KITSAP PUBLIC HEALTH DISTRICT
ENVIRONMENTAL HEALTH DIVISION
WATER POLLUTION IDENTIFICATION & CORRECTION PROGRAM

SINCLAIR INLET RESTORATION PROJECT
FINAL REPORT

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WASHINGTON STATE DEPARTMENT OF ECOLOGY

KITSAP COUNTY SSWM Surface and Storm Water Management

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ACKNOWLEDGMENTS

The authors would like to thank the fellow Kitsap Public Health District staff, the Washington State Department of Ecology, the Kitsap Conservation District, and Kitsap County Surface and Storm Water Management for their assistance in completing the Sinclair Inlet Fecal Pollution Reduction Project.

SINCLAIR INLET
FINAL REPORT

EXECUTIVE SUMMARY

Table E1 below describes how this project met its goals, anticipated outcomes, and required deliverables:

Table E1. Comparison of Project Results to Project Goals, Outcomes and Deliverables

Goals	***Status***	***Comments***
• Designated beneficial uses will be restored and protected	**Progress**	Remaining sources of fecal contamination must be corrected, and flushing of contaminated discharges must occur before we can fully assess project success. .
• Healthy waters prevented from being degraded	**Progress**	Beneficial uses were protected by educating 784 watershed residents about preventing sources of nonpoint pollution on their properties.
• Water bodies on the 303(d) list for fecal coli form bacteria contamination will be restored to water quality standards.	**Progress**	This project resulted in improvements for four TMDL (4A) streams including Black Jack, Annapolis, Karcher, and Sacco Creek
Water Quality & Environmental Outcomes	***Status***	
• Reduce fecal coliform (FC) levels to standard in project area streams and marine waters.	**Progress**	Good progress has been made on four TMDL streams as shown above. Results were mixed for other major streams in the watershed and the receiving marine waters.
• Reduce FC pollution in shoreline drainages and storm water outfalls.	**Achieved**	
• Inspect **450** onsite sewage systems.	**Exceeded**	**784** onsite sewage systems were inspected.
• Correct **23** failing onsite sewage systems.	**Exceeded**	**79 of 84** failing onsite sewage systems have been repaired.
• Inspect **15** high and medium priority agricultural properties.	**Exceeded**	**52** high priority farms were investigated. **Nine (9)** farms were found to have water quality concerns.
• Install best management practices at **15** agricultural properties.	**Exceeded**	See Kitsap Conservation District report in Appendices for project results. **Thirty (30)** agricultural properties installed best management practices.
• Distribute **50** pet waste buckets.	**Revised by West Sound Environmental Outreach Group**	Distribution of pet waste buckets was cancelled in favor of distribution of West Sound Storm Water Outreach Group pet waste brochures and posters to property owners with pet waste problems. Also Mutt Mitt information was submitted to interested community groups throughout the project.
• Implement marina pump out outreach program by distributing 100 educational boat seat cushions and monitoring pump out use before and after distribution.	Revised by WSU Extension	WSU Extension recommended revising this task due to the confounding impacts of the economic downturn on marina pump-out data
• Provide public meetings and workshops for a total of 150 participants.	**Exceeded**	
• Provide Washington State University training workshops for an anticipated thirty realtors.	**Achieved**	Realtor workshops conducted by WSU May 7, 2009, March 1, 2010, and May 6, 2010
Performance Items & Deliverables	***Status***	
• Project administration/management	**Achieved**	All required reports and billings have been submitted.
• Public education and outreach	**Exceeded**	Four (4) public meetings, three (3) onsite sewage system work shops, five Girls Exploring Math & Science workshops, four Girl Scout day camp presentations, two South Kitsap High School workshop, and three (3) KCD public outreach events were conducted during the project period.
• Pollution Identification and Correction	**Achieved**	Completed, 79 of 84 (94%) of failing onsite sewage systems have been repaired
• Final report	**Achieved**	Completed and submitted to Ecology for approval
•		

Kitsap Public Health District's (Kitsap Health) Water Pollution Identification and Correction Program reviewed the results of samples collected, surveyed residents and made observations during the Sinclair Inlet Fecal Pollution Reduction Project.

- Many of the OSS in the area experience risk factors that can lead to failure including age,lack of permit records, shallow ground water, inadequate setback to surface waters, and deeper installation depths that can degrade the ability of soil bacteria and microbes to provide adequate treatment. OSS without permit records have not been evaluated and inspected for conformance with installation requirements that minimize failure risk including: size and depth of tanks and drainfield, type of materials used, and level drainfield trenches for equal effluent distribution.

- Shoreline surveys are an effective method of finding OSS failures and other pollution sources.

- Cost share money for livestock and agricultural animal manure land management practices has been a good catalyst, resulting in behavior change and increased landowner stewardship. This incentive program has proven effective in achieving water quality improvements in challenging situations and during adverse economic conditions. This method minimizes expensive and time-consuming enforcement that also damages public relationships and strains partnerships. Good land management practices prevent erosion that forms run-off channels through the riparian zone and transports pollution to streams and shorelines.

- Kitsap Health's Operation and Maintenance program ensures that owners of alternative systems have a certified maintenance contract, and that the required inspections are being conducted. Owners of gravity flow systems need to have their systems inspected every three years and pumped if necessary.

- Poor garbage and grease housekeeping practices provide a food source for urban wildlife that results in fecal pollution.

- Kitsap County residents are urged not feed wildlife. Multiple FC "hot spots" in the growing area were confirmed or suspected to be wildlife related. Feeding wildlife is not healthy for wildlife, water quality or public health.

- Non-point pollution is best addressed by visiting as many watershed residents as possible and door-to-door surveys are an excellent way to provide site-specific information about how to reduce bacterial and nutrient sources.

Kitsap Health recommends the following:

- This watershed needs an ongoing effort to protect water quality because many of the OSS are well past the average functional lifespan of approximately 30 years.

- Conduct periodic shoreline surveys along Sinclair Inlet to identify and correct new sources of fecal bacteria.

- Continue the strong partnership with DOH, Ecology and other water quality agencies to coordinate, assess and implement ongoing water quality restoration and protection tasks. Communicate significant water quality issues with appropriate agencies.

- Kitsap Health should continue to be involved in the Sinclair Inlet watershed through public complaint response, water quality trend monitoring, and follow-up of reports submitted by certified monitoring and maintenance specialists and pumpers. In addition, continue to flag properties with ongoing concerns in Kitsap Health records to assist future inspections.

- Research potential methods to better build public trust, by actively working to provide accurate and representative data upon which to base regulation and legislation.

- Utilize and develop public outreach and education materials based on social marketing principles that will result in measurable behavior changes.

1.0 BACKGROUND AND PROBLEM STATEMENT

The “Water Quality Standards for Surface Waters of the State of Washington” are codified in Chapter 173-201A of the Washington Administrative Code. The surface waters in the project area are currently designated in the WAC as Extraordinary Primary Contact Recreational Waters. Freshwater and marine water standards for fecal coliform (FC) bacteria are shown in Table 1.

Table 1
Washington State Surface Water Quality Standards
(Chapter 173-201A-030 WAC)

Parameter	**Freshwater - Primary Contact**	**Marine - Primary Contact**
Fecal Coliform Bacteria (FC)	**Part 1: ≤ 100 FC**/100ml (geometric mean) **Part 2:** Not more than **10%** of all samples obtained for calculating a geometric mean **>200 FC**/100 ml	**Part 1: ≤ 14 FC**/100ml (geometric mean) **Part 2:** Not more than **10%** of all samples obtained for calculating a geometric mean **>43 FC**/100 ml
Parameter	**Freshwater - Extraordinary Primary Contact**	**Marine - Extraordinary Primary Contact**
Fecal Coliform Bacteria (FC)	**Part 1: ≤ 50 FC**/100ml (geometric mean) **Part 2:** Not more than **10%** of all samples obtained for calculating a geometric mean **>100 FC**/100 ml	**Part 1: ≤ 14 FC**/100ml (geometric mean) **Part 2:** Not more than **10%** of all samples obtained for calculating a geometric mean **>43 FC**/100 ml

Table 2, Table 3, and Table 4 provide a summary of pre-project FC data collected by the Health District for Sinclair Inlet tributaries and salt water stations. As you can see, during the 2008 water year, most Sinclair Inlet major streams failed the applicable standard, whereas marine water quality was excellent.

Table 2
Summary of Historical Fecal Coliform Data for
Sinclair Inlet Extraordinary Primary Contact Streams

Stream Mouth	**2008 Water Year (October 2007 – September 2008)**					
	Number of samples	**Range (FC/100 ml)**	**GMV (FC/100 ml)[1, 2]**	**#Samples exceeding standard**	**%Samples exceeding standard [2]**	**Meets Washington Dept. of Ecology Standard?**
Beaver	12	11 - 500	63	5	42%	**No**
Karcher	12	50 - 1601	164	10	83%	**No**
Sacco	12	2 - 1600	353	9	75%	**No**

1. GMV = geometric mean value
2. Shaded entries indicate an exceedance of the applicable water quality standard (**Extraordinary Primary Contact** - Chapter 173-201A-030 WAC) during Water Year 2008. FC levels shall not exceed a GMV of 50 FC/100ml, and not have more than 10% of all samples exceed 100 FC/100 ml

Table 3
Summary of Historical Fecal Coliform Data for
Sinclair Inlet Primary Contact Streams

Stream Mouth	2008 Water Year (October 2007 – September 2008)					
	Number of samples	Range (FC/100 ml)	GMV (FC/100 ml)[1, 2]	#Samples exceeding standard	%Samples exceeding standard [2]	Meets Washington Dept. of Ecology Standard?
Anderson	12	2 - 30	11	0	0	Yes
Annapolis	12	30 - 500	146	5	42%	**No**
Black Jack	12	8 - 500	52	2	17%	**No**
Gorst	12	4 - 240	33	2	17%	**No**
Ross	12	2 - 1601	29	1	8%	Yes
Wright [3]	7	2 - 300	17	1	14%	**No**

1. GMV = geometric mean value
2. Shaded entries indicate an exceedance of the applicable water quality standard (**Extraordinary Primary Contact** - Chapter 173-201A-030 WAC) during Water Year 2008. FC levels shall not exceed a GMV of 100 FC/100ml, and not have more than 10% of all samples exceed 200 FC/100 ml
3. Wright Creek was not monitored until 2009 water year, so data presented is from 2009

Table 4
Summary of Historical Fecal Coliform Data for
Sinclair Inlet Marine Waters

Marine Station	2009 Water Year (October 2007 – September 2008)					
	Number of samples	Range (FC/100 ml)	GMV [1] (FC/100 ml)	#Samples >43 FC/100 ml	%Samples >43 FC/100 ml [2]	Meets Washington Dept. of Ecology Standard?
SN03	6	<2 - 2	<2	0	0	Yes
SN05	6	<2 - 8	3	0	0	Yes
SN10	6	<2 - 30	2	0	0	Yes
SN12	8	<2 - 4	2	0	0	Yes
SN13	6	<2 - 2	<2	0	0	Yes
SN14	6	<2 - 4	2	0	0	Yes
SN15	6	<2 - 4	2	0	0	Yes
SN22	6	<2 - 4	2	0	0	Yes
SN23	6	<2 - 17	2	0	0	Yes
SN24	6	<2 - 4	2	0	0	Yes
SN25	6	<2 - 4	<1	0	0	Yes
SN26	6	<2 - 2	<2	0	0	Yes
SN27	6	<2 - 50	2	1	17%	**No**

1. Shaded entries indicate an exceedance of the applicable water quality standard (**Extraordinary Primary Contact** - Chapter 173-201A-030 WAC) during Water Year 2008. FC levels shall not exceed a GMV of 14 FC/100ml, and not have more than 10% of all samples exceed 43 FC/100 ml

2.0 PROJECT AREA DESCRIPTION

The Sinclair Inlet project area is mapped in Figure 1 and Figure 2 below.

