Whatcom Clean Water Program Quarterly Progress Report
October 1- December 31, 2014

Quarterly Overview

Program partners continue bacteria pollution identification and correction efforts -

- Pages 2-6 summarize fecal coliform bacteria* sampling and results
- Pages 6-10 summarize property assessments and results
- Pages 11-17 include maps of fecal coliform sampling locations and results

Pending downgrade of Portage Bay shellfish harvest -
Washington Department of Health's (DOH) Office of Shellfish and Water Protection staff evaluated the marine water fecal coliform (FC) sampling data collected in Portage Bay through December 2014. Five marine stations in Portage Bay are failing to meet National Shellfish Sanitation Program standards.

DOH staff worked in consultation with Lummi Nation to propose boundaries around the five stations where growing area classification is to be downgraded. The resulting "Addendum to the Sanitary Survey Report of Portage Bay" proposed a downgrade to classification of 496 acres of the tribe's commercial growing area. DOH will issue an administrative order finalizing the downgrade in March 2015.

Whatcom County Pollution Identification & Correction (PIC) program -
In December 2014, County Council members approved a $300,000 grant agreement between Whatcom County and Washington Department of Health (DOH) to support the county-led Pollution Identification and Correction (PIC) program:

- One full-time position at Whatcom Conservation District (WCD) to work with non-dairy livestock owners to assess potential FC bacteria sources and provide technical and financial assistance if needed for corrections.
- Partial positions at County Planning & Development Services (PDS) and at Public Works. Public Works will coordinate landowner contact and PDS staff will provide regulatory enforcement for residents who choose not to correct violations and pollution discharges associated with critical areas.

In addition to grant funding through DOH, new County funding was included in the 2015-2016 budget to support WCD's community outreach staff and to help WCD provide cost-share assistance for landowners to implement agricultural Best Management Practices (BMPs).

Drayton Harbor shellfish harvest -
The conditionally approved classification for Drayton Harbor shellfish harvest remains in place, with commercial shellfish harvest prohibited from November through January due to poor water quality.

In order to regain the economic benefits of commercial harvest and public health benefits of clean water, enhanced County PIC efforts in 2015 will focus in "hotspot" areas with high fecal coliform levels. These areas are Lower Dakota, Loomis Trail and Brown-Malloy.

Program website -
The Whatcom Clean Water Program website - (http://www.ecy.wa.gov/water/whatcomcleanwater/) - contains past quarterly reports, program partner and contact information, a list of frequently asked questions, and other information.

*Fecal coliform bacteria monitoring results are reported in fecal coliform per 100 milliliters of sample for each sample location (FC/100mL).

1. FECAL COLIFORM BACTERIA SAMPLING & RESULTS

LOWER NOOKSACK/PORTAGE BAY WATERSHED
Monitoring fecal coliform density

Whatcom County Public Works (Public Works):

- Public Works sampled fecal coliform (FC) bacteria twice monthly at 17 fixed-location sites throughout the lower Nooksack watershed (see Figure 1). Four sampling locations are on the mainstem Nooksack River (upstream to downstream: M5, M4, M2, and M1). Other sites measure FC density at tributaries before water flows into the Nooksack River. The sub-basins of Fishtrap Creek, Scott Ditch, Bertrand Creek, Wiser Lake/Cougar Creek, Schneider Ditch and Tenmile Creek all flow into the Nooksack River between the M4 and M2 mainstem Nooksack River sampling locations.
- Data gathered during 2014 for the 17 routine monitoring sites shown in Figure 1 is available online on the Public Works Natural Resources webpage http://www.whatcomcounty.us/publicworks/water/naturalresources/pic.jsp#Monitoring.
  - The Portage Bay Shellfish Protection District Sampling Sites link describes monitoring site locations.
  - The Portage Bay Shellfish Protection District Monitoring Results link documents results at each station for routine sampling during 2014.

Figure 1— Whatcom County Public Works routine water quality monitoring sites in the Lower Nooksack/Portage Bay watershed

