

- A status highlighted in green as "meets standards" indicates that the site has met the geometric mean standard and less than 10% of the samples exceed 100 cfu/100ml (Birch Bay), 43 cfu/100ml (Lummi Island salt water) or 200 cfu/100ml (Drayton Harbor, Lummi Island freshwater, and Chuckanut Bay) for the recreation bacteria freshwater criteria.
- A yellow "partially meets standards" indicates that the geometric mean is below the criterion, but more than 10% of the samples exceed either 100 cfu/100ml (Birch Bay), 43 cfu/100ml (Lummi Island salt water) or 200 cfu/100 ml (Drayton Harbor, Lummi Island freshwater, and Chuckanut Bay).
- A status highlighted in orange as "does not meet standards" indicates that the sample meets neither the geometric mean nor the 10% exceeding standard. However, the geometric mean is between 50 and 100 cfu/100 ml for Birch Bay, and is between 100 and 200 cfu/100 ml for Drayton Harbor, Lummi Island freshwater, and Chuckanut Bay. These sites are considered a high priority for follow-up and outreach.
- A red "does not meet standards" indicates the site is above the geometric mean standard, and greater than 10% of the samples exceed either 100 cfu/100ml (Birch Bay) or 200 cfu/100 ml (Drayton Harbor, Lummi Island freshwater, and Chuckanut Bay). The geometric mean for these sites is greater than 100 cfu/100 ml for Birch Bay and greater than 200 cfu/100 ml for Drayton Harbor , Lummi Island freshwater and Chuckanut Creek. These sites are considered the highest priority for follow-up and outreach actions.

It should be noted that the Lummi Island sample size is low due to its recent introduction as a sampling location.

Table 3. Comparison of Water Quality Data to Bacteria Criteria

Birch Bay

Site	Number of samples	GeoMean (cfu/100mL)	90th Pct (cfu/100mL)	% > 100 cfu/100 mL	Status as of 5/26/10
BB17	42	61	289	36	Does not meet standard
BB1	27	143	990	63	Does not meet standard
BB2	41	62	670	39	Does not meet standard
BB3	31	38	150	26	Partially meets standard
BB4	40	96	765	45	Does not meet standard
BB5	36	58	2195	36	Does not meet standard
BB6	38	104	1979	32	Does not meet standard
BB7	27	146	3460	52	Does not meet standard
BB8	32	539	4230	88	Does not meet standard
BB11	25	109	564	56	Does not meet standard
BB12	15	42	572	33	Does not meet standard
BB15	28	21	282	18	Partially meets standard
BB16	30	52	237	33	Partially meets standard
BB18	25	92	3020	44	Does not meet standard
BB19	21	11	92	10	Partially meets standard
BB20	27	41	552	30	Partially meets standard
BB21	22	78	3076	41	Does not meet standard
BB22	26	58	287	23	Does not meet standard

Drayton Harbor

Site	Number of samples	GeoMean (cfu/100mL)	90th Pct (cfu/100mL)	% > 200 cfu/100 mL	Status as of 5/26/10
DH14	14	33	131	7	Meets standard
DH2	28	9	205	11	Partially meets standard
DH3	30	41	259	13	Partially meets standard
DH5	30	45	236	20	Partially meets standard
DH4	21	6	64	5	Meets standard

Lummi Island

Site	Number of samples	GeoMean (cfu/100mL)	90th Pct (cfu/100mL)	% > 200 cfu/100 mL	Status
LI1	5	53	426	40	Partially meets standard
LI2*	7	9	52	0	Partially meets standard
LI3	3	4	35	0	Meets standard
LI4	6	67	222	17	Partially meets standard
LI5*	8	3	25	0	Meets standard
LI7	2	37	621	50	Partially meets standard

Chuckanut Bay

Site	Number of samples	GeoMean (cfu/100mL)	90th Pct (cfu/100mL)	% > 200 cfu/100 mL	Status
CB1	35	30	438	20	Partially meets standard
CB2	42	27	164	5	Meets standard
CB3	42	47	346	24	Partially meets standard
CB4	37	43	214	30	Partially meets standard