Figure 1
Project Area Overview

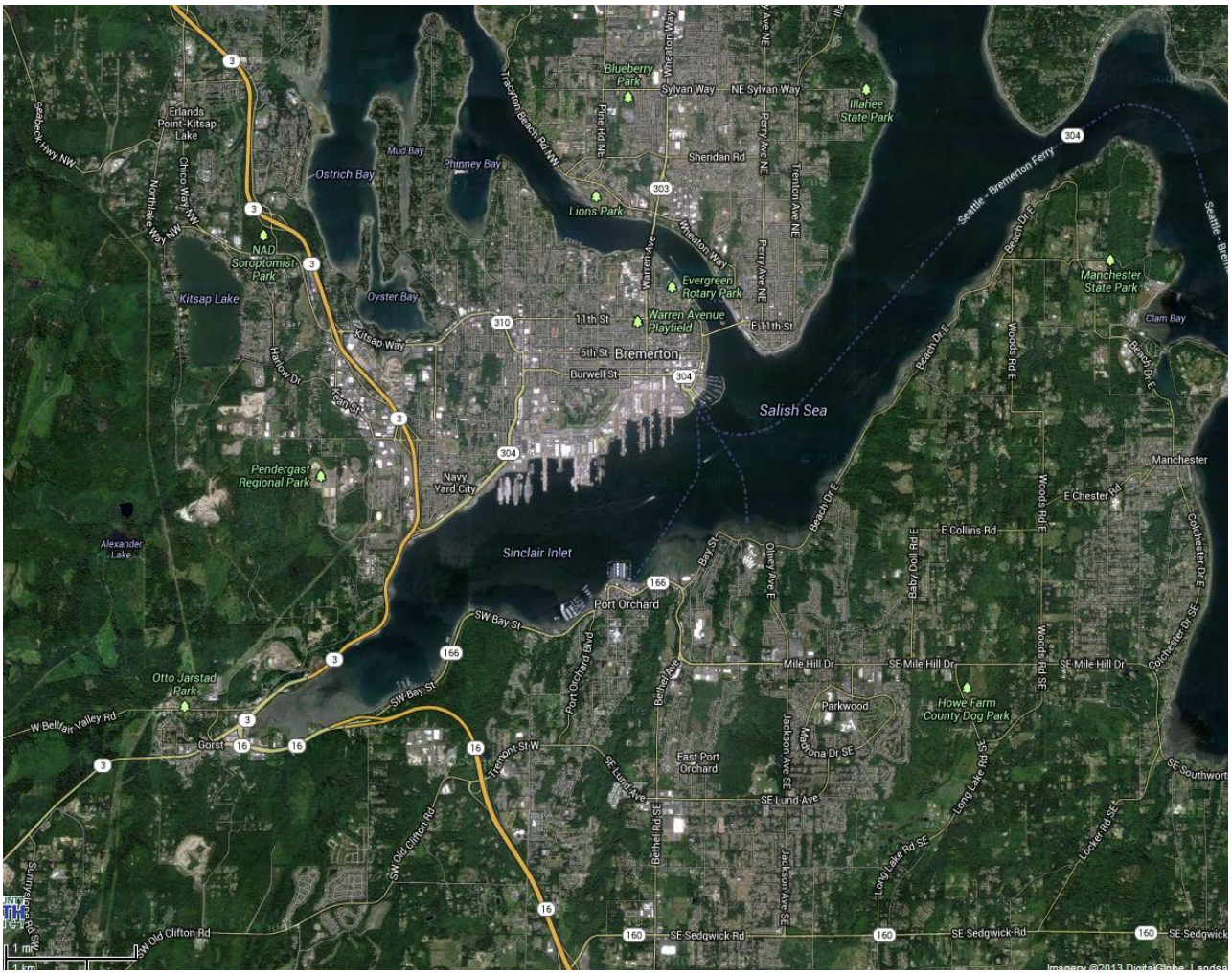
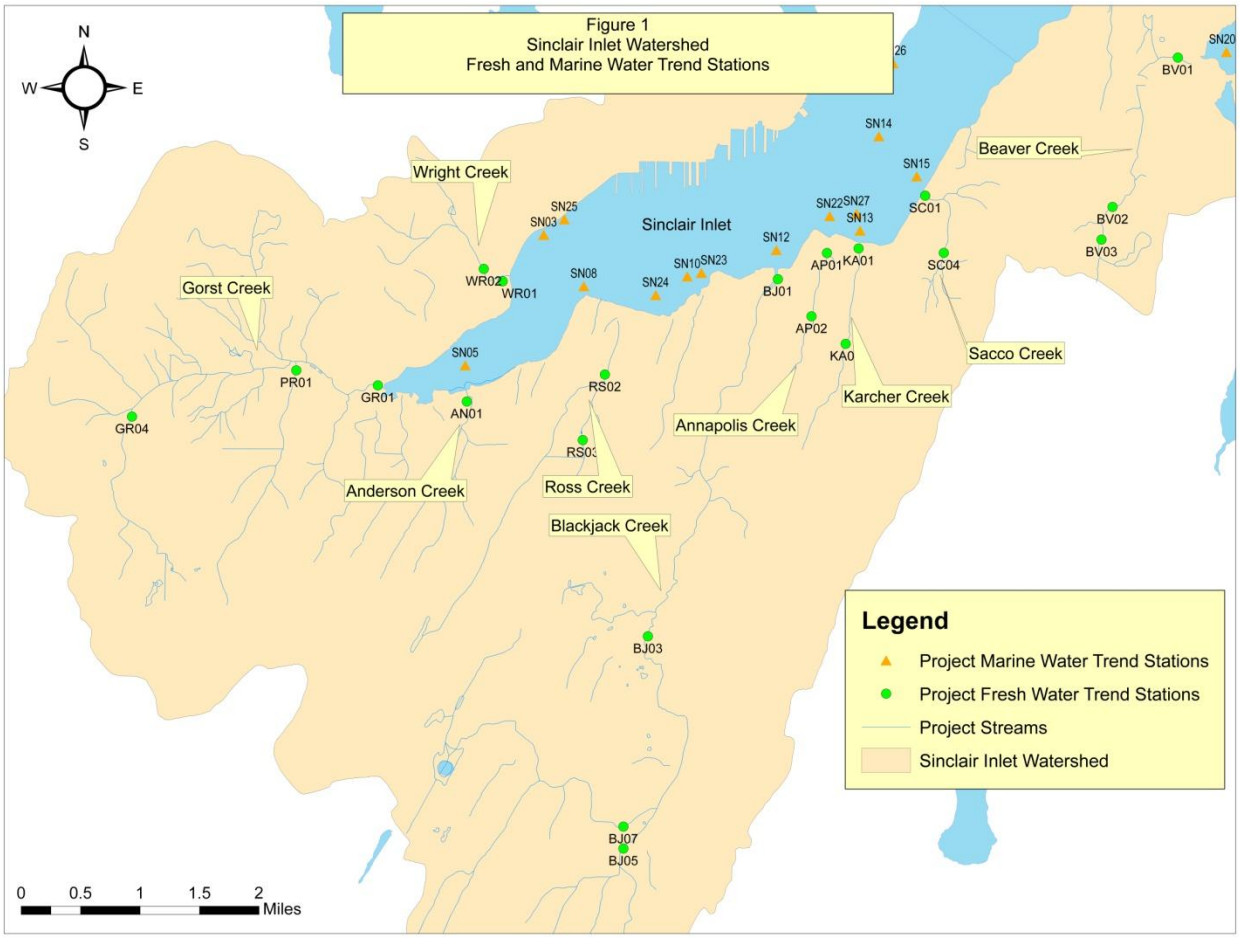


Figure 2
Project Area Detail



3.0 GOALS, OUTCOMES, AND PROJECT DELIVERABLES

The goals of the Sinclair Inlet Fecal Pollution Reduction Project were:

- Designated beneficial uses will be restored and protected.
- Healthy waters prevented from being degraded.
- Water bodies on the 303(d) list for fecal coliform bacteria contamination will be restored to water quality standards.

The water quality and environmental outcomes of the Sinclair Inlet Fecal Pollution Reduction Project were to:

- Reduce fecal coliform (FC) levels to standard in project area streams and marine waters.
- Reduce FC pollution in shoreline drainages and storm water outfalls.

- Inspect **450** onsite sewage systems.
- Correct **23** failing onsite sewage systems.
- Inspect **15** high and medium priority agricultural properties.
- Install best management practices at **15** agricultural properties.
- Distribute **50** pet waste buckets.
- Implement marina pump out outreach program by distributing 100 educational boat seat cushions and monitoring pump out use before and after distribution.
- Provide public meetings and workshops for a total of 150 participants.
- Provide Washington State University training workshops for an anticipated thirty realtors.

The Performance Items and Deliverables required by this project were:

- Administer and manage the project
- Provide public education and outreach
- Identify and correct fecal pollution sources
- Conduct post corrective monitoring to document improvements in water quality
- Prepare a final project report

Section 4, Project Design and Methods describes the Health District's four tier plan that was implemented to accomplish the goals and expected outcomes listed above. Section 5, Results and Discussion, presents project results as compared to these goals and expected outcomes.

4.0 PROJECT DESIGN AND METHODS

4.1 Shoreline Surveys

The core activity completed by the Health District to achieve project goals and outcomes was marine shoreline surveys in the project area. Two wet season shoreline surveys and two dry season shoreline surveys were conducted during the project period. Wet season shoreline surveys screen for OSS that fail due to surface or groundwater intrusion. Dry season surveys can identify failures masked by dilution during the wet season. One special low tide survey was conducted on approximately one-half mile of shoreline west of Port Orchard near Gorst.

During the shoreline survey, all significant discharges to the marine environment were sampled for FC bacteria. Typical discharges included: curtain drains, bulkhead drains, roof drains, culverts, small streams and bank seeps. Samples were collected at low tide to target the discharge of fresh water versus the drainage of residual marine water.

Sampling stations were given an identification number in sequence from the starting point to the endpoint of the survey. They were also photographed, noted, and global position system

(GPS) coordinates were recorded. Location descriptions were recorded at each sample station in the field notebook.

Discharges exceeding screening criteria of 200 FC/100ml were resampled twice to confirm contamination. If the geometric mean of the samples exceeded screening criteria, then the location was designated a hot spot and the source identification process was initiated. The purpose of this is to ensure that only stable and consistent "hot spots" are investigated, which improves our efficiency.

Properties associated with the FC hot spots were inspected to identify and correct any human caused FC sources.

4.2 Property Surveys

In addition to inspecting properties associated with FC hot spots, the Health District inspected additional properties that had the possibility of impacting water quality in the shellfish closure areas. Property survey results are located in Section 5.2.

Individual property surveys were conducted according to the "Manual of Protocol: Fecal Coliform Bacteria Pollution Identification and Correction". A property survey consisted of an OSS record search, homeowner/resident interview, field inspection, and water sampling and dye test when necessary. The purpose of the survey was to identify all potential sources of FC pollution and to provide information to property owners about how to operate and maintain their OSS and manage animal waste and other nutrient sources to prevent fecal and nutrient pollution. Inspectors identified any concerns that could cause premature OSS failure. Property owners were given copies of their OSS records, a fact sheet about the project, and information about septic loan programs when appropriate. Homeowners were encouraged to inspect their drainfield and tank areas with Health District staff to learn the symptoms of a failing OSS. Often these inspections revealed potential problems, such as improper placement of roof drains, damage to a drainfield by parking vehicles over the laterals, or unwanted growth of blackberry bushes and tree roots that could obstruct the disposal lines. Many properties were selected based on the watershed boundaries, but others were selected based upon proximity to marine shoreline FC "hot spots", public sewage complaints and "deficient" OSS monitoring and maintenance or pumper reports.