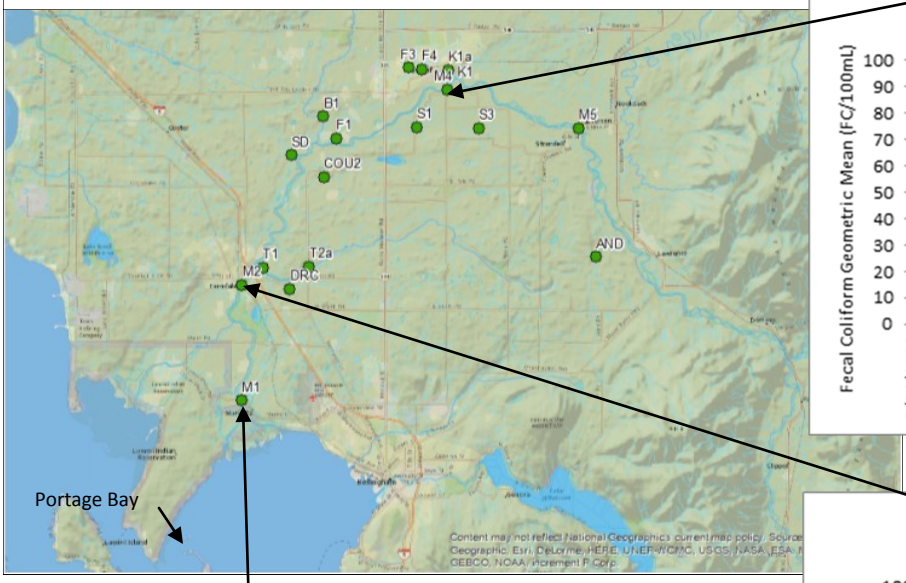


Figure 2 - Nooksack River (M4) upstream Lynden
Fecal coliform geometric mean

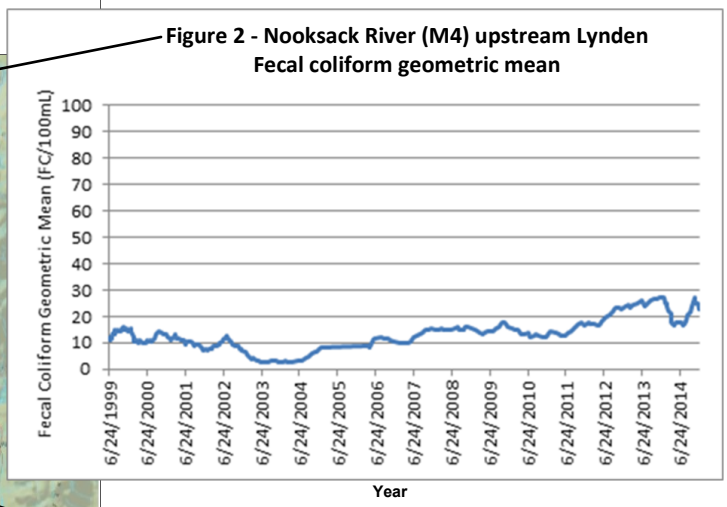


Figure 3 - Nooksack River (M2) at Ferndale
Fecal coliform geometric mean

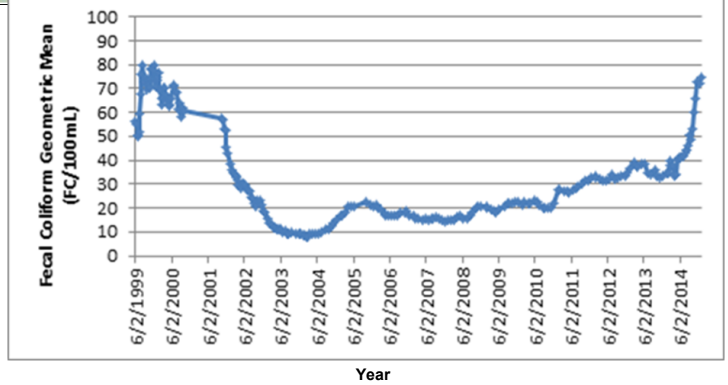
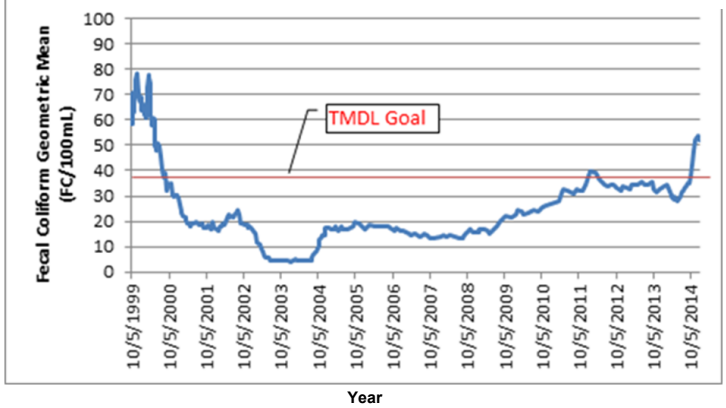
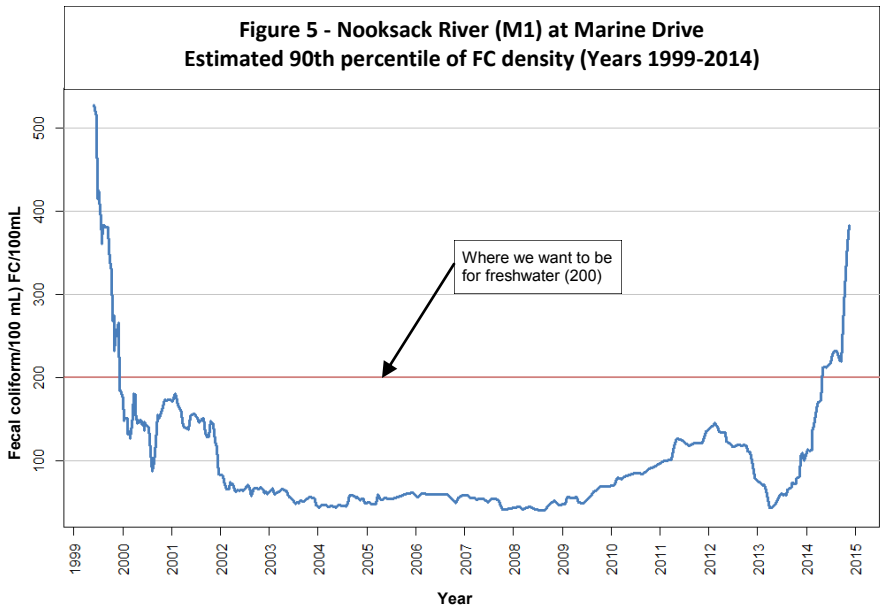
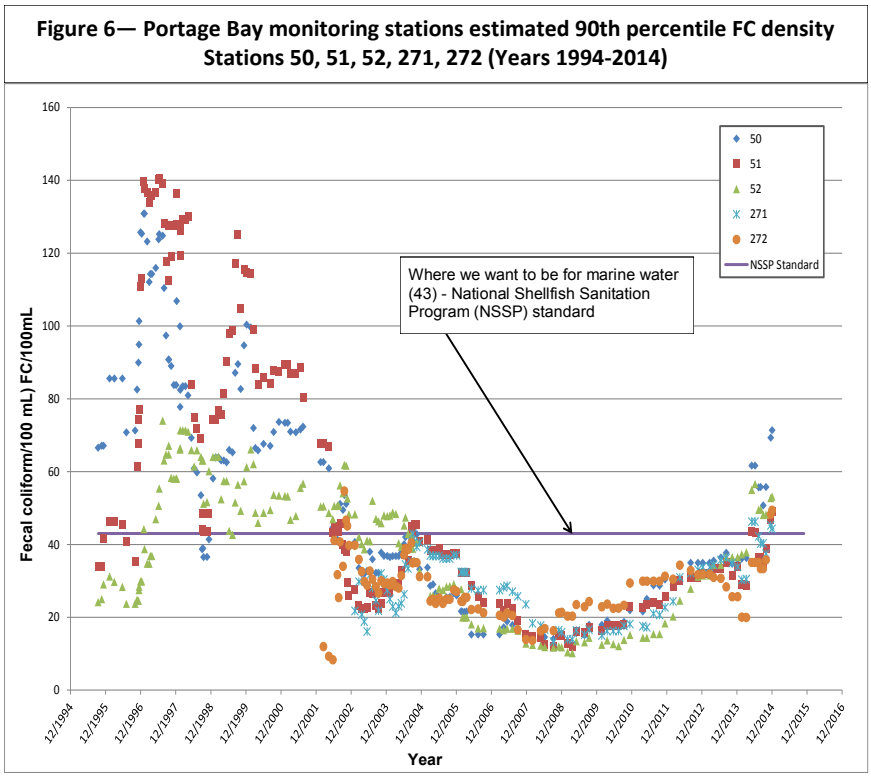


Figure 4 - Nooksack River (M1) at Marine Drive
Fecal coliform geometric mean







- Figures 2-4 illustrate a 30-sample FC geometric mean trend in the Nooksack River through 2014 using data collected by Northwest Indian College and Whatcom County Public Works.
- Figure 4 shows that by the end of 2014 the geometric mean FC bacteria concentration measured in the Nooksack River at Marine Drive (M1) was above the goal of 39 FC /100mL set by the Lower Nooksack Bacteria Total Maximum Daily Load (TMDL) detailed implementation plan.

The TMDL goal of 39 FC/100mL at M1 is stricter than the geometric mean criterion in the state's water quality standard[1]. The 39 FC/100mL goal is the expected value when bacteria concentrations are meeting the 90th percentile criteria of the water quality standard.

When the TMDL bacteria concentration goals are achieved in freshwater of the Nooksack River, marine shellfish harvesting bacteria criteria should also be met[2].

The increase in the estimated 90th percentile in the Nooksack River shown in Figure 5 correlates with increased 90th percentile values in FC density measured at five marine water monitoring stations (50, 51, 52, 271, and 272) in Portage Bay most directly affected by Nooksack River flow (Figure 6).

See Figure 7 for location of Portage Bay monitoring stations.

[1] To protect the health of people contacting freshwater for recreation, Washington State's bacteria surface water quality standard has two criteria—a geometric mean criterion and a 90th percentile criterion. Both criteria must be met for water quality to meet standard. In the Lower Nooksack watershed, water quality must meet bacteria criteria established to protect "primary contact recreation" as a use. Freshwater designated uses and criteria are explained further in Washington Administrative Codd (WAC) 173-201A-200.

[2] Marine shellfish harvesting bacteria criteria are detailed in WAC 173-201A-210.