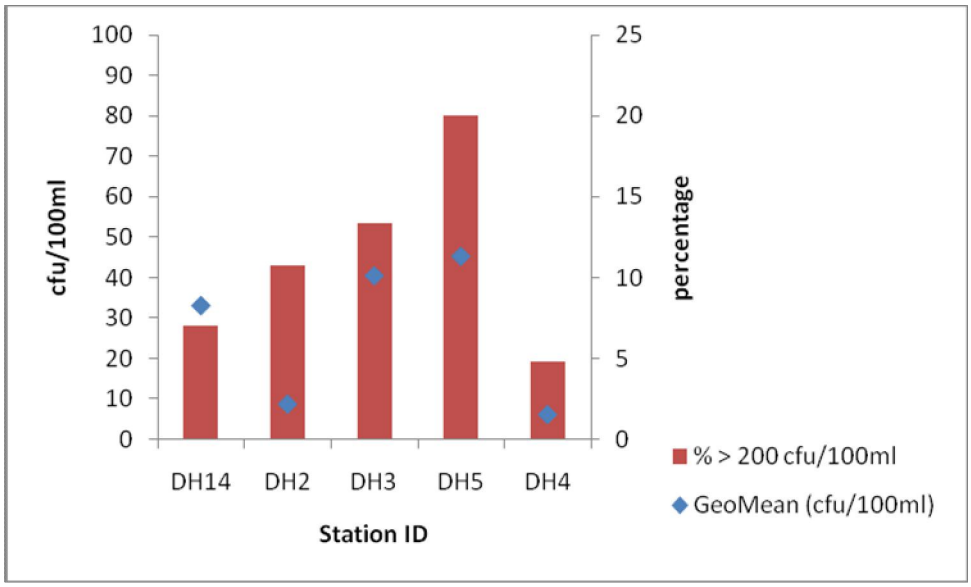
* indicates a saltwater sampling site with marine water criteria

Drayton Harbor

As of May 2010, 28 samples have been collected at DH2, 30 samples have been collected at DH3 and DH5, 21 samples have been collected at DH4, and 14 samples have been collected at DH4. All five sites meet the geometric mean criterion of less than 100 cfu/100ml. Three sites, DH2, DH3 and DH 5 do not meet the criterion requiring less than 10% of the samples to exceed 200 cfu/100ml, as seen in Figure 1. The DH2 site has seen a decrease in water quality since the last report, with its 90th percentile increasing to 205 cfu/100ml. A comparison of water quality data at Drayton Harbor to the bacteria criteria is presented in Figure 1.

Figure 1. Comparison of Drayton Harbor Data to Bacteria Criteria

Blue diamonds represent the geometric mean (cfu/100ml) at each site. Red bars represent the percent of samples exceeding 200 cfu/100ml.