Some of the surveys required additional inspections due to conditions that suggested a failing OSS. These "suspect" systems required laboratory samples of surface water and dye testing. A system with suspect conditions, such as a saturated drainfield area, or a negative dye test with high FC counts, received a rating of "suspect," and the homeowner was encouraged to take the necessary steps to improve the operation of the OSS. When an OSS received a rating of "non-conforming," such as non-permitted repairs or alterations or additional bedrooms added to the home, the homeowner was informed of the issues, their impact on the OSS, and the necessary steps to resolve the issues. Suspect and non-conforming systems found during this project were recorded in Health District records without corrective enforcement.

Inspectors also identified potential non-OSS FC sources like pet waste, livestock and agricultural waste, as well as nutrient sources during the survey. If a problem with animal waste was observed, the owner or resident was informed that pet and other animal waste is a fecal pollution source.

If a problem with pet waste was observed, the owner was educated on how to manage it correctly. This includes a discussion of what the regulations require, and outreach materials from the West Sound Stormwater Outreach Group (WSSOG). Kitsap County and the Cities of Poulsbo, Bremerton, Port Orchard, and Gig Harbor began working together in 2008 to jointly develop, implement, and fund Permit-required outreach via interlocal agreements. In early 2012, the cities of Bainbridge Island and Port Angeles joined and signed interlocal agreements and the group assumed the name WSSOG to align with other similar groups across Puget Sound under the Stormwater Outreach for Regional Municipalities (STORM) outreach umbrella.

One of the focuses of the WSSOG is pet waste and they developed a Mutt Mitt program that provides dog waste bags and disposal that resulted in an estimated 89 tons of dog waste diverted from surface waters in 2012. WSSOG also developed a Backyard Pet Waste Program with new outreach materials to address the estimated eleven plus tons of dog waste dropped on the Kitsap Peninsula daily. This daily load is consistent with other Puget Sound communities. In extreme cases, the pet owners can be enforced to comply with local pet waste regulations.

Wildlife can adversely affect water quality by digging latrines, obstructing stormwater conveyances and burrowing into drainfields. Raccoons, mountain beavers, otters, waterfowl, and deer are present throughout the project area, and can be found in dense populations in certain areas. Additional site specific information on the potential effect of wildlife on the project is discussed below in the Shoreline Survey Results section.

If a problem with livestock and agricultural animal waste was observed during the survey, the owner or resident was informed about Kitsap's solid waste regulations requirement that animal waste not be allowed to accumulate in any place where it can pollute surface water or drinking water. The property owner or resident was informed about the non-regulatory KCD, asked permission to share their contact information, and the parcel was referred to a KCD planner.

4.3 Agricultural Inventory, Farm Planning and BMP Implementation

There is a significant amount of livestock and agricultural animal activity in the Sinclair Inlet watershed. Kitsap Health partnered with Kitsap Conservation District (KCD) to identify and address high priority farm activities with the potential to impact water quality.

The Health District contracted with KCD to inventory and prioritize farms, to provide free technical assistance, farm planning and best management practice implementation in the project area. The inventory is an office and field evaluation of all livestock and agricultural properties in the watershed to evaluate their potential for creating fecal and nutrient

contaminated runoff. Farm planning and best management practice implementation were carried out according to Washington Conservation Commission and United States Department of Agriculture Natural Resource Conservation Service standard practices and requirements.

Kitsap Health investigated high priority farms and landowners with water quality violations were referred to KCD to address water quality violations due to animal waste management. Kitsap Health investigated 52 high priority farms in the Sinclair Inlet Project area.

4.4 Education and Outreach

Educating homeowners on potential FC and nutrient sources and how to prevent them was a critical part of the project. Public education was accomplished in four primary ways:

- During property surveys
- Public meetings
- Outreach at project area marinas
- KCD informational mailings
- KCD landowner workshops and Real Estate Workshops
- During KCD technical visits

4.5 Water Quality Monitoring

Water quality monitoring was conducted pursuant to the approved "Sinclair Inlet Fecal Pollution Reduction Project Quality Assurance Project Plan" (March 2009).

4.5.1 Trend Monitoring

The Health District conducted monthly trend monitoring of nine (9) stream mouth stations (Beaver Creek, Karcher Creek, Sacco Creek, Anderson Creek, Annapolis Creek, Blackjack Creek, Gorst Creek, Ross Creek, and Wright Creek), and thirteen (13) marine stations in the vicinity of the project area. Please see Appendix A for a list of monitoring stations, and Figure 1 for their locations.

5.0 RESULTS AND DISCUSSION

Table E-1 in the Executive Summary compares project results to project goals, outcomes and deliverables.

The following is a detailed discussion of project results organized by major activity. Each activity was one of the components of the Health District's four tier plan designed to clean up the degraded portions of the Sinclair Inlet watershed

5.1 Shoreline Surveys

Forty shoreline fecal coliform "hotspots" were investigated during this project. Eighteen failing OSS were identified and corrected, five leaking sewer connections were found and corrected, two travel trailer discharges were removed, three illicit discharges to stormwater were identified and corrected, and two farm violations impacting the shoreline were found. One of the farms is an agricultural operation that has since installed numerous best management practices. The other farm owner has worked with KCD to develop and implement manure management.. The shoreline will be surveyed through the new county-wide shoreline survey program funded through the stormwater utility. Any fecal hotspots will be investigated and fecal sources will be identified and corrected

One of the OSS failures precipitated the installation of sewer in the Gorst waterfront area by the City of Bremerton through the American Recovery and Reinvestment Act of 2009. This grant provided sewer infrastructure and residential connections. Kitsap Public Health ordered commercial properties in the area with non-conforming OSS and those with no OSS records to connect to the public sewer system by the end of 2011. All of these were connected or vacated with the exception of one property, with limited use, that is in the process of working through complex easement issues in order to connect to sewer.

5.2 Property Surveys

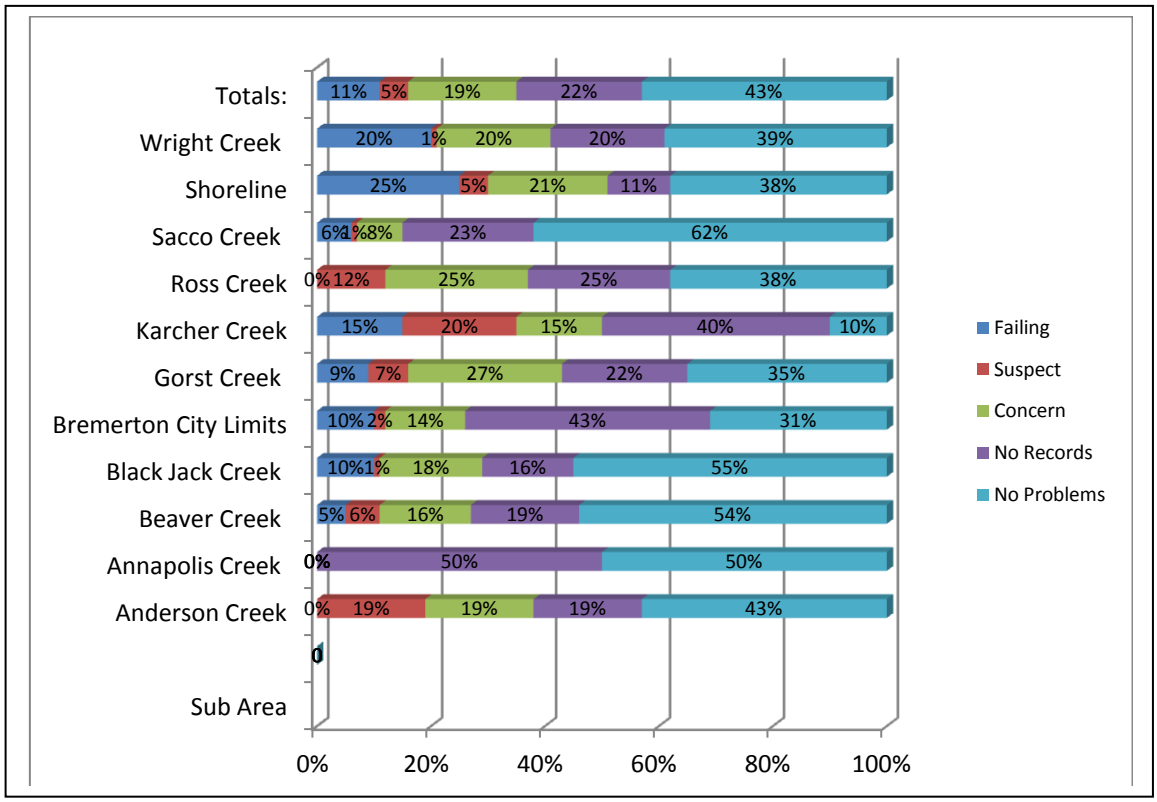
Pollution Identification and Correction (PIC) OSS surveys were conducted from October 2008 to September 30, 2013.

Residents of **784** properties participated in the PIC survey and based upon the results of each survey, OSS were categorized as "Failing," "Suspect," "Concern," "No Records," or "No Apparent Problems." Table 5 summarizes the project OSS survey results. OSS were rated according to "Criteria for Rating OSS" in Appendix B**.**

Table 5. Summary of PIC Property Inspection Results 10/1/2008 – 9/30/2013

Sub Area	Total	Failing		Suspect		Concern		No Records		No Problems	
		#	%	#	%	#	%	#	%	#	%
Anderson Creek	**16**	0	*0%*	3	*19%*	3	*19%*	3	*19%*	7	*43%*
Annapolis Creek	**4**	0	*0%*	0	*0%*	0	*0%*	2	*50%*	2	*50%*
Beaver Creek	**108**	5	*5%*	7	*6%*	17	*16%*	20	*19%*	59	*54%*
Black Jack Creek	**185**	18	*10%*	1	*1%*	33	*18%*	29	*16%*	104	*55%*
Bremerton City Limits	**125**	13	*10%*	3	*2%*	17	*14%*	54	*43%*	38	*31%*
Gorst Creek	**152**	13	*9%*	10	*7%*	41	*27%*	33	*22%*	55	*35%*
Karcher Creek	**20**	3	*15%*	4	*20%*	3	*15%*	8	*40%*	2	*10%*
Ross Creek	**8**	0	*0%*	1	*12%*	2	*25%*	2	*25%*	3	*38%*
Sacco Creek	**48**	3	*6%*	1	*1%*	4	*8%*	11	*23%*	29	*62%*
Shoreline	**103**	26	*25%*	5	*5%*	22	*21%*	11	*11%*	39	*38%*
Wright Creek	**15**	3	*20%*	1	*1%*	3	*20%*	3	*20%*	5	*39%*
Totals:	**784**	**84**	***11%***	**36**	***5%***	**145**	***19%***	**176**	***22%***	**343**	***43%***

Figure 3. Summary of Pollution Identification and Correction Results 10/1/2008 – 9/30/2013



As presented in Table 5 and Figure 3, **35%** of the onsite sewage systems in the project area were failing, suspected to be failing, or at higher risk of failing because of conditions noted during the inspection. This percentage is average as compared to the six other most recent projects. Additionally, the shoreline and Karcher Creek had the highest percentage of failing, suspect and concern systems in the project area. It will be critical to re inspect these areas as soon as possible to prevent significant impacts from failing onsite sewage systems.

5.2.1 Analysis of Failures

Historically, the average life expectancy for onsite sewage systems in Kitsap County is approximately thirty years. Misuse and environmental factors can shorten their life and regular maintenance and good home practices can lengthen it. The most common factors observed in the project area that contributed to OSS failure were:

- Age of the OSS
- Poor soil types
- Shallow depth to water table or an impervious layer
- Hydraulic overload by the residents
- Inadequate or lack of maintenance of the OSS
- Root intrusion into OSS components

The **10.7%** failure rate found in the project area is within the expected range for properties in Kitsap County. Historically, similar projects conducted by the Health District since 1995 have found a failure rate between two and fifteen percent (2% - 15%).