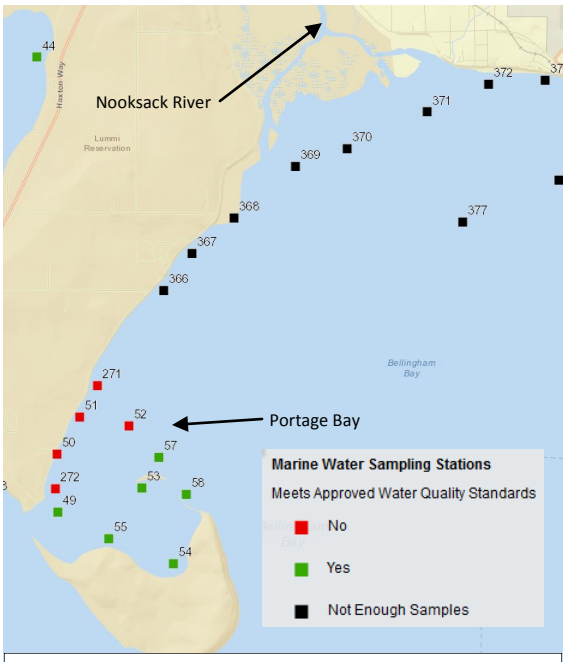


Figure 7 — Portage Bay monitoring station status

Washington Department of Health (DOH) staff in the Growing Area program evaluated marine water FC sampling data collected in Portage Bay through December 2014. Growing area classifications are assigned based on results of the evaluation.

Analysis concluded stations 50, 51, 52, 271, and 272 in Portage Bay fail to meet National Shellfish Sanitation Program (NSSP) standards (see Figure 7). A downgrade to classification of 496 acres of the tribe's commercial growing area will be finalized March 2015.

Additional monitoring in Lower Nooksack/Portage Bay watershed

Lummi Nation Natural Resources (LNNR) sampled three times monthly at station SW118, located on the Nooksack River downstream of the Marine Drive bridge near Public Works' M1 location.

Figure 8 reports FC density measured at station SW118. During late October through November 2014, results were well above the TMDL goal of 39 FC/100 mL.

Figure 8 — LNNR Station SW118

	FC/100mL
10/2/2014	36
10/9/2014	16
10/23/2014	400
11/5/2014	110
11/6/2014	500
11/19/2014	130
12/4/2014	31
12/16/2014	9
12/17/2014	9

Bertrand Creek sub-basin of the Lower Nooksack/Portage Bay watershed

Bertrand Creek is a lowland tributary that flows from southern British Columbia (B.C.) to the Nooksack River in Whatcom County. The upper watershed in B.C. contains substantial agricultural and rural residential land use, as well as part of the town of Aldergrove. Land use in the lower U.S. portion of the watershed is mostly agricultural.

Washington Department of Ecology (Ecology) and Nooksack Indian Tribe (NIT) monitored water quality at six Bertrand locations. Figure 9 reports FC density measured by Ecology inspectors and NIT staff (see Appendix Map 1 for monitoring locations).

Station B1 (also called SW14) is the lowest downstream monitoring location on mainstem Bertrand Creek before the creek flows into the Nooksack River.

Figure 9 — Bertrand Creek sub-basin FC sampling results (FC/100mL)

Sample date	Agency	Monitoring Locations					
		B1 (and SW14)	SW13 Bertrand @ H St	BE9.1 Bertrand @ border	BECC0.2 Cave Creek @ border	BEMC1.8	BEDF2.2
10/21/2014	NIT	540	3400				
10/23/2014	Ecology	250		450	220	400	
11/17/2014	Ecology	23		88	15	44	32
12/9/2014	NIT	2400	2800				
12/11/2014	Ecology	2000		230	901	230	270

indicates result below 100 FC/100mL

indicates result between 100 and 200 FC/100mL

indicates result above 200 FC/100mL

Bertrand Creek sub-basin monitoring (cont.)

Washington Department of Agriculture Dairy Nutrient Management Program (DNMP):

During fall and spring manure application seasons, DNMP routinely samples fecal coliform (FC) density in water at locations related to dairy nutrient land application acreage. When elevated FC levels are detected, staff also samples from source identification locations to narrow down possible pollution sources

The Bertrand sub-basin contains fields and facilities of 16 dairy operations. DNMP sampled seven times in the Bertrand sub-basin during 4th quarter 2014 (see Appendix Table 1 for monitoring results). See sample site locations on Appendix Map 2 and Appendix Map 3.

DNMP staff:

- Sampled for FC bacteria in the Jackman Ditch drainage and in sites adjacent to dairy operations in areas of Duffner Ditch and McClellan Creek.
  - Duffner drainage sites have shown little bacterial pollution to waterways
  - McClellan sampling results have identified potential bacteria sources from non-dairy livestock
- Began collecting samples at sites immediately north of the U.S./Canada border in October 2014 to better measure FC density in water flowing into the U.S. from Canada.
  - Reported quarterly monitoring results to staff at the B.C. Ministry of the Environment
  - Shared data with U.S. Environmental Protection Agency when elevated FC levels were detected at the border sampling locations
- Detected consistently high counts of FC bacteria at border stations in the Jackman Ditch drainage during spring and summer 2014.
  - Fall 2014 DNMP storm event FC sampling showed lowering bacteria counts at the border stations and at stations near the downstream end of the Jackman Ditch sampling area (Appendix Table 1). Further monitoring will help determine if this is a trend toward cleaner water in Bertrand Creek.
- Monitored additional parameters (pH, dissolved oxygen, and temperature) at some sites. Monitoring may include testing for ammonia nitrogen when discharge of anaerobically digested manure is suspected.

Kamm Creek sub-basin of the Lower Nooksack/Portage Bay watershed

Kamm Creek is a small stream and ditch system in the lower Nooksack watershed east of City of Lynden. Land use is predominantly agricultural and rural residential.

Figure 10 — Kamm Creek sub-basin FC sampling results (FC/100mL) Department of Ecology

Sample date	Monitoring Locations						
	K0	K2	K3	K6	Morman 1	MD2	MD3
10/7/2014	22	48	46	290	5		
10/23/2014	260	91	190	210	127	604	37
11/5/2014	90	50		60	2100	5700	390
11/17/2014	44	50	20	7	10	330	48
12/9/2014	460	430	460	380	210	340	520

indicates result below 100 FC/100mL

indicates result between 100 and 200 FC/100mL

indicates result above 200 FC/100mL

DNMP inspectors work with Ecology inspectors through referrals, coordinated sampling and surveillance to identify and correct livestock-related FC bacteria sources.

Ecology sampled on five dates during the quarter at locations along Kamm Creek and Morman Ditch. Results are reported in Figure 10.

DNMP sampled multiple sites on five dates during the quarter. See Appendix Table 2 for FC sampling results and Appendix Map 4 for sampling locations.

DRAYTON HARBOR WATERSHED

Monitoring fecal coliform density

Whatcom County Public Works (Public Works):

Routine sampling - Dakota Creek and California Creek are the two main freshwater sources draining to Drayton Harbor. Within the watershed, Public Works staff collected monthly water quality samples at 30 stations.

- The Public Works Natural Resources webpage (http://www.whatcomcounty.us/publicworks/water/naturalresources/pic.jsp) contains a map of the 30 routine sampling locations and results for samples collected during 2014. (See the "Drayton Harbor Shellfish Protection District Sampling Sites and Results" link http://www.whatcomcounty.us/publicworks/water/naturalresources/pdf/DHSPD01-15.pdf.)