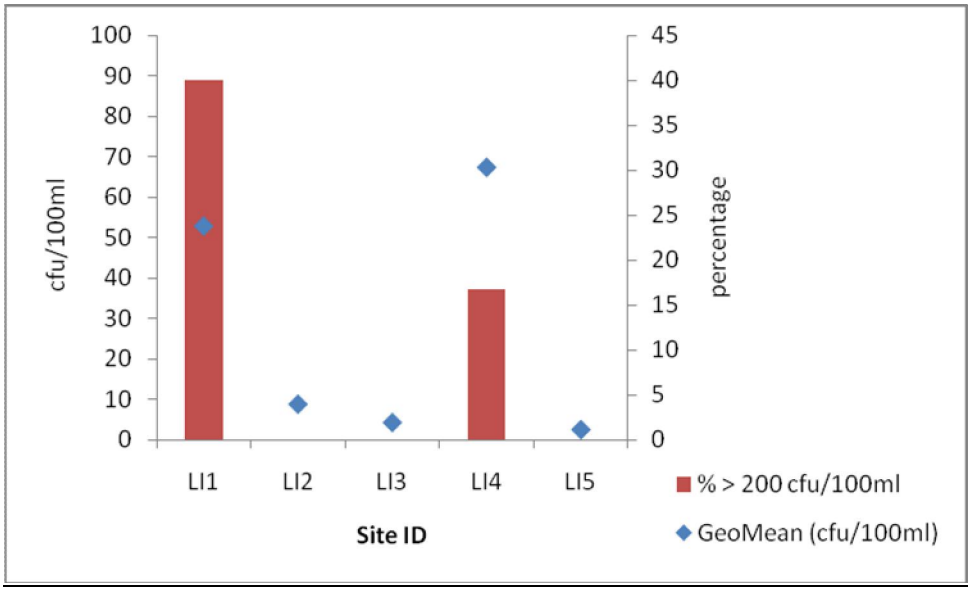


Lummi Island

As of May 2010, five samples have been collected at LI1, seven collected at LI2, three collected at LI3, six at LI4, and eight have been collected at LI5. The two saltwater sites, LI2 and LI5 both meet the geometric mean criterion of less than 14 cfu/100ml, although LI2 exceeds the criterion requiring sites to have less than 10% above 43 cfu/100ml. The freshwater sites all meet the geometric mean criterion of less than 100 cfu/100ml. Two sites, LI1 and LI4 do not meet the criterion requiring less than 10% of the samples to exceed 200 cfu/100ml, as seen in Figure 2. As sampling continues at this location we will begin to get a better picture for how these sites compare to water quality criteria. A comparison of water quality data at Lummi Island to the bacteria criteria is presented in Figure 2.

Figure 2. Comparison of Lummi Island Data to Bacteria Criteria

Blue diamonds represent the geometric mean (cfu/100ml) at each site. Red bars represent the percent of samples exceeding 200 cfu/100ml.

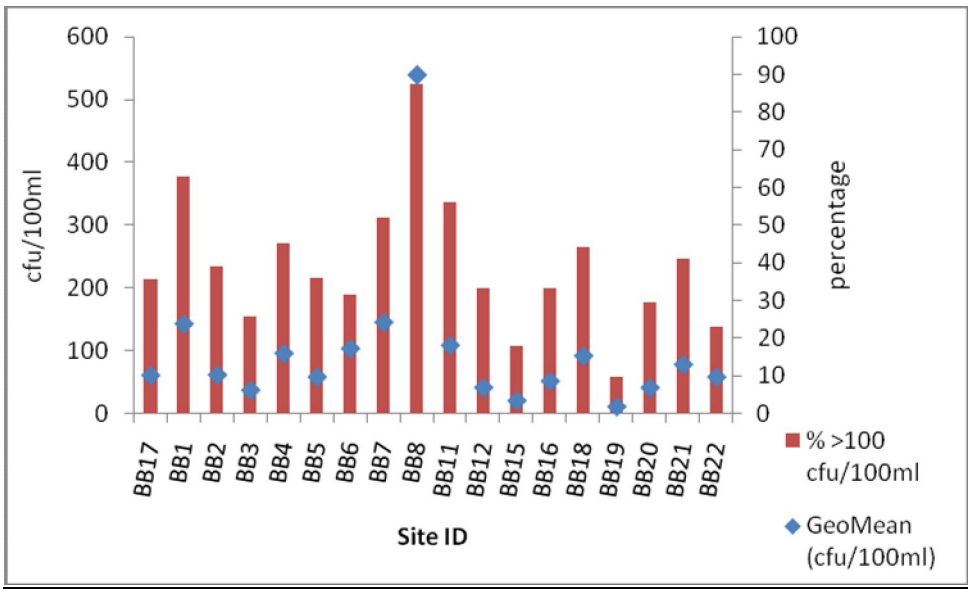


Birch Bay

Of the 18 freshwater sites sampled in Birch Bay, 13 meet neither the geometric mean nor the percentage exceeding 100 cfu/100ml criteria. Five sites meet the geometric mean criterion, but greater than 10% of the samples are higher than 100 cfu/100ml. This indicates that all of the sites have greater than 10% of the samples with greater than 100 cfu/100ml. A comparison of water quality data at Birch Bay to the bacteria criteria is presented in Figure 3.