Of the **84** failures identified during the project, the most common identifying characteristic was sewage coming to the surface of the ground from the OSS. Table 6 displays the types of failures observed during the project. Figure 4 describes the location of the failing OSS and illustrates that most of the failing OSS were located within 200 feet of a stream or the shoreline.

Of the 84 sewage sources confirmed during the project, there were seventy-three (73) failing OSS, four (4) discharging travel trailers, six (6) side sewer failures, and (1) direct discharge from a coffee stand. The travel trailers were vacated. Five of the side sewer failures were repaired and the sixth is in progress.

Table 6. Onsite Sewage System Failure Type

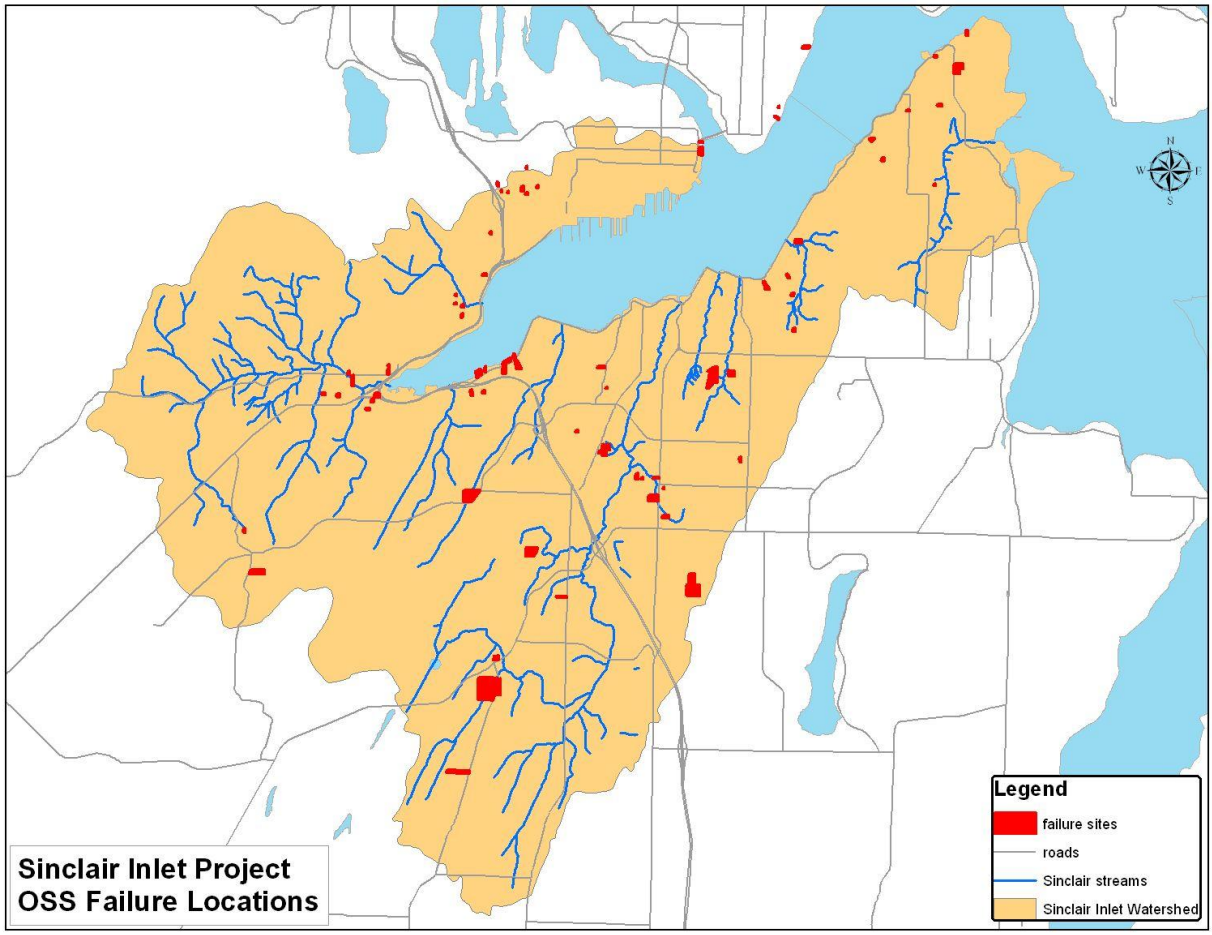
Number	Percent of total	Description
49	58%	Surfacing on ground
10	12%	Backing into structure
8	10%	Discharge to surface water
6	7%	Direct discharge to ground surface
4	5%	Sewage from recreational vehicle
4	5%	Storm water illicit discharge or connection
3	3%	Cross connection to drain system
0	0%	Greywater Discharge

As shown in Table 7 below, 79 of 84 (94%) failing OSS have been repaired. Twenty-six (26) homeowners were able to fix the failure through minor repairs, twenty-nine (29) installed new systems, twelve (12) connected to sewer, ten (10) vacated the structure in lieu of repair and a notice to title documented the failure, and two (2) installed phased repairs. A phased repair involves implementation of a full repair plan in steps. For example, a curtain drain could be installed as a first phase to see if it can reduce shallow water table in the drainfield area. The site is monitored and if the problem is not fixed, the next phase of the repair plan is implemented.

Table 7. Onsite Sewage System Repair Type

Number	Percent of total	Description
26	33%	Minor repair
19	24%	New alternative system
12	15%	Sewer connection
10	13%	New gravity system
10	13%	Structure vacated
2	3%	Phased repair

Figure 4. Location of OSS Failures



Of the 73 failing OSS:

- Five properties were vacated
- Twelve properties were connected to municipal sewer
- Fifty-one failures were repaired: nineteen were alternative OSS, ten were standard gravity systems, twenty were minor repairs, and two were phased repairs
- Five repairs are in progress: all have approved repair plans awaiting installation.

5.3 Agricultural Inventory, Farm Planning & Best Management Practice Implementation

Kitsap Conservation District conducted inventories of farm properties within the Sinclair Inlet watershed, contacted owners of these properties to offer technical assistance, and worked with landowners to implement BMPs to reduce non-point source pollution. Appendix C contains a full report prepared by the Conservation District.

Public outreach included two mailings to all initially inventoried properties, and continued mailings as additional properties were identified. Two farm workshops were held to illustrate the use of BMPs in manure, mud and pasture management.

Three realtor workshops were co-sponsored, with 32 Kitsap realtors receiving tuition reimbursements. In addition, landowners were provided with frequent emails about other educational opportunities, as well as seasonal farm management tips. These workshops have proven very effective in the Burley Lagoon watershed to help realtors better identify sensitive areas and how to help their clients better match properties to planned land activities. Realtors were educated about natural shoreline processes and the effects of human land use on these processes. They were alerted to local onsite sewage and solid waste regulations, given tips about how to protect the onsite sewage system investment, and how to apply green landscaping techniques.

Seventeen farm plans (and one forestry plan) were developed for landowners. These plans inventoried existing conditions and evaluated resource needs and challenges. Assistance was provided to procure cost share assistance for implementing BMPs, and $50,038.24 has been awarded. One hundred five **(105)** BMPs, both physical and management, have been implemented. KCD will continue to provide technical assistance to landowners as they implement their plans.

Two major barriers to BMP implementation were: (1) A significant percentage of high priority farms owners were unable to afford the most commonly needed - as well as most expensive – BMPs, such as waste storage structures, heavy use area protection, and fencing. Allocating additional funds towards cost share assistance would greatly improve landowners' ability to construct BMPs. (2) Many landowners within this watershed were resistant to government entities and did not want to work with KCD, despite it being non-regulatory. For the landowners who did work with KCD, a disadvantage of being non-regulatory was that these landowners did not always feel a sense of urgency regarding correcting conditions or changing management of their farms. Working in conjunction with Kitsap Health District investigations helped address this particular challenge. One solution to this could be conducting education and outreach research using social marketing methods to determine motivations and barriers to needed behavior change. Another solution could be holding more educational events, publishing articles, etc. for landowners to learn in a non-pressured way that preventing run-off from their farms can directly impact their communities', and their own, quality of life.

Table 8 below provides a summary of the major types of best management practices that were implemented during the project:

Table 8. Agricultural BMP Implementation Summary

Type of BMP	Quantity
Heavy Use Area Protection	**0.29 Acres**
Livestock Access Control	**99 Acres**
Fencing	**7091 Feet**
Filter Strip	**0.77 Acres**
Livestock Waste Transfer	**6 Transfer**
Waste Storage Structures	**2 Structures**

5.4 Education and Outreach

During property inspections, Kitsap Health staff provided homeowners with educational brochures, a copy of the sewage disposal permit, as-built, and OSS plans for their home. Kitsap Health staff also emphasized that operation and maintenance is crucial to prevent premature septic system failures and for protecting water quality in Sinclair Inlet. During the OSS inspection, staff shared site-specific recommendations on how to get the most life out of their system. Any practice that might stress the system or reduce performance was identified and possible solutions were provided. Informational brochures and water-conserving fixtures were made available to all residents.

Four (4) public meetings, three (3) onsite sewage system work shops, five (5) Girls Exploring Math and Science workshops, four (4) Girl Scout day camp presentations, two (2) South Kitsap High School presentations, and three (3) KCD public outreach events were conducted during the project period.

Kitsap Health contracted with the KCD to prepare agricultural and natural resource educational programs and develop and maintain a mailing list. KCD prepared and conducted special interest workshops/field days/meetings to educate landowners/stakeholders toward better natural resource stewardship. As presented in Appendix C, the Conservation District completed the following activities:

Initial mailing, 7/29/09. An introductory postcard explaining district services was sent to all 87 agricultural landowners identified in the initial inventory.

Second mailing, 9/4/09. A detailed flyer was created and mailed to all 87 agricultural landowners initially identified in the inventory.

Landowner workshop, 10/2/11: Farm tour and workshop held on a Sinclair Inlet watershed horse farm. Subjects included pasture, mud & manure management. Handouts on these topics, as well as on rain gardens, stream steward program, native plants, general conservation etc. were available. 23 people attended.

Landowner workshop, 5/30/12: Ios Ranch farm walk presented with WSU Extension, 50+ attendees. Purpose was to demonstrate/educate landowners with livestock about BMPS to protect water quality. 48 Sinclair Inlet landowners, including all Priority 1 and Priority 2 landowners were sent invitations, followed by a lettering offering free admission to the tour. Five landowners from Sinclair Inlet attended.

Individual mailings – throughout the life of the grant, individual landowners were sent educational information, such as local farm events, season-specific farm management tips, farm management booklets, and more. As farms were added to the inventory, landowners were sent information about KCD's services.

Real Estate Workshops – KCD co-sponsored the following WSU workshops. These workshops included information on natural shoreline processes, interactions and effects of human land use on these processes, and current regulations; care and maintenance of septic systems; and green landscaping. Participating real estate professionals received tuition reimbursement. Thirty-two Kitsap real estate professionals received this reimbursement.

- May 7, 2009: Shorelines
- March 1, 2010: Septic Sense
- May 6, 2010: Shorelines

Boat Waste Education – The grant agreement required that a boat waste education program be performed throughout Dyes and Sinclair Inlets which host six marinas. The initial program scope was to distribute seat cushions printed with a boat waste slogan and a map of the locations of pump outs on the cushion in Kitsap County to boaters. Seat cushions were to be distributed from Spring 2009 through Fall 2010. Effectiveness was to be measured by establishing a waterproof log-in station at the Port Orchard Marina on Sinclair Inlet. Users would log pump out use during the summer of 2008. Comparing the pump out station usage before and after distribution would monitor post-distribution effectiveness. Kitsap Health planned to maintain the log out station by visiting every two weeks.