Focus Area Sampling - Whatcom County chose focus areas for fecal pollution identification and correction efforts based on sampling results locating areas with chronically high levels of fecal coliform (FC) bacteria. During the reporting period, Public Works conducted eleven sampling runs in the Drayton Harbor watershed focus areas of Lower Dakota, Loomis Trail, and Brown/Malloy.

Public Works staff summarized FC monitoring data through December 2014 for the Lower Dakota Creek focus area and provided a map of monitoring locations with high FC density. The summary is available at http://www.whatcomcounty.us/publicworks/water/naturalresources/pdf/LowerDakotaFS2015.v1.pdf.

During January 2012-December 2014, FC monitoring at focus area locations resulted in values over two to three times the state water quality standard geometric mean and about 45-65% of the samples exceeded 200FC/100mL (nearly five to seven times the allowed percentage).

Nooksack Indian Tribe (NIT):

NIT staff sampled at fixed-location sites in the California Creek sub-basin focus areas of Brown-Malloy and Loomis Trail (see Figure 11) as well as in the Dakota Creek sub-basin (see Figure 12).

Figure 11 — NIT sub-basin FC sampling results (FC/100mL)

	California Creek sub-basin								
	Brown-Malloy							Loomis Trail	
Date	SW26	SW28	SW29	SW30	SW31	SW44	SW46	SW37	SW41
10/16/2014	746	dry	255	2800	673	84	dry	78	94
10/22/2014	637			655	360				
10/30/2014	204.5	450	138	500	158	2600	550	84	102
11/25/2014	250	500	260	400	230	220	3000	5300	590
12/15/2014	23	15	20	76	15.5	46	27	3	15

Figure 12 — NIT sub-basin FC sampling results

	Dakota Creek sub-basin				
Date	SW19	SW20	SW21	SW22	SW38
10/15/2014	80	147	360	8700	64
10/22/2014				112	
10/29/2014	51	1146	3600	200	350
11/24/2014	78	76	86	37	245
12/16/2014	4	5	9	5	22

2. PROPERTY ASSESSMENTS & RESULTS

Ecology *(non-dairy livestock properties)*

Kamm sub-basin - 2 site inspections

Since focusing on the Kamm Creek sub-basin in early 2014, Ecology inspectors have identified 24 high priority non-dairy livestock properties. Properties are prioritized based on water quality data, observed conditions, and proximity to surface water.

- Ecology inspected a non-dairy livestock property that has a portion of the land covered under a dairy nutrient management plan. Ecology coordinated response to FC bacteria pollution risks from the nutrient management plan portion of the property with WSDA Dairy Nutrient Management Program staff.

- Ecology recommended to a large horse-boarding facility to improve solid manure storage (move manure pile to covered area away from top of slope draining to Kamm Creek) and prevent horse access to surface water. The landowner agreed to allow Ecology to monitor a pipe that conveys runoff from the farm property. Monitoring results have not shown violations of water quality standards.

Additional work in Kamm Creek sub-basin included:

- Ecology inspectors suspected a group of Lindsay Road properties may contribute manure-contaminated runoff to waterways flowing through property owned by Washington Department of Fish & Wildlife (WDFW) to Kamm Creek. From the WDFW property, inspectors assessed runoff conditions from adjacent upstream livestock operations and located two discharge points to waterways. Inspectors will monitor to determine if neighboring properties are contributing FC bacteria pollution to Kamm Creek drainages.
- Ecology and the contracted grant administrator, A Rocha USA, continued to help a landowner prepare an application for cost-share funds from the National Estuary Program Agricultural Best Management Practices (BMP) fund. The BMP fund will pay up to 75% of the cost to install livestock exclusion fencing, heavy use area protection, and covered manure storage.

Ecology completed follow-up site work with landowners in the Terrell Creek drainage and in the Dakota Creek drainage to ensure landowners were maintaining property and management improvements recommended to prevent manure-contaminated runoff from flowing to ditches.

Washington Department of Agriculture Dairy Nutrient Management Program (DNMP) activity:
(dairy operations)

Lagoon assessments - DNMP completed manure storage lagoon assessments in fall 2014. Lagoon assessments evaluated available storage capacity and roof water diversion. When clean roof water is not diverted and comes in contact with manured areas, the water must be collected, conveyed, and stored in the lagoon for later land application. The addition of roof water to lagoon storage unnecessarily impacts available storage capacity and can result in an operator opting to apply manure to land during winter when conditions present a high risk for manure-contaminated runoff to surface water.

Eighty-one percent (81%) of dairy operations inspected by DNMP staff in focus areas (including areas of Whatcom, Skagit and Snohomish counties) had adequate lagoon storage capacity and effectively diverted clean water from storage. DNMP staff provided technical assistance to the 19% of the facilities needing improvements and prioritized these facilities for follow-up.

Overflight - In October DNMP completed an aerial surveillance overflight with Ecology staff to observe land use conditions. The flight identified water quality concerns on both dairy facilities and non-dairy livestock properties. DNMP referred water quality concerns regarding non-dairy livestock properties to Ecology. Combined with information from the overflight, DNMP staff considered field conditions, nutrient applications, and lagoon/storage capacity in determining additional water sampling and investigations activities.

Reporting data - DNMP shared sampling data and maps identifying sample locations with dairies and custom manure pumpers on a monthly basis, with preliminary results reported as promptly as possible when results showed elevated fecal coliform in areas near dairies. The ongoing email correspondence helped producers tie recent farm activities and weather to water quality results near their farms. DNMP routinely shared data with the partnering state and local agencies working in the watersheds.

Bertrand sub-basin - 4 inspections (3 routine, 1 investigation), 3 referrals to Ecology

The Bertrand Creek watershed contains fields and facilities of 16 dairy operations. DNMP work included:

- One investigation related to animal access to surface water resulted in a pending warning letter.
- Three non-dairy livestock properties identified during the October overflight were referred to Ecology for follow up.

Kamm sub-basin - 5 inspections (3 routine, 1 investigation, 1 follow-up), 1 referral to Ecology

Nine dairy operations have fields or facilities mostly concentrated in the southern portion of Kamm sub-basin. DNMP's fall 2014 sampling results showed decreased FC concentrations compared to spring 2014 results; however, staff identified water quality concerns during the October flyover:

- Identified two water quality issues with manure storage and land application. Based on DNMP follow-up, the dairies responsible successfully began to mitigate risks associated with their practices.
- One inspection involved a non-dairy property owner. The outcome of investigation is pending.
- DNMP referred one referral to Ecology concerning a non-dairy manure collection system.

Whatcom County Public Works *- (pollution identification and correction (PIC) program)*

Landowner contact - Public Works staff completed a drainage characterization and windshield survey for the Lower Dakota PIC focus area and created mailing lists to send PIC program information to area residents. PIC information includes a letter from County Executive Jack Louws and from Council Chair Carl Weimer.

The County-led PIC program includes additional information sent to parcels who appear to have livestock. County and WCD staff have finalized plans for landowner contacts in the initial Lower Dakota Creek focus area and will be communicating with residents about opportunities to assess pollution risk and make improvements if needed.