Figure 3. Comparison of Birch Bay Data to Bacteria Criteria

Blue diamonds represent geometric mean (cfu/100ml) at each site. Red bars represent percent of samples exceeding 100 cfu/100ml.

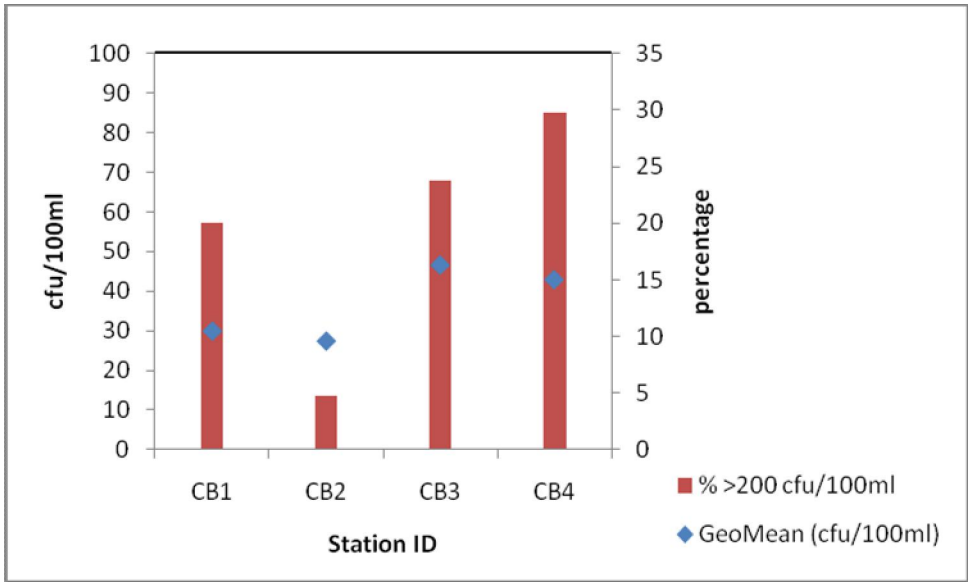


Chuckanut Bay

As of May 2010, 35 samples have been collected at CB1, 42 at CB2 and CB3, and 37 at CB 4. All four sites meet the geometric mean criterion of less than 100 cfu/100ml. CB2 meets both criteria, while CB1, CB3, and CB4 all exceed the percentage criterion. A comparison of water quality data at Chuckanut Bay to the bacteria criteria is presented in Figure 3.

Figure 2. Comparison of Chuckanut Bay Data to Bacteria Criteria

Blue diamonds represent geometric mean (cfu/100ml) at each site. Red bars represent percent of samples exceeding 200 cfu/100ml.



Discussion

These data suggest that fecal coliform remains an important pollutant of concern in freshwater tributaries and discharges to Drayton Harbor, Birch Bay, Lummi Island and Chuckanut Bay. Birch Bay continues to be of particular concern; both due to its importance as a recreational harvest and swimming area, and as the stations there all exceed at least one of the criteria for water quality. Lummi Island data is limited, but with continued sampling we will be able to draw greater conclusions about what pollution influences the surrounding land uses may have on recreational harvest areas. The Drayton Harbor drainage sites focused on in this report continue to improve in water quality, despite occasional high fecal coliform counts. Two of the sites are well within both standards, and one site is 5 cfu/100 ml away from meeting both standards. The remaining two sites should be focused on for follow-up outreach and education. The Chuckanut drainages sites have seen a decrease in water quality since last year, although all sites still fall well within the geometric mean criterion. The 90th percentile of the sites has increased, indicating occasional spikes are still persistent in the watershed. A community volunteer has recently begun monitoring more frequently and at more locations in the Bay to attempt to distinguish from where sources of bacterial pollution may be coming.

The MRC water quality monitoring project is scheduled for funding through June 2011. The MRC is working with Whatcom County to develop outreach and response strategies to identify and control fecal coliform sources. Coordinated efforts between Whatcom County Natural Resources, Nooksack Salmon Enhancement Association, Whatcom County Beach Watchers, Birch Bay Watershed and Aquatic Resource Management, and others, will help ensure that sampling continues to occur in an efficient and adequate manner.