Staff met with WSU Cooperative Extension to discuss ways in which the education requirements for this grant and the Liberty Bay grant could be met more efficiently (simultaneously). It was decided to revise the boat waste education component as follows. Written surveys were created to assess boater awareness and use of sewage pump-out facilities. The first phase involved meeting with boaters in local marinas, discussing the issues with them, and requesting that they complete a written survey. This was done on Friday evening prior to Labor Day weekend in September 2011. Clean Boating Kits were distributed along with the initial survey. These contained printed materials on clean boating, tips for preventing pollution and boat fires, small spill kits and Boater Guide Maps. In addition, bilge BioSoks (oil & fuel absorbents) were provided to each boater that completed the survey as a "thank you" gift. Educational materials were developed in partnership with the WSU Extension and Puget Soundkeeper Alliance.

The second survey was mailed to boaters who completed the first survey in December 2011. This survey asked follow up questions about which educational materials the boaters found most helpful, and what changes in attitude or behavior (if any) had occurred since the first survey. To encourage boaters to complete the second survey, a No Spill Fuel Recovery container was offered as a gift. Even with this incentive, and multiple efforts to contact participants, only 55% of participants returned the second survey.

Appendix D contains a report that details the results of boater education efforts. In summary, the pre and post boater's surveys provided information about boating habits and behaviors. The small number of participants did not provide definitive information regarding a change in boater knowledge or behavior related to sewage discharge. Generally the educational materials were reported to be helpful, and with respect to the recognition of the pump out symbol, these may have increased awareness as indicated by the responses to that question. However this increase in knowledge was not statistically different. In future, it is recommended that a similar pre and post survey be conducted, with a larger group of boaters and combine the distribution of educational materials with a workshop or presentation.

5.5 Water Quality Monitoring

5.5.1 Trend Monitoring Results

Table 9
Summary of 2013 Water Year (FC) data for
Sinclair Inlet Freshwater Tributaries
Extraordinary Primary Contact

Stream Mouth	2013 Water Year (October 2012 – September 2013)					
	Number of samples	Range (FC/100 ml)	GMV (FC/100 ml)[1,2]	#Samples exceeding standard	%Samples exceeding standard [2]	Meets Washington Dept. of Ecology Standard?
Beaver	12	10 - >=2000	74	4	33%	**No**
Karcher	12	4 - 740	66	6	50%	**No**
Sacco	12	4 - >=2000	40	4	33%	**No**

1. GMV = geometric mean value
2. Shaded entries indicate an exceedance of the applicable water quality standard (**Extraordinary Primary Contact** - Chapter 173-201A-030 WAC) during Water Year 2008. FC levels shall not exceed a GMV of 50 FC/100ml, and not have more than 10% of all samples exceed 100 FC/100 ml

Table 10

Summary of 2013 Water Year (FC) data for Sinclair Inlet Freshwater Tributaries - Primary Contact

Stream Mouth	2013 Water Year (October 2012 – September 2013)					
	Number of samples	Range (FC/100 ml)	GMV (FC/100 ml)[1]	#Samples exceeding standard	%Samples exceeding standard [2]	Meets Washington Dept. of Ecology Standard? 2
Anderson	12	4 - >=2000	20	2	17%	**No**
Annapolis	12	10 - >=2000	93	2	17%	**No**
Black Jack	12	4 - >=2000	47	1	8%	Yes
Gorst	12	4 - >=2000	32	2	17%	**No**
Ross	11	4 - 1745	29	3	27%	**No**
Wright [3]	12	4 - >=2000	43	4	33%	**No**

1. GMV = geometric mean value
2. Shaded entries indicate an exceedance of the applicable water quality standard (**Extraordinary Primary Contact** - Chapter 173-201A-030 WAC) FC levels shall not exceed a GMV of 100 FC/100ml, and not have more than 10% of all samples exceed 200 FC/100 ml
3. Wright Creek was not monitored until 2009 water year, so that data is presented.

Table 11

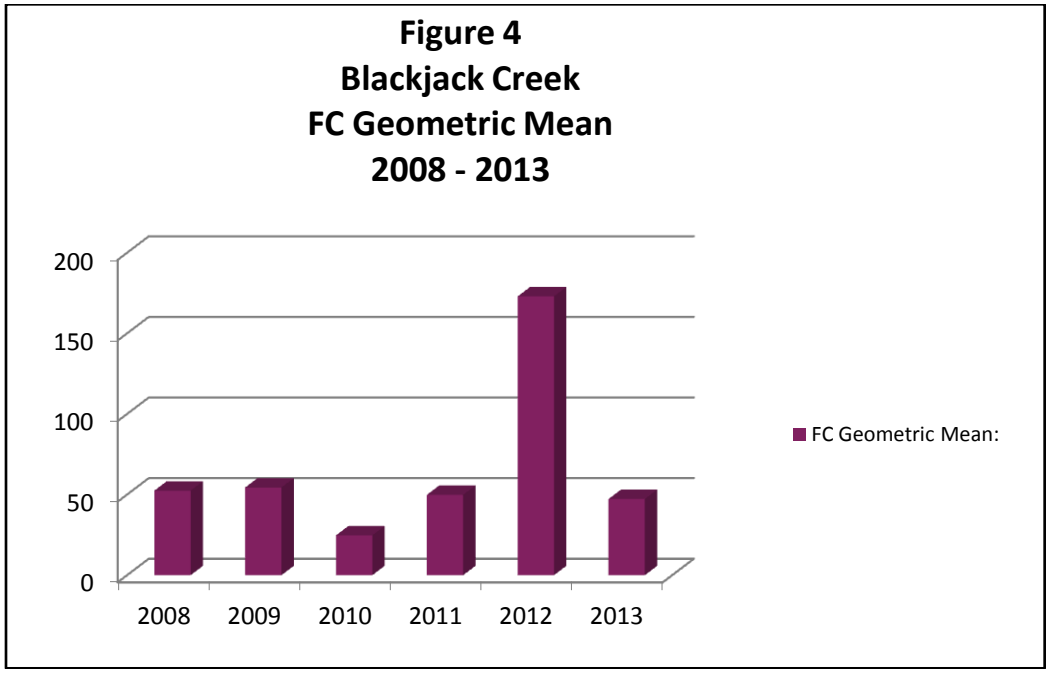
Summary of 2013 Water Year (FC) data for Sinclair Inlet Marine Waters

Marine Station	2013 Water Year (October 2012 – September 2013)					
	Number of samples	Range (FC/100 ml)	GMV [1] (FC/100 ml)	#Samples >43 FC/100 ml	%Samples >43 FC/100 ml [2]	Meets Washington Dept. of Ecology Standard?
SN03	12	<2 - 7	<2	0	0%	Yes
SN05	12	<2 - 70	6	2	17%	**No**
SN10	12	<2 - 24	3	0	0%	Yes
SN12	11	<2 - 75	8	1	9%	Yes
SN13	12	<2 - 70	4	2	17%	No
SN14	12	<2 - 34	2	0	0%	Yes
SN15	12	<2 - 54	3	1	8%	Yes
SN22	12	<2 - 92	7	2	17%	**No**
SN23	12	<2 - 279	6	2	17%	**No**
SN24	12	<2 - 35	3	0	0%	Yes
SN26	12	<2 - 30	2	0	0%	Yes
SN27	12	<2 - 44	2	1	8%	Yes

Table 12
Summary of Last 30 Samples (FC) data for
Sinclair Inlet Marine Stations

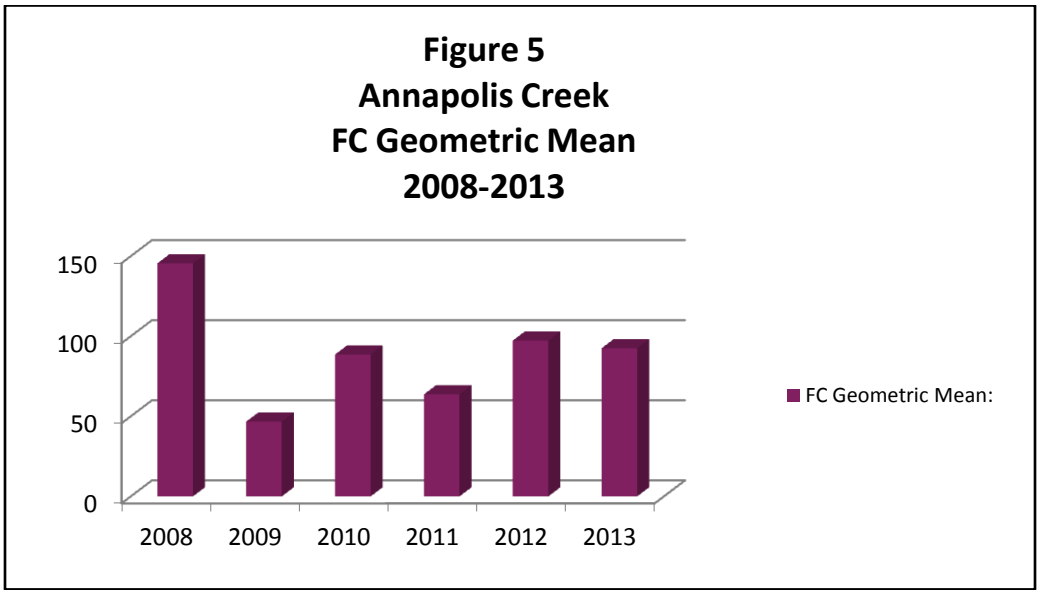
Area	Station	Last 30 Samples (-)	Last 30 Samples (+)	Change	Explanation
Bremerton WWTP outfall	SN03	4	4	No change	
Gorst Creek	SN05	17	54	Decline	new "hotspots" on north shore, older OSS in area
Port Orchard Blvd Outfall	SN10	32	15	Improve	Illicit discharge eliminated in 2010
Black Jack	SN12	52	46	Improve	Reduction in stream FC, fixed 18 sources
Karcher	SN13	34	65	Decline	Sewage discharge from public housing complex found in 2013
Mid Channel	SN14	8	7	No change	
Sacco	SN15	9	27	Decline	Waterfowl in estuary above mouth of Sacco Creek
Annapolis	SN22	90	38	Improve	Reduction in Annapolis Creek FC, fixed illicit discharges at mall, sewer line replacement
Port Orchard boat ramp, storm water outfall	SN23	19	31	Decline	Unknown, but average annual rainfall was significantly higher 2008 +
Outfall west side of pier, Wilkins Place Road	SN24	13	27	Decline	Unknown, but average annual rainfall was significantly higher 2008 +
	SN25	14	31	Decline	Large number waterfowl on WWTP lawn
Bachman Park	SN26	30	7	Improve	Unknown
Karcher Creek WWTP Outfall	SN27	34	18	Improve	Unknown

As presented in Table 4 and Table 5, five of the thirteen stations demonstrated good reductions in Part 2 of the FC standard during the project period. Two remained unchanged, and five showed declines. As shown in the explanations column, stations SN12 (mouth of Blackjack Creek) and SN22 (mouth of Annapolis Creek) have shown significant improvement during the project. The FC concentrations of project area streams is shown below.