Whatcom County Health Department (WCHD) *- (on-site sewage system (OSS) operation & maintenance)*

WCHD prepared a resolution for designating Portage Bay as a marine recovery area (MRA). As DOH issues an administrative order in March 2015 to downgrade the Portage Bay shellfish growing area classification, WCHD will present the MRA designation request to Whatcom County Council.

The MRA designation will allow WCHD to enforce OSS operation and maintenance (O&M) inspection requirements in the watershed area draining to Portage Bay.

WCHD activity summary 4th quarter 2014

Watershed	# of satisfactory ROSS* - 4th Qtr	ROSS—maintenance needed	ROSS - Failures	Failures Repaired	# OSS	% OSS evaluated
Bertrand/Fishtrap	17	5	0	n/a	1089	24%
Kamm	0	2	0	n/a	252	27%
Drayton Harbor	121	33	1	0	3151	89%

* ROSS = Report of System Status

Through 2014, WCHD identified 1500 on-site sewage systems (OSS) countywide that were previously unaccounted for. Whatcom County's 2015-2016 budget includes one new full-time employee at WCHD to support the O&M program. In the Drayton Harbor and the Lake Whatcom watersheds where O&M requirements are enforced, compliance levels are high.

Based on review of submitted Report of System Status (ROSS) O&M paperwork through 2014, WCHD plans to send quarterly newsletters to OSS-related professionals (designers, installers, inspectors, pumpers) to clarify performance expectations and provide training. WCHD has oversight of licenses for OSS pumpers and installers, while the state DOH maintains oversight of OSS designers.

During the reporting period, WCHD issued 26 civil penalties to 29 Drayton Harbor watershed properties for failure to submit a ROSS. Two of the penalties have been waived (inspection completed but paperwork not turned in) and one penalty, based on conversation with the system owner, appears likely to go to collection.

WCHD follow-up on high FC bacteria results

- During December, WCHD confirmed through a dye test a priority one OSS failure in the Terrell Creek drainage that flows to Birch Bay. A pipe from the home's septic tank emptied directly into a roadside ditch. WCHD directed the landowner to immediately cap the tank to prevent outflow to the ditch and to have the tank pumped. Requirements included design and installation of a new system within 30 days. Through Whatcom Conservation District's grant-funded Terrell Creek Landowner Incentive Program, the landowner qualifies for up to $10,000 to help cover costs of a new OSS. The landowner installed a new system and WCHD performed a final inspection in mid December. The non-functioning system was identified through FC sampling by Ecology, Public Works and DNMP.

Dye testing an on-site sewage system—In this case, dye poured into the tank resulted in sewage flowing to the roadside ditch within 2 minutes of starting the flow test.

- WCHD staff performed a flow test in October on a Hoier Road OSS. The test resulted in no visible sign of surfacing sewage.
- For a Haynie Road property first identified in August for follow up, WCHD conducted a site inspection in late October after a Report of System Status (ROSS) was submitted noting tank pumping and suspected collapsed transport line. WCHD performed a follow-up inspection in mid November and confirmed no visual signs of sewage.
- For a Sweet Road property, WCHD conducted an OSS flow test in mid-October. The flow test resulted in no visual signs of surfacing sewage.

OSS Operation & Maintenance homeowner trainings and rebate program

- WCHD conducted one homeowner training in the Terrell Creek watershed; 35 homeowners attended.
- During 2nd quarter 2014, WCHD and Public Works established a rebate program for Drayton Harbor watershed residents who completed one of four OSS homeowner trainings hosted by Whatcom County. County staff sent a reminder postcard to workshop attendees who had not submitted a rebate application for work associated with OSS inspection or maintenance work.
- Between October and December 2014, 13 workshop attendees submitted rebate applications. Two systems had both pumping and equipment installation and two systems had both an evaluation and pumping. Public Works approved rebates for:
  - 5 OSS evaluations by certified inspectors
  - pumping services for 10 septic tanks
  - Installation of O&M equipment (e.g. risers and lids, baffles) on 2 systems

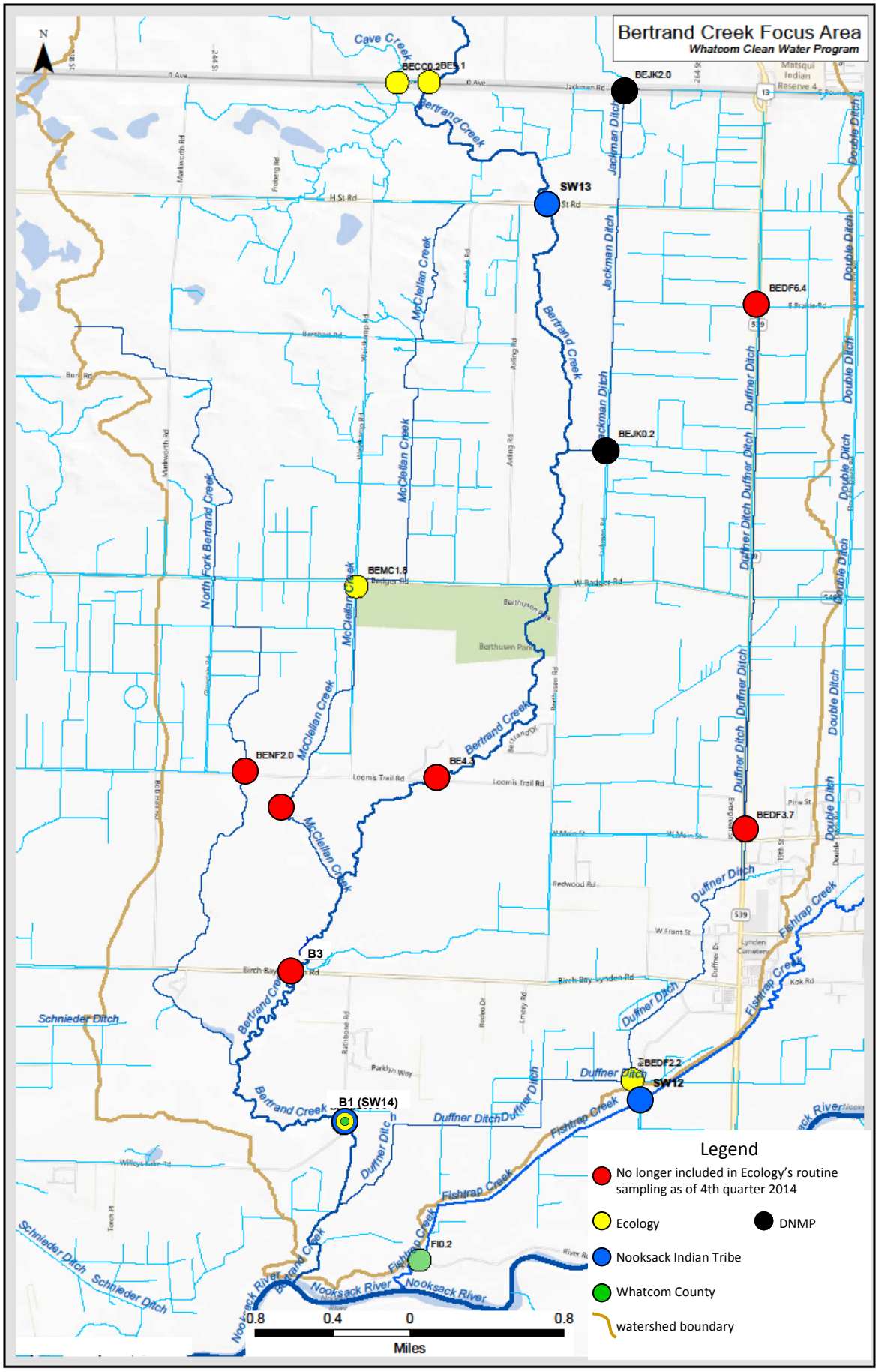
3. OTHER ACTIVITIES

Livestock related fecal coliform bacteria pollution presentations:
Ecology staff presented information to both the Tenmile Clean Water Project and to the Whatcom Conservation District Board of Supervisors during the reporting period. The presentations provided an overview of Ecology's efforts to identify and correct fecal pollution from nondairy livestock and to coordinate with other agencies and programs. Ecology inspectors emphasized the observable conditions that contribute to pollution discharges.