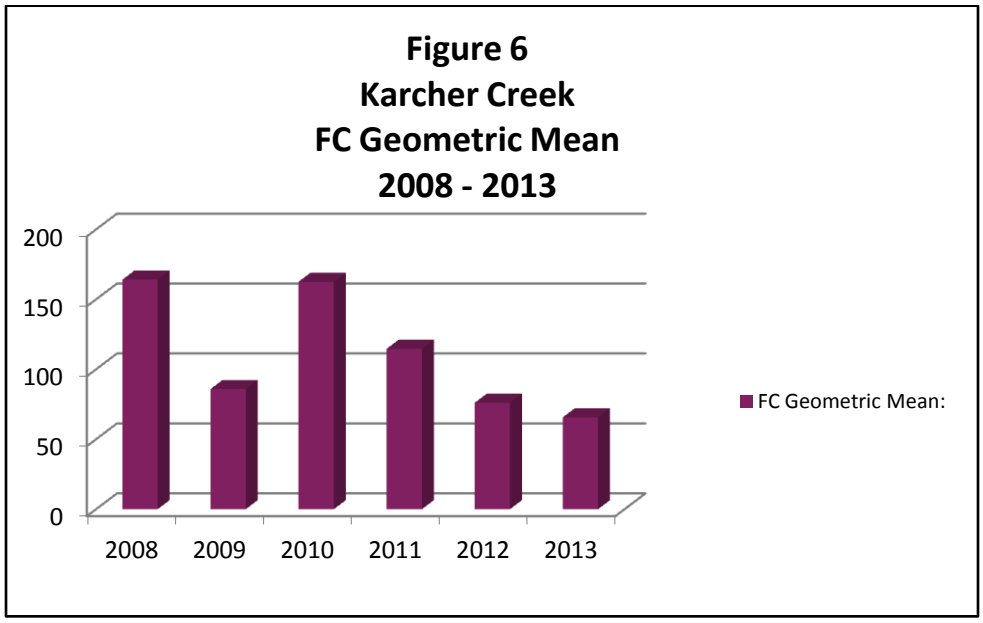


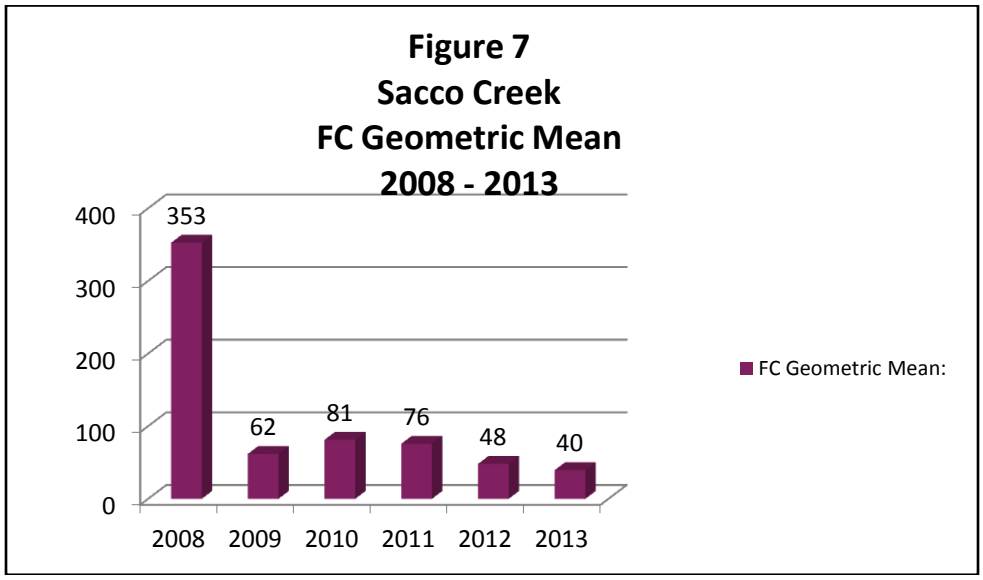
Blackjack Creek met the FC standard for the first three years of the project. In 2012, we saw FC increases and conducted segment sampling and found that the high segments were located in the northern portion of the stream within the City of Port Orchard. An intense investigation was initiated in the Fall of 2012. Research was conducted to find OSS within 200 feet of Blackjack Creek and those parcels were surveyed. Several failing OSS were identified and corrected and human waste was found near homeless camps in the woods next to the creek. Several joint site visits were conducted with Port Orchard code enforcement and the city police and the homeless camps were abandoned and cleaned up.

The improvements seen in Blackjack Creek in 2013 are the direct result of fecal source corrections resulting from the intense investigation. Since then, five failing OSS were identified and corrected in this watershed. Since the beginning of the project in October 2008, 17 human sewage sources have been corrected in the Blackjack Creek watershed.



Sewer infrastructure was investigated and replaced in portions of the area upland of Annapolis Creek and a major stormwater infrastructure renovation is scheduled for 2014.





6.0 CONCLUSIONS

- FC concentrations in many of the problem drainages have been reduced. The Health District expects to see more improvements after additional OSS repairs and follow-up work is completed. Unfortunately, those improvements may be masked by new FC sources in this area with many OSS beyond the average 30 year life span.

- 94% (79 of 84) of the sewage sources have been corrected, and 5 are in the correction process. Repairs should be complete by December 2013.

- Analysis of wet and dry season monitoring indicates that FC levels are significantly higher during the dry season then during the wet season in various drainages. Decreased stream flow and external sources such as runoff from impervious surfaces may contribute to higher bacteria levels during dry weather.

- Many of the OSS in the area experience risk factors that can lead to failure including age, lack of permit records, shallow ground water, inadequate setback to surface waters, and deeper installation depths that can degrade the ability of soil bacteria and microbes to provide adequate treatment.

- Shoreline surveys were an effective method of finding OSS failures. OSS inspections and water quality monitoring activities are effective in the wet season to find OSS failures caused by surface or ground water intrusion. Dry season inspections and monitoring are effective to find OSS failures that are masked by storm water or are only occupied in the summer. Extreme low tide shoreline surveys can be an effective method of finding direct discharges into the shoreline as illustrated by the failure found in the special low

tide shoreline survey of the half-mile section of shoreline west of Port Orchard near Gorst.

- Kitsap Health's Operation and Maintenance program ensures that owners of alternative systems have a certified maintenance contract, required inspections are being conducted, and that needed repairs are made. Owners of gravity systems need to have their systems inspected every three years and pumped when necessary as implemented through permit applications including the Permit program and Property Conveyance Inspection process.

- Cost share money for livestock and agricultural animal manure land management practices has been a good catalyst, resulting in behavior change and increased landowner stewardship. This incentive program has proven effective in achieving water quality improvements in challenging situations and during adverse economic conditions. This method minimizes expensive and time-consuming enforcement that also damages public relationships and strains partnerships. Good land management practices prevent erosion that forms run-off channels through the riparian zone and transports pollution to streams and shorelines.

- Poor garbage and grease housekeeping practices provide a food source for urban wildlife that results in fecal pollution. Two shoreline "hotspots" were associated with restaurants. One was washing greasy mats outdoors near a storm drain and both had leaky garbage and grease receptacles.

- Kitsap County residents are urged not to feed wildlife. Multiple FC "hotspots" in the growing area were confirmed or suspected to be wildlife related. Feeding wildlife is not healthy for wildlife, water quality or public health.

- Non-point pollution is best addressed by visiting as many watershed residents as possible. Door-to-door surveys are an excellent way to provide site-specific information on local water quality problems and how to reduce bacterial and nutrient pollution sources.

7.0 RECOMMENDATIONS

The following recommendations are presented as a result of interaction with homeowners, experience gained, and evaluation of sample results from the Sinclair Inlet Fecal Pollution Reduction Project:

- Complete correction of the remaining OSS failures and investigate remaining FC hotspots found through subsequent shoreline surveys.

- This watershed will need an ongoing effort to protect water quality because many of the OSS are well past the average functional lifespan of approximately 30 years. Older OSS designed through percolation tests provide disposal and may not provide adequate effluent treatment.

- Continue to track water quality trend data at mouth stations for post-corrective analysis and long-term correction. The Health District's annual project area ranking process automatically assesses water quality for FC problem areas. These are ranked by KCSSWM partners and guide program activities.

- Continue to conduct marine shoreline surveys in the area to protect beneficial uses and restore surface waters to standard.

- Continue the strong partnership with DOH, Ecology and other water quality agencies to coordinate, assess and implement ongoing water quality restoration and protection tasks. Communicate significant water quality issues with DOH, Ecology and other appropriate agencies.

- Continue to be involved in the Sinclair Inlet watershed through public complaint response, water quality trend monitoring, and follow-up of reports submitted by certified monitoring and maintenance specialists and pumpers. Properties with ongoing concerns are flagged in Kitsap Health records.

- Recommended follow-up work will be conducted through ongoing KCSSWM funding, the trend monitoring program, shoreline monitoring program, public OSS/water quality complaint process, and review and follow up of deficient tank pumping reports.

- Continue to seek technology and methods to better identify and correct FC pollution sources.

- Research potential methods to better build public trust, by actively working to provide accurate and representative data upon which to base regulation and legislation.

- Utilize and develop public outreach and education materials based on social marketing principles that will result in measurable behavior changes.

- Develop specific educational materials that apply to water quality impacts of wildlife. A brochure should be developed that highlights the importance of not feeding wildlife and managing garbage, manure, compost, etc. in such a way that prevents attractive nuisance.

8.0 REFERENCES

Kitsap County Board of Health Ordinance No. 2008A-01, "Rules and Regulations Governing On-Site Sewage Systems." 2008.

Bremerton-Kitsap County Health District, Ordinance 2010-1, Solid Waste Regulations. July 6, 2010.

Kitsap County Health District, Trend Monitoring Plan. March 2010.

Kitsap County Health District, Manual of Protocol: Fecal Coliform Bacteria Pollution Identification and Correction Projects. 2011.

Kitsap County Health District. Water Quality Monitoring Report. 2011-2012.

Kitsap County Stormwater Management Manual, Appendix 8A Maintenance Guidelines. April 1997.

Washington State Department of Ecology. Chapter 173-201A of the Washington Administrative Code Water Quality Standards for Surface Waters of the State of Washington. 1992.

Washington State Department of Ecology, Clean Water Act Section 303(d) List of Impaired Surface Waters. 1996, 1998, 2005, 2008 and 2012.

Washington State Department of Health, 2009 Shoreline Survey of the Port Orchard Passage Shellfish Growing Area, March 2009

Appendix A

LIST OF MONITORING STATIONS

Sinclair Inlet - Freshwater Stream Stations

Station ID	Stream	Station Description	Latitude	Longitude
AN01	Anderson Creek	Culvert between Hwy 16 and south side of Hwy 166	47.52743	122.68217
AP01	Annapolis Creek	Downstream Arnold Avenue culvert	47.54695	122.61811
BV01A	Beaver Creek	Upstream Beach Drive culvert near #7032 & Beaver Creek Rd	47.57021	122.55901
BJ01	Blackjack Creek	Upstream Bay Street culvert west of Maple, next to 1365 Bay	47.54179	122.62778
GR01	Gorst Creek	Downstream Hwy 3 culvert	47.52754	122.69804
KA01	Karcher Creek	Under Karcher Creek Treatment Plant, 1165 Bay St.	47.54672	122.61307
SC01	Sacco Creek	End of Sacco Lane behind power pole, near 2121 Sacco Lane	47.55221	122.60117
RS02	Ross Creek	Off Cedar Ridge Court, past stormwater pond behind #1406/1408	47.52607	122.66006
WR01	Wright Creek	End of Sherman Heights Road, upstream Hwy 3 culvert	47.54183	122.67649

Sinclair Inlet – Marine Water Stations

Station ID	Location Description	Latitude	Longitude
SN03	Nearshore Hwy 3 merge near pilings (Bremerton WWTP Outfall)	47.54655	122.66997
SN05	Nearshore head of Sinclair Inlet - Gorst Creek at pilings by quarry	47.52933	122.69103
SN10	Nearshore dock near Port Orchard Blvd outfall	47.54087	122.64285
SN12	Nearshore Blackjack Creek estuary	47.54663	122.62772
SN13	Mouth of Karcher Creek	47.547653	122.612877
SN14	Mid-channel between Point Heron and Annapolis	47.55845	122.61053
SN15	Nearshore Sacco Creek mouth	47.55368	122.60353
SN22	Nearshore mouth of Annapolis Creek	47.548381	122.618356
SN23	Nearshore outfall right side of Port Orchard Public Boat Ramp	47.54169	122.64127
SN24	Nearshore outfall west side base of pier, Wilkins Place Road	47.53835	122.649394
SN25	Nearshore Hwy 304, Bremerton, offshore Miller Sheet Metal	47.54876	122.666075
SN26	Outfall at Backmann Park Gazebo	47.56865	122.60764
SN27	Karcher Creek WWTP outfall	47.54927	122.61432

Appendix B

CRITERIA FOR RATING OSS

Rating Classification	Criteria for Meeting Classification	Action
No Apparent Problems	• Completed/signed Sewage Disposal Permit on file at Health District, or provided by owner at time of inspection and entered into our systems by support staff. • No illegal repairs or alterations have been performed on OSS. • All applicable setbacks and conditions in effect at the time of permitting are in place.	None
No Records	• No completed/signed Sewage Disposal Permit on file at the Health District, or in possession of the owner/occupant. • No Concern, Suspect or Failure conditions were observed.	None
Concern	Concerns include, but are not limited to: • System with no records and drainfield less than 50 feet from surface waters or wells • Improper use of designated reserve area • Vehicular traffic and/or pavement on OSS components • Roof drains or other drainage/infiltration systems potentially impacting the OSS • Unpermitted expansion or modification of existing structure(s), or addition of new structures, or recreational vehicle connections, that impacts the OSS • Unpermitted work conducted on the OSS • Excavation or excess fill within the OSS area, or a cut down slope of the OSS that has the potential to impact the performance of the OSS.	For un permitted alterations, expansions, repairs, connections or new construction, consult with Program Manager regarding enforcement options. No Logger flag without Program Manager approval
Suspect	• Drainfield area is saturated. • Collected water sample results from bulkhead drains, curtain drains, or other pipes or seeps, **at or above 500 FC/100 ml (or 406 EC/100ml) and a positive non visual dye test** confirmed by Ozark Underground Laboratories • Collected water sample results from bulkhead drains, curtain drains, or other pipes or seeps, **less than 500 FC/100 ml (or 406 EC/100ml) and positive visual dye-test**.	Mail Suspect Letter Follow up with wet season dye trace Flag Logger (Other)
Failure	• Sewage on the surface of the ground • Sewage discharged directly to surface water or upon the surface of the ground unless the discharge is under permit from WA DOE. • Sewage backing up into, or not draining out of a structure caused by slow soil absorption of septic tank effluent. • Sewage leaking from a septic tank, pump tank, holding tank, or collection system. • Any component of an onsite sewage system or public sewer connection found to be broken, in disrepair, or not functioning as intended. • Inadequately treated sewage effluent contaminating ground or surface water. • Collected water sample result from bulkhead drains, curtain drains, or other pipes or seeps, at or above 500 FC/100 ml (or 406 EC/100ml) **and** positive visual dye-test results. • Cesspools or seepage pits where evidence of ground water or surface water quality degradation exists, or inadequately treated effluent contaminating ground or surface water • Non compliance with standards stipulated on the permit, with the regulations in effect at the time the system was approved for use, or with the regulations in effect at the time the structure was constructed or modified. • Straight discharge (greywater or blackwater) from any indoor plumbing, including recreational vehicles, is observed and documented	Enforcement Flag Logger (Failure)

Appendix C

KITSAP CONSERVATION DISTRICT FINAL REPORT

Sinclair Inlet Fecal Pollution Reduction

Interlocal Agreement between Kitsap Public Health District & Kitsap Conservation District, for Washington State Department of Ecology Centennial Clean Water Program

Grant Number G0900050

Final Report November, 2013

Project Summary

Kitsap Conservation District made inventories of agricultural properties within the Sinclair Inlet watershed, contacted owners of these properties to offer technical assistance, and worked with landowners to implement BMPs that would reduce non-point source pollution.

Public outreach included two mailings to all initially inventoried properties, and continued mailings made as additional properties were identified. Two farm workshops were held to illustrate the use of BMPs in manure, mud and pasture management. 3 realtor workshops were co-sponsored, with 32 Kitsap realtors receiving tuition reimbursements. In addition, landowners were provided with frequent emails about other educational opportunities, as well as seasonal farm management tips.

Seventeen farm plans (and one forestry plan) were developed for landowners. These plans inventory existing conditions and evaluate resource needs and challenges. Assistance was provided in procuring cost share assistance for implementing BMPs, and $50,038.24 has been awarded so far. 101 BMPs, both physical and management, have been implemented. KCD will continue to provide technical assistance to landowners as they implement their plans.

Challenges within Sinclair Inlet watershed:

Economic. High priority farms had a high percentage of lower income landowners who were unable to afford the most commonly needed - as well as most expensive – BMPs, such as waste storage structures, heavy use area protection, and fencing. Allocating additional funds towards cost share assistance would greatly improve landowners' ability to construct BMPs.

Landowner resistance to government agencies. Many landowners within this watershed were resistant to government entities and did not want to work with KCD, despite it being non-regulatory. For the landowners who did work with KCD, a disadvantage of being non-regulatory was that these landowners did not always feel a sense of urgency regarding correcting conditions or changing management of their farms. Working in conjunction with Kitsap Health District helped address this particular challenge. Another solution to this could be holding more educational events, publishing articles, etc. so that landowners could learn in a non-pressured way how preventing run-off from their farms can directly impact their communities', and their own, quality of life.

Task 1 – Project Administration/Management

Effective administration and management of the grant project, maintenance of all project records, submittal of payment vouchers and progress reports.

The project was managed to meet the goals of the grant. Records were kept by the Financial Coordinator and all planners involved in the grant. Quarterly project reports and vouchers were completed and submitted in a timely fashion.

Task 2 – Public Education & Outreach

Maintain agricultural and natural resource educational program and mailing list. Prepare special interest workshops/field days/meetings to educate landowners/stakeholders toward better natural resource stewardship.

Initial grant mailing, 7/29/09. An introductory postcard explaining district services was sent to all 87 agricultural landowners identified in the initial inventory.

Second grant mailing, 9/4/09. A detailed flyer was created and mailed to all 87 agricultural landowners initially identified in the inventory.

Landowner workshop, 10/2/11: Farm tour and workshop held on a Sinclair Inlet watershed horse farm. Subjects included pasture, mud & manure management. Handouts on these topics, as well as on rain gardens, stream steward program, native plants, general conservation etc. were available. 23 people attended.

Landowner workshop, 5/30/12: Ios Ranch farm walk presented with WSU Extension, 50+ attendees. Purpose was to demonstrate/educate landowners with livestock on BMPS to protect water quality. 48 Sinclair Inlet landowners, including all Priority 1 and Priority 2 landowners were sent invitations, followed by a lettering offering free admission to the tour. 5 landowners from Sinclair Inlet attended.

Individual mailings – throughout the life of the grant individual landowners were sent educational information, such as local farm events, season-specific farm management tips, farm management booklets, and more. As farms were added to the inventory, landowners were sent information about KCD's services.

Real Estate Workshops – KCD sponsored the following WSU workshops. These workshops included information on natural shoreline processes, interactions and effects of human land use on these processes, and current regulations; care and maintenance of septic systems; and green landscaping. Participating real estate professionals received tuition reimbursement. 32 Kitsap real estate professionals received this reimbursement.

- May 7, 2009: Shorelines
- March 1, 2010: Septic Sense
- May 6, 2010: Shorelines

Task 3 – Pollution Identification and Correction

Watershed Inventory and Prioritization: Update and maintain GIS database with prioritized parcel inventory.

Table 1: Parcels by Priority

Priority Level	6/30/09	10/31/13
1	19	2
2	23	10
3	18	47
4	11	39
5	16	12
TOTAL	**87**	**110**

Agricultural properties in the target watershed were prioritized based on their potential to pollute. Factors such as land use, livestock numbers, proximity of livestock use areas to surface water, presence of critical areas, pasture management, and facilities for waste were taken into consideration. A priority scale of 1 – 5 was used, with 1 being the highest priority.

As conditions changed on farms, priority levels were changed accordingly. Additional farms were added to the inventory during the course of the grant.

Priority Rating Criteria

1. High: Pasture poor. Livestock access to surface water and/or high probability of runoff. Evidence of contamination.
2. Medium-High: Pasture poor. Some reason to believe conditions could get worse seasonally. Probability of runoff.

3. Medium:	Pasture fair. Open water in vicinity of the property but with limited access or little evidence of use.
4. Medium-Low:	Pasture good. No open water in vicinity and/or a low probability of contaminated runoff reaching surface water.
5. Low:	Visual inspection from roadside indicates historic or recent past farming activity. No livestock currently on site

Farm Planning: Provide technical services to agricultural landowners in Sinclair Inlet. This includes Agricultural BMP Design, Facilitation and Implementation, provide technical oversight to implement farm management practices, write farm plans, respond to complaints, and referrals.

All initially inventoried properties were contacted twice, via mail, at the beginning of the grant. In addition, all higher priority (1-2) and nearly all lower priority (3-4) landowners identified during subsequent inventories were contacted at least once during the course of the grant; most were contacted at least twice. This contact was made via mail, phone, or in person. Technical support was provided to landowners.

Farm plans contain an average of fifteen BMPs, and KCD's work in the watershed will continue well past the grant's end as landowners continue to implement their farm plans and to construct BMPs.

See Appendix A for further details. Appendix A contains only the landowners who received BMP designs and/or completed BMPs; it does not include landowners who received technical support but did not report any BMPs.

Before and After Photographs:

Jones, Animal Trail & Walkway (575)

Before:

After:

Lindstrom, Filter Strip (393)

Before:

After:

Merriman, Fencing (382)

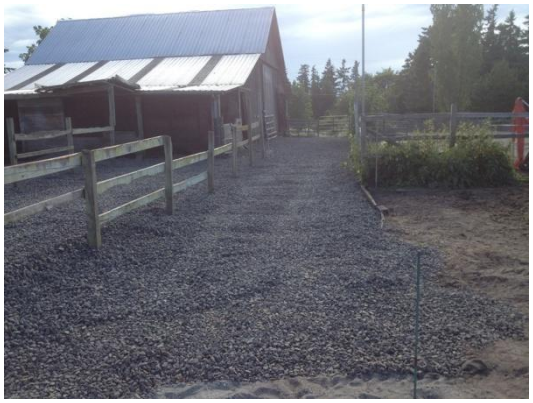
Before:

After:

Dirks, Heavy Use Area Protection (561)

Before:

After:



Landowner	Priority Level		Activity					Cost Share Amount			
	Initial	2013	Site visits	FP?	BMP designs provided	BMPs implemented	Refered by	Applied for	Paid to date		
Ahern (Wozlek)	4	4	2		561	561/.01 acre					
						528/2.3acres					
Bilodeau	4	4	4	y	382, 554	472/5 acres		$2,400.00	$1,443.50		
						595/5 acres					
						528/5 acres					
						554/ 1 each					
Bornhouser					590	590/1 acre					
Bryant (H Brown prop)	2	3	1			382/300'					
Dirks	1	2	10	y	561, 558, 607, 512	561/0.1 acre	Health	$6,400.00	$5,355.60		
						558/ 1 each					
						607/300'					
						472/7 acres					
						362/145'					
						512/0.2 acres					
						634/ 1 each					
Figg	3	3	1			590/0.3 acre					
Fritz	1	3	4		362, 558, 634, 620		Neighbor	$29,738.00			
Gilman (Workman)	1	2	7	y	313, 558, 620		USDA	$6,000.00			
Hall	1	1	7	y	362	472/1.5 acres	Health				
						382 (2)/120' + 80', exclusion	west of barn				
						393/0.1 acre					
						528/1.5 acre					
						620/40'					
						558/1 each					