Ecology staff and a Whatcom Conservation District planner presented information to a WSU Whatcom County Extension-hosted Small Fruit Growers Conference in December 2014. The presentation focused on potential sediment and fecal coliform pollution from berry operations. ECY described water quality regulations and conditions that cause pollution to surface water. WCD described technical assistance resources available and best management practices that can help prevent pollution discharges.

*The standard for approved shellfish growing waters is fecal coliform geometric mean not greater than 14 organisms/100 mL with an estimated 90th percentile not greater than 43 organisms/100 mL.

Appendix Map 1. Bertrand watershed water quality monitoring locations



Appendix Table 1. Washington Department of Agriculture Dairy Nutrient Management Program (DNMP) fecal coliform sampling results - Bertrand watershed (Jackman Ditch, McClellan Creek and Duffner Ditch)

Station ID	Site Type	Lat (WGS84)	Long (WGS84)	Location Description	Site importance/Coordination	10/14/2014	10/23/2014	11/18/2014	11/25/2014	12/3/2014	12/12/2014	12/15/2014
24 hr precipitation (Inches)						0.23	0.04	0.00	0.42	0.00	0.44	0.00
JD-C	SIS	49.002396	-122.507012	North side of Zero Ave, at culvert opening, west of JD-B and Jackman ditch	Upstream in system. Public, BC	1,100	160	20	54/68	5	16	
JD-B	SIS	49.002393	-122.501108	North side of Zero Ave, at culvert opening, upstream of JD-2.0	Upstream in system. Public, BC	860/1,100	110	42/24	110	44	280	
JD-HLAT	SIS	48.955318	-122.507107	East side of Jackman Road, taken from ditch flowing down from JD-C and BC	Downstream of dairy application acreage. Public				11,000		27	
JDSI-4 (DH-LAT)	SIS	48.997129	-122.501329	Above lateral ditch coming from lagoon area	Downstream of dairy application acreage. Private	940			2,000	48		
JD-1.73	SIS	48.996874	-122.501341	30 feet South of lateral ditch coming from between lagoons East of Jackman road	Downstream of dairy application acreage. Public				2,900	42		
JD-1.5*[h]	STM	48.993533	-122.501447	30 feet north of H street on the east side of Jackman road.	Downstream in system. Public	880/1,100	170	68	1700	46	700	
JD-0.38[*h]	STM	48.977625	-122.501844	0.38 mi north of Jackman Road bridge, east side of Jackman road across from power line pole.	Upstream of dairy application acreage and facility. Public	1,100	160	38	460	22	330/800	
JD-0.31	SIS	48.97645	-122.501828	0.31 mi North of bridge, south of driveway, East side of Jackman road	Downstream of dairy application acreage and facility. Public	1,100	140					
JD-0.25	SIS	48.975689	-122.501878	0.25 mi North of bridge, north of lateral, East side of Jackman road	Downstream of dairy application acreage and facility. Public	1,700	140	34	580			
JD-0.2[*h]	STM	48.974964	-122.502042	Jackman Road bridge, sampled from bank with pole on west side of Jackman Road.	Downstream in system. Site selection in collaboration with working partners. ECY name BEJK0.2. Public	2,300	110	36	520	46	420	

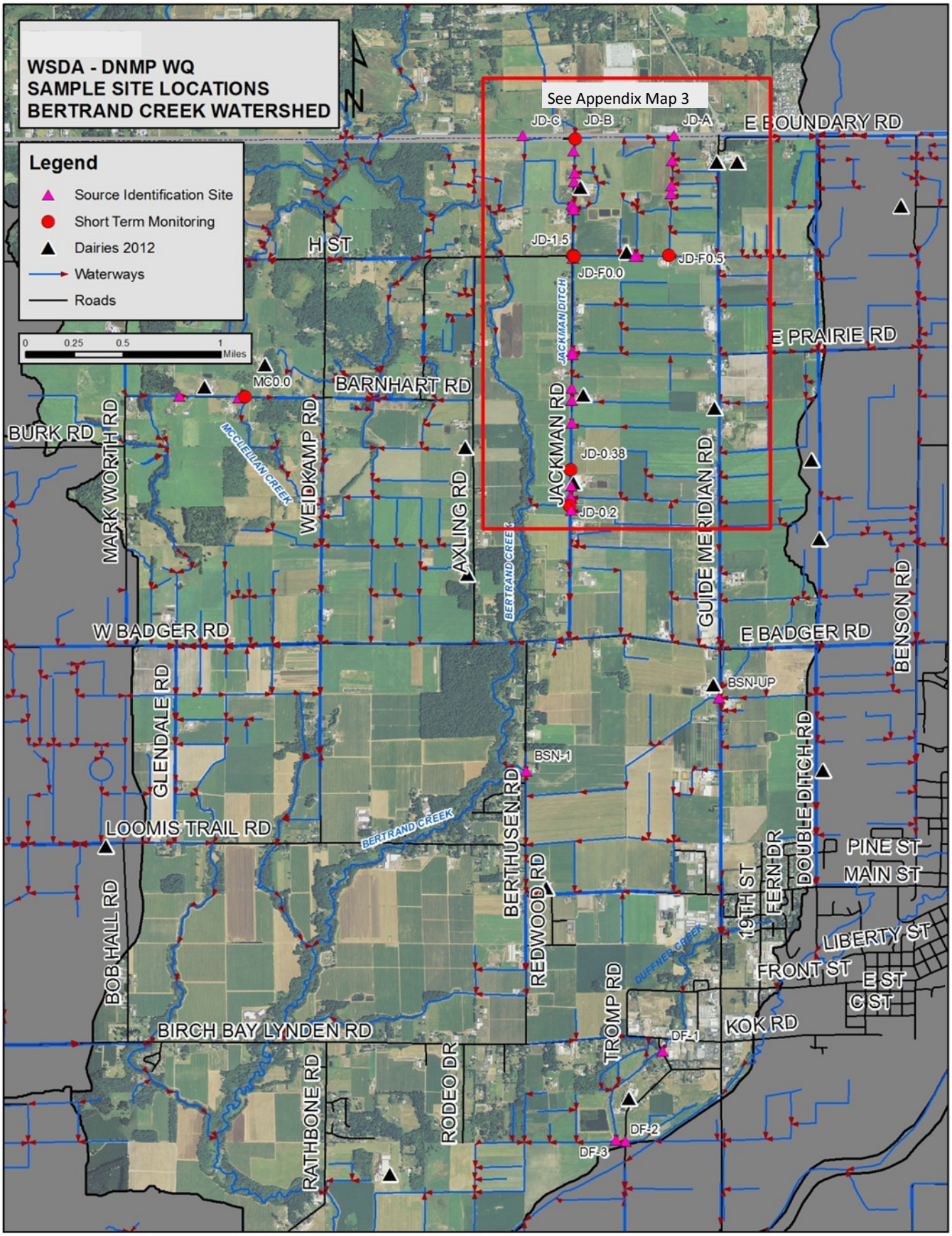
Appendix Table 1 (continued). Washington Department of Agriculture Dairy Nutrient Management Program (DNMP) fecal coliform sampling results - Bertrand watershed (Jackman Ditch, McClellan Creek and Duffner Ditch)