						512/0.1 acre					
Holler	2	2	3	y		472/2 acres	Health	$1,500.00			
Johnson	2	4				528/3.7 acres					
						472/3.7 acres					
Jones	4	4	3		575, 554	575 (2)/745'+80'		$516.00	$1,226.66		
						612/0.2 acre					
						620/30'					
						382/330', cross					
						472/0.4 acre					
						528/0.4 acre					
						595/2.5 acres					
						590/0.4 acre					
						634/ 1 each					
						554/ 1 each					
						393/0.1 acre					
King	1	2	9	y	561	382/50', cross		$2,076.00			
						472/2.5 acres					
						512/0.2 acre					
						612/0.07 acre					
						590/0.2 acre					
						528/0.2 acre					
						393/0.05 acre					
						382/120', excl					
						362/55'					
Kitsap Saddle Club	3	3	7		606, 620	606/250'		$33,550.00	$8,550.00		
						620/250'					
Kraus (Fernwood Creamery, Harper Rd)	1	3	4	y	620, 430, 558	313/cover, 1 each	Health	$16,000.00	$3,575.26		

						472/3 acres					
						382/130', excl					
						430/2033'					
						620/512'					
						558/1 each					
Lindstrom	1	3	15	y	561, 620, 393, 612	620/80'	Health	$2,900.00	$1,613.95		
						561 (2)/.02+.01 acres					
						472/3.5 acres					
						393 (2)/0.41+0.05 acre					
						382 (2)/330' + 130', exclusion					
						612/0.1 acre					
						634/ 1 each					
Merriman	1	2	10	y	362, 620, 382	620 (3)/242' total	Health	$43,555.00	$28,273.27		
						382/3726', exclusion					
						362/926'					
						472/8 acres					
						528/8 acres					
						590/8 acres					
Meser	2	3	1	y		590/7 acres	Health				
						528/7 acres					
Morey	3	4	10	y	612, 561	595/4.8 acres		$16,000.00			
						512/0.9 acre					
Norwood	3	3	2		512	512/1.5 acres					
Olson (Blackjack Farm)	2	3	2	y		561/0.01 acre	WSDA				

						558/1 each					
						620/300'					
						313/1 each					
						382/240', excl					
						634/1 each					
						528/2.9 acres					
						472/2.9 acres					
						590/2.9 acres					
Post (Winkler)	1	5	2			382/600', excl	Health				
						472/39 acres					
Rachner	3	3	1			512/0.7 acres					
						561/0.04 acre					
Rodriguez	1	2	8	y	561	393/0.06 acre	Health, solid waste	$3,600.00			
						472/3 acres					
Simpson	4	4	3	y		595/1 acre					
						314/1 acre					
						634/1 each					
						**382					
Smith	3	3	1			634/1 each		$12,500.00			
						558/1 each					
						590/4.7 acres					
						472/4.7 acres					
						512/1.3 acres					
Stock				y*							
Sundberg	1	1	1		313		Health	$8,500.00			
Sutman	3	3	3	y		528/5.5 acres		$14,500.00			
Tower	2	2	2		561, 313	472/12.8 acres		$38,203.00			

Weatherly	4	4	3	y		314/4.5 acres					
						382/935'					
						460/0.5 acre					
Werbelo/Kittelson	2	3	4	y		528/5.7 acre	Health				
						561/0.1 acre					
Williams					590	590/1 acre					
Wiltermood			1		645	645/10 acres					
TOTALS			**131**	**18**	**40**	**105 (not including multiples of same practice on a farm)**	**14**	**$237,938.00**	**$50,038.24**		
				*Stock: Forestry plan		**Landowner reported fencing but not length					
	NRCS Best Management Practices Codes										
	Code	Practice				Code	Practice				
	313	Waste Storage Facility				472	Access Control				
	314	Brush Management				512	Pasture and Hayland Planting				
	322	Channel Bank Vegetation				516	Pipeline				
	324	Deep Tillage				528	Prescribed Grazing				
	340	Cover Crop				554	Drainage Water Management				
	342	Critical Area Planting				558	Roof Runoff Structure				
	362	Diversion				560	Access Road - Culvert				
	378	Pond				561	Heavy Use Area Protection				
	380	Windbreak/Shelterbelt Establishment				575	Animal Trails and Walkways				
	381	Silvopasture Establishment				580	Streambank and Shoreline Protection				
	382	Fence				590	Nutrient Management				
	386	Field Border				595	Pest Management				
	391	Riparian Forest Buffer				606	Subsurface Drain				

	393	Filter Strip			607	Surface Drainage, Field Ditch			
	395	Stream Habitat Improvemnt & Managmnt			612	Tree/Shrub Establishment			
	412	Grassed Waterway			614	Watering Facility			
	422	Hedgerow Planting			620	Underground Outlet			
	430	Irrigation Pipeline			634	Waste Transfer			
	449	Irrigation Water Management			644	Wetland Wildlife Habitat Managmnt			
	460	Land Clearing			645	Upland Wildlife Habitat Managemnt			
	466	Land Smoothing							

Appendix D

BOATER EDUCATION SUMMARY REPORT

Boater Education Project Summary for Sinclair Project Report

S. Ultican/E.Crim 11.6.13

Background

Sinclair Contract

A boat waste education program will be performed throughout Dyes and Sinclair Inlets which hosts six marinas. Seat cushions printed with a boat waste slogan and a map of the locations of pump outs on the cushion in Kitsap County will be given to boaters. Effectiveness will be measured by establishing a waterproof log-in station at the Port Orchard Marina on Sinclair Inlet. Users will log pump out use during the summer of 2008. Seat cushions will be distributed beginning Spring 2009 and continue through Fall 2010. Comparing the pump out station usage before and after distribution will monitor post-distribution effectiveness. Kitsap Health will maintain the log out station by visiting every two weeks.

Project Description: Goals and Challenges

One component of the education and outreach tasks under this project focused on reducing discharge of sewage from boats. The intent was to improve the awareness and understanding of boaters regarding the cumulative impact of sewage discharge, and measure changes in behavior through monitoring use of sewage pump-out stations at local marinas.

The following marinas were included in this project:

- Sinclair Inlet; Bremerton Marina (221 slips), and Port Orchard Marina (378 slips). 13 months of pump out data.
- Liberty Bay; Port of Poulsbo (399 slips), Poulsbo Yacht Club (155 slips), and Liberty Bay Marina (177 slips). 20 months of pump out data.

Meters were installed on pump-outs at these marinas, and data was collected in Sinclair Inlet over 13 months. However, discussions with boaters and marina operators revealed that the economic changes during the project period were a confounding factor in the accuracy of using marina pump-out data as a measurement tool. Fewer people were using their boats and pump-outs during this period due to the economic downturn, independent of our educational efforts. So, the Health District implemented a new approach to accomplish the goals of the project regarding boat waste education.

Education and Outreach Efforts

Written surveys were designed as assessment tools and conducted in two phases, combined with distribution of educational materials to boaters. The goal of the surveys was to assess boater's awareness and use of sewage pump-out facilities. The first phase involved meeting

with boaters in local marinas, discussing the issues with them, and requesting that they complete a written survey. This was done on Friday evening prior to Labor Day weekend in September 2011. Clean Boating Kits were distributed along with the initial survey. These contained printed materials on clean boating, tips for preventing pollution and boat fires, small spill kits and Boater Guide Maps. In addition, bilge BioSoks (oil & fuel absorbents) were provided to each boater that completed the survey as a "thank you" gift. Educational materials were developed in partnership with the WSU Extension and Puget Soundkeeper Alliance.

The second survey was mailed to boaters who completed the first survey in December 2011. This survey asked follow up questions about which educational materials the boaters found most helpful, and what changes in attitude or behavior (if any) had occurred since the first survey. To encourage boaters to complete the second survey, a No Spill Fuel Recovery container was offered as a gift. Even with this incentive, and multiple efforts to contact participants, only 55% of participants returned the second survey.

Results and Conclusions

Boater survey #1 (pre-survey) was completed by 79 boaters. This same group of individuals received Boater survey #2 (post-survey) approximately three months after completing the pre-survey and receiving a variety of educational materials. Of this group, 44 boaters responded to the second survey. The data from the pre and post surveys were analyzed from the responses received from this group of 44 respondents.

Information regarding vessel types and uses are summarized below. The majority of the respondents (63%) owned power boats versus sailboat (36%); 80% of the boat lengths were greater than 26 ft, and 97% of the respondents indicated they used their boats for recreational purposes. Only 5% of respondents indicated that they did not have any type of marine sanitation device. 90% of respondents had a Type III MSD holding tank.

Question	Frequency
Vessel type	
Power	28 (63%)
Sail	16 (36%)
Vessel Length	
16 to 26 ft	9 (20%)
Greater than 26 ft	35 (80%)
Vessel Use	
Recreational	43 (97%)
Commercial	1 (3%)
Live aboard	
Yes	6 (14%)
No	38 (86%)
Use	
Day	32 (73%)
Multi day	12 (27%)
Saltwater	41 (93%)
Freshwater	3 (7%)
Type of MSD	
None	2 (5%)
Type I onboard	2 (5%)
Type II better treatment	0
Type III holding tank	40 (90%)

Don't know

A comparison was conducted between the responses to survey #1 (pre) and survey#2 (post) to determine what changes may have occurred with respect to boater's knowledge and/or behavior. The 95% confidence intervals were calculated to determine whether there was statistical significance between the pre and post surveys.

Recognition of Pump out symbol. There was an increase in symbol recognition from 32 to 43 respondents however this was not statistically different.

When asked whether it is **illegal to dump untreated sewage within 3 miles of shore**, there was essentially no difference between the pre and post survey. The majority of respondents (42 to 43 respondents, out of a total of 44) indicated that YES it was illegal to dump untreated sewage.

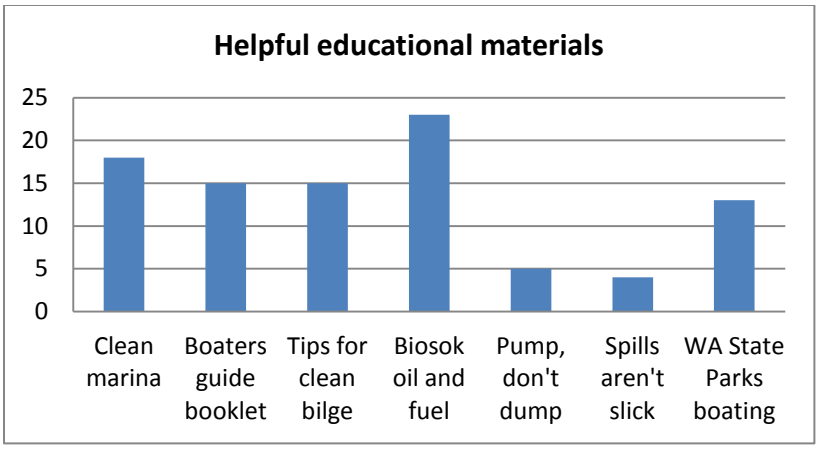
When asked whether **untreated sewage from boats was biodegradable and generally harmless**, the majority of respondents for both pre and post surveys indicated that they did not agree.

When asked whether **untreated sewage from boats can harm the environment**, there was a slight increase from 35 to 38 of respondents who agreed with this statement, however this was not statistically different.

The majority of respondents stated that they do not **discharge their tank into the water when pump out facilities are not convenient**, but again this was not a statistically significant difference.

The post boater survey included several questions regarding motivating factors that influenced changes in boating habits. Marina rules and educational materials were the top two responses to this question as shown below. Among educational materials the BioSok oil and fuel was ranked as the most helpful.

Motivating factor	**Number**	**Percent**
Marina rules	9	21%
Educational materials	8	19.50%
Law	5	12.2%
Word of mouth	5	12.2%
Friends or family	3	3.40%



Conclusions

The pre and post boaters surveys provided information about boating habits and behaviors however due to the small sample did not definitely provide information regarding a change in boater knowledge or behavior related to sewage discharge. Generally the educational materials were reported to be helpful, and with respect to the recognition of the pump out symbol, these may have increased awareness as indicated by the responses to that questions. However this increase in knowledge was not statistically different.

In future, it is recommended that a similar pre and post survey be conducted, with a larger group of boaters and combine the distribution of educational materials with a workshop or presentation.