Station ID	Site Type	Lat (WGS84)	Long (WGS84)	Location Description	Site importance/Coordination	10/14/2014	10/23/2014	11/18/2014	11/25/2014	12/3/2014	12/12/2014	12/15/2014
JD-A	SIS	49.002338	-122.489962	North side of Zero Ave, at culvert opening, upstream of JD-F1.1	Upstream of dairy application acreage. Public, BC	9,500	5,900	400	960			
JD-F1.1	STM	49002181	-122.490069	ditch flowing south from mushroom farm at border, 25 feet south of Zero ave, accessed from US side	Upstream in system. Private				9,000	46/40	46	
JD-F0.5[*h]	STM	48.993478	-122.490650	30 feet north of H Street at lateral ditch south of BC mushroom farm. Sampled from west bank of ditch.	Downstream of dairy application acreage. Upstream of dairy facilities and application acreage. Public	1,700	150	7	620	5	120	
JD-F0.34	SIS	48.993382	-122.494168	0.34 mi East of Jackman road ditch along north side H Street road, 30 feet upstream of lateral	Upstream of dairy application acreage. Public				660			
JDSI-1	SIS	48.99339	-122.494485	30 feet downstream of latteral at telephone pole. N side of H St. Rd.	Downstream of dairy application acreage. Upstream of dairy facilities and application acreage. Public				540/460			
JD-F0.0[*h]	STM	48.993422	-122.501286	30 feet east of Jackman Road on the north side of H Street	Downstream in system. Public	1,000	92	9	150	80	84	
DF-1	SIS	48.934513	-122.491927	East side Duffner bridge on BayLyn Dr.	Upstream in system. Public		220	25				
DF-2	SIS	48.92782	-122.49619	East side Flynn/Schuleyman Rd. at culvert flowing to city stormwater facility	Downstream of dairy application acreage. Public			52				
DF-3	SIS	48.927937	-122.497262	Duffner ditch before confluence and turn at city stormwater	Downstream of dairy application acreage. Public		170	22				
MC0.0[*h]	STM	48.983195	-122.538471	downstream of pond drains, at culvert opening on north side of Barnhart Road.	Down stream of dairy facility and application acreage. Public	280		<2				
BSN-UP	SIS	48.960647	-122.485325	East side Guide Meridian Upstream of flowing to Berthusen ditch (BSN-1).	Upstream of dairy application acreage. Public							7
BSN-1	SIS	48.955318	-122.507107	East side of Berthusen Rd at culvert opening; 0.65mi south of badger rd.	Downstream of dairy application acreage. Public				820	30	1,400	58

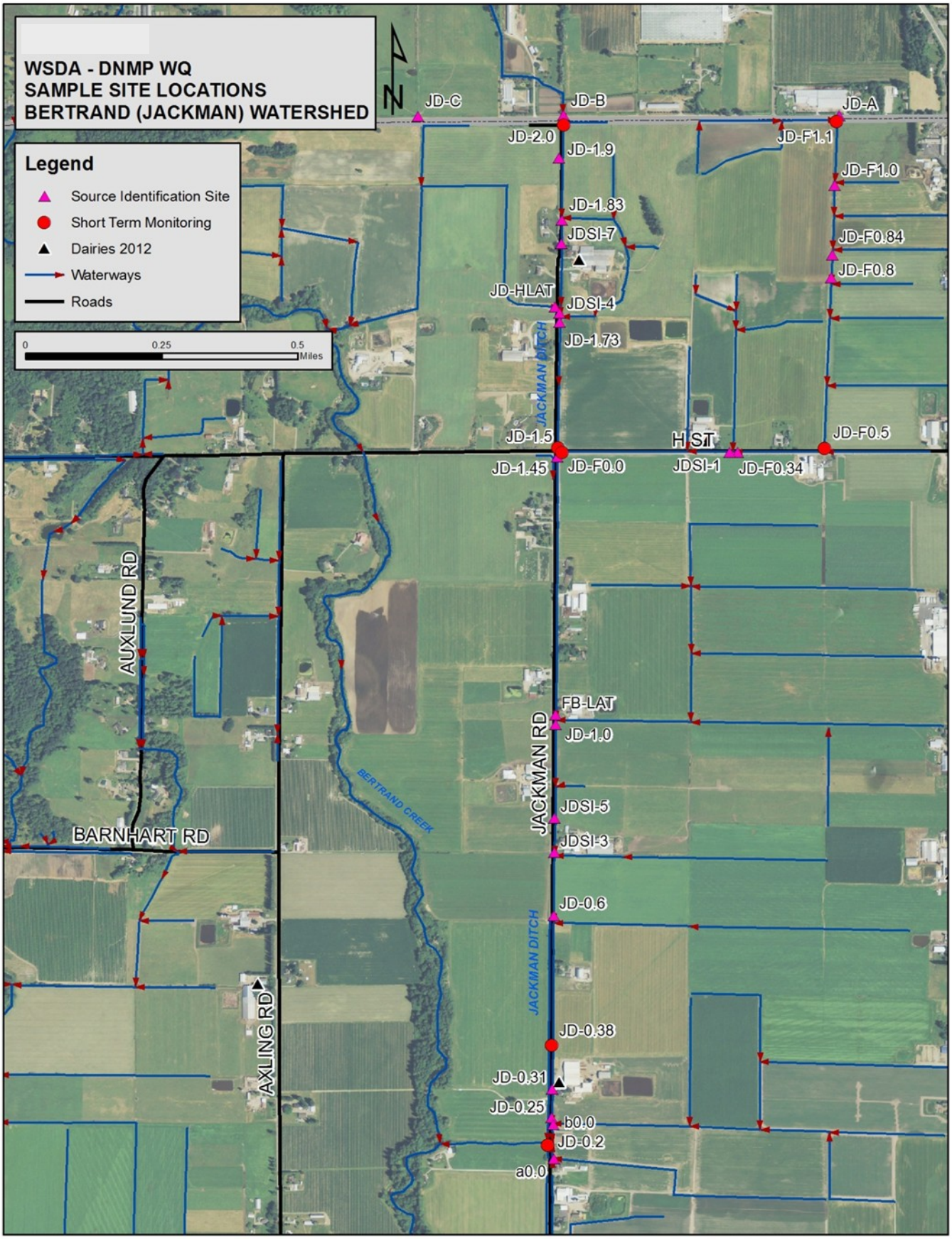
[h] Sample locations including environmental parameters tested with Hach HQ40d
STM = Short Term Monitoring Stations
SIS = Source Identification Sampling

Green = WQ sampling results below 100 colony forming units per 100 ml (CFU/100ml)
Yellow = WQ sampling results between 100-200 CFU/100ml
Red = WQ sampling results above regulatory limit, 200 CFU/100ml

Appendix Map 2. WSDA DNMP fecal coliform sampling locations — Bertrand Creek watershed



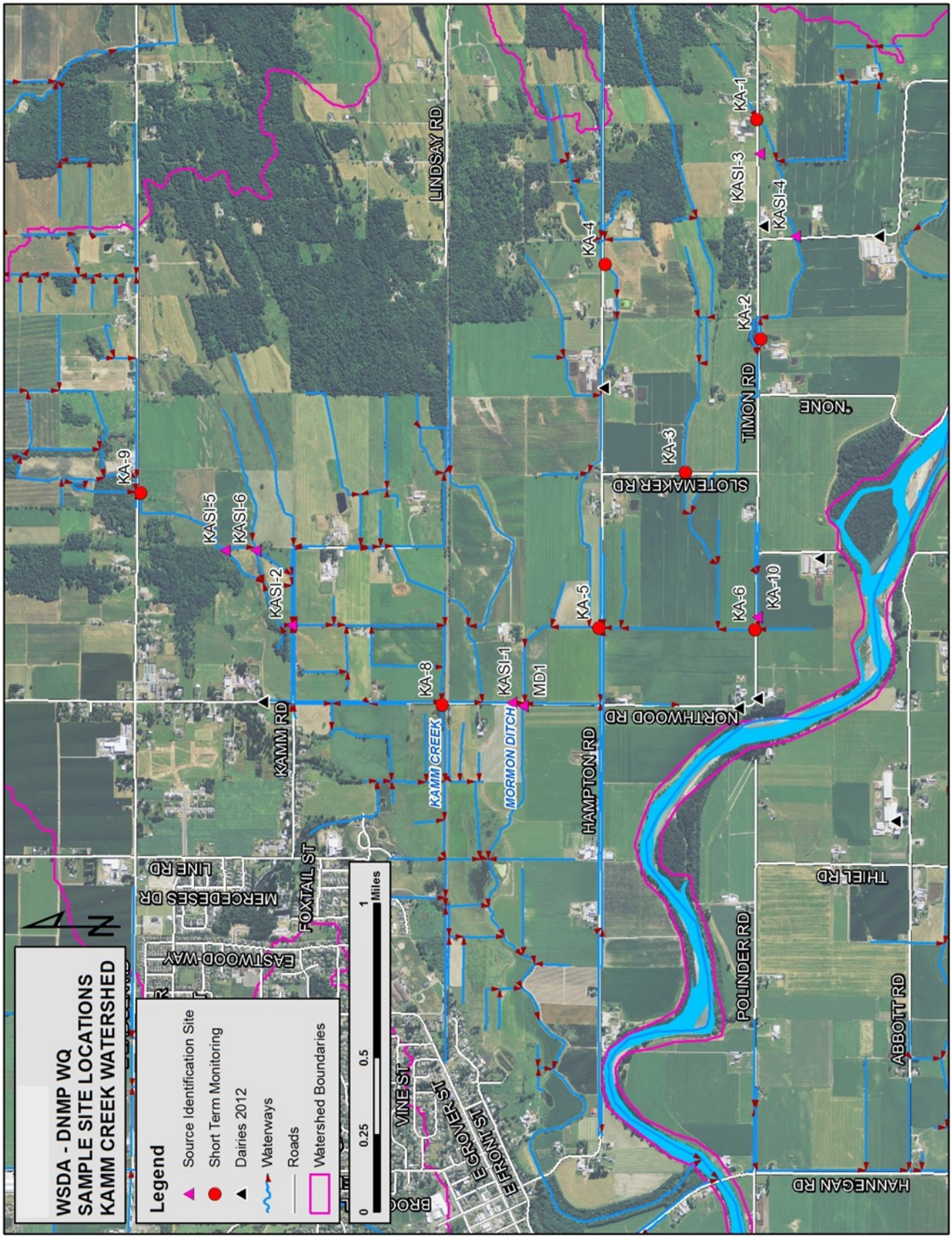
Appendix Map 3. WSDA DNMP fecal coliform sampling locations
Jackman Ditch drainage within Bertrand watershed



Appendix Table 2. Washington Department of Agriculture Dairy Nutrient Management Program (DNMP) fecal coliform sampling results - Kamm Creek watershed

Station ID	Site Type	Lat(WGS84)	Long(WGS84)	Location Description	Site importance/Coordination	10/14/2014	11/6/2014	11/18/2014	12/3/2014	12/12/2014
24 hr precipitation (Inches)						0.23	0.28	0.00	0.00	0.32
KA-9	STM	48.963735	-122.392639	South side of Badger Road at Kamm Creek culvert opening	Upstream in system. Upstream of dairy application acreage. Public	1,100/1,400	48/36	11	14	9
KASI-5 (KA-B)	SIS	48.959782	-122.396797	At private property edge, Kamm creek proper	Upstream and Downstream of dairy application acreage. Private	720				
KASI-6 (KA-C)	SIS	48.958342	-122.396831	At private property edge, Kamm creek tributary	Upstream and Downstream of dairy application acreage. Private	660				
KASI-2	SIS	48.956682	-122.402167	North side Kamm Road at Kamm Creek east culvert.	Downstream in system. Downstream of dairy application agreage. ECY site K3. Public	600/460	140	58/29	13/2	5
KA-8*h	STM	48.949650	-122.407943	West side of Northwood Road at Kamm Creek Bridge	Downstream in system Downstream of dairy application acreage. ECY site (K2) sampled by-weekly. Public	860	120	14	22/4	44
KA-4	STM	48.941819	-122.376617	South side of Hampton Road at culvert opening	Upstream in system. Upstream of dairy application acreage. Public	11000	78	21	7	28
MD1*h	SIS	48.945831	-122.408059	West side of Northwood Rd at Mormon ditch.	Downstream of dairy application acreage. ECY site (Mormon 1) sampled bi-weekly. Sampled by WSDA in alternating weeks when field observations inidcate	620	50		18	74
KA-1	STM	48.934650	-122.366379	North side Timon Road at culvert opening, 0.4 miles east of Stickney Island Road	Upstream in system. Upstream of dairy application acreage. Public		98	7	4	90
KASI-4	SIS	48.93287	-122.374733	E side of Stickney Is. Rd. 0.12 miles south of Timon Rd.	Downstream in system. Downstream of dairy application acreage and facilities. Public					25/32
KA-2	STM	48.934534	-122.382014	South side Timon Road at culvert opening	Downstream in system. Downstream of dairy application acreage and facilities. Public		27	5	2	70
KA-3	STM	48.938118	-122.391506	East side of Slotemaker Road at culvert opening	Single site in system. Downstream of dairy application acreage. Public		330	7	4	14
KA-6	STM	48.934899	-122.402770	North side of Timon Road at culvert opening	Downstream in system. Downstream of dairy application acreage. Public		520	9/13	13	210
KA-5	STM	48.942237	-122.402542	North side of Hampton Road at culvert	Down stream in multiple systems. Downstream of dairy application acreage. Public	12,000/13,000	130	42	9	74

STM = Short Term Monitoring Stations
SIS = Source Identification Sampling
*h = Sample locations including environmental parameters

Green = WQ sampling results below 100 colony forming units per 100 ml (CFU/100ml)
Yellow = WQ sampling results between 100-200 CFU/100ml
Red = WQ sampling results above regulatory limit, 200 CFU/100ml

Appendix Map 4. WSDA DNMP fecal coliform sampling locations
Kamm Creek watershed