FINAL PROJECT REPORT

FOR

Grant Agreement Number G0800588

KITSAP REGIONAL ILLICIT DISCHARGE DETECTION AND ELIMINATION CLEAN RUNOFF PROJECT

KITSAP PUBLIC HEALTH DISTRICT

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

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Pollution Identification & Correction Program
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Kitsap Truck & Tractor
Hertz Rental
Budget Rental
Ken's Automotive
Kitsap Tire
Bainbridge Island Rental
Island 76 Gas Station

KITSAP REGIONAL IDDE CLEAN RUNOFF PROJECT
FINAL REPORT
EXECUTIVE SUMMARY

The Kitsap Regional Illicit Discharge Detection and Elimination (IDDE) Clean Runoff Project is a cooperative multi-jurisdictional approach to perform IDDE in the cities of Bainbridge Island, Bremerton, Port Orchard, Poulsbo and unincorporated Kitsap County. This project has also implemented "early actions" for the Sinclair/Dyes Inlets Total Maximum Daily Load currently being finalized by Washington State Department of Ecology.

Multiple contaminants in illicit discharges and stormwater sediments are a concern for marine and freshwater receiving waters in Kitsap County. Stormwater has been identified as a major source of several pollutants into water bodies within the project area: fecal coliform (May and Cullinan, 2005), metals and petroleum hydrocarbons (Cullinan, et al, Puget Sound Georgia Basin Conference, 2007). Fecal coliform (FC) and other various pollutants from stormwater runoff impair local water bodies for recreational contact and shellfish harvest.

Besides FC bacteria, the contaminants of concern (those that are potentially toxic) found in catch basin sediments of commercial and residential properties are copper (Cu), Zinc (Zn), lead (Pb), cadmium (Cd), petroleum hydrocarbons, toluene, and xylene (Ecology, 1993; King County and Seattle Public Utilities Source Control Program for the Lower Duwamish Waterway, 2005). Reduction and prevention of stormwater contaminated sediments and toxic sources flowing to Kitsap County receiving waters will improve public and environmental health.

To achieve stormwater quality improvements, Kitsap Public Health District (Health District) coordinated the development of a county wide Illicit Discharge Detection and Elimination (IDDE) approach. Interlocal agreements (ILAs) were developed with partnering agencies to update and complete stormwater system mapping; produce or refine written IDDE procedures; develop regulatory mechanisms to prevent illicit discharges into stormwater; and perform outfall screening of high priority areas. These requirements, outlined in the National Pollutant Discharge and Elimination System (NPDES) Phase II permits for the municipalities, have been satisfied by all permitees during this project.

In addition to NPDES Phase II requirements, joint commercial property inspections were conducted between May of 2009 and November of 2011. Commercial property inspections were successful in identifying neglected stormwater systems and illicit discharges. Eighty percent (80%) of the total commercial properties were targeted in each Phase II jurisdiction. The results of commercial property inspections were:

- A project total of 1252 commercial property inspections (80%) were completed.
- A project total of 222 IDDE investigations were initiated through complaint response and commercial property inspections.
- Of the 222 IDDE investigations, 155 illicits were (70%) confirmed.
- A project total of 113 IDDEs were (73%) removed.

The most common deficiency identified during the stormwater system inspections was excess sediment build up. Of the 469 systems with deficiencies, 458 (98%) had excess sediments. Additionally, a total of 155 illicit discharges were identified through commercial property inspections or reports by the general public. Of the 155 confirmed illicit discharges, one hundred forty four (144) properties were associated with food establishments with the potential to provide a food source for urban wildlife. Deficiencies were corrected using a combination of education and enforcement. Property owners and their tenants relied on local storm system maintenance specialists for correcting deficiencies using hand (e.g., with a shovel) or vacuum truck methods.

Fresh and marine water samples were analyzed at 17 stream and 41 marine stations influenced by stormwater runoff before and during the completion of the project. This analysis was done with the intent to determine if water quality improvements had been achieved. In **Table 1**, most project streams are showing reductions in FC concentrations since the beginning of the project. Additionally, 41 of 41 marine stations are currently meeting standard compared to 32 at the beginning of the project.

In addition to monthly trend monitoring, catch basin sediments from eight commercial properties with illicit discharges were evaluated for total petroleum hydrocarbons (TPH), FC and total metals. Catch basin solids were collected during the dry season (May – October) to determine if there was a significant improvement as a result of the implementation of best management practices (BMPs). Results from statistical analysis concluded that the BMP implementation did not have a significant impact on pollution reduction. Although the level of significance indicates no improvements from BMPs, the majority of impact and control sites show a practical difference (reduction) in contaminant concentrations. The outcome is an indication of incomplete data, where available data is not enough to meet the demands of the analysis producing inaccurate or biased conclusions.

This project included a strong educational component to educate property and business owners on how to identify illicit discharges, report spills, and maintain neglected stormwater systems. In addition, Health District and Kitsap County Surface and Stormwater Management (KCSSWM) staff conducted a regional eight hour workshop to provide guidance materials and support for stormwater managers and field inspectors. Training sessions included topics related to IDDE investigations, enforcement to remove illicit discharges, implementing commercial property inspections, and example of stormwater controls through field visits.

In addition to the projects educational component, restaurant focus groups and social marketing strategies for stormwater business outreach were studied. This work summarized findings from six different formative research projects recently completed in the Puget Sound region focusing on business practices that can pollute stormwater runoff. Evidence gathered through both studies helped to provide a summary of recommended and undesirable outreach strategies for project partners and regional stormwater groups. These strategies have been tested through surveys, interviews, and focus groups as well as some that have been piloted and evaluated.

TABLE 1. PRE & POST-PROJECT WATER QUALITY COMPARISON

Waterbody	Long term trend	Short term trend	Meets WQ Standard?	2008 FC Bacteria GMV	2008 Health Advisory?	2011 FC Bacteria GMV	2011 Health Advisory?
CC01 Clear Crk	Stationary	Stationary	NO	70	NO	61	NO
KW01 Kitsap Mall Crk West	Stationary	Stationary	NO	52	NO	38	NO
SR01 Strawberry Crk	Stationary	Stationary	NO	25	NO	48	NO
OB01 Ostrich Bay Crk	Stationary	Stationary	NO	142	YES	82	YES
PH01 Phinney Bay Crk	Stationary	Stationary	NO	232	YES	339	YES
BK01 Barker Crk	Stationary	Stationary	YES	61	NO	47	NO
PA01 Pharman Crk	Stationary	Stationary	NO	31	NO	43	NO
MS01 Mosher Crk	Stationary	Stationary	YES	25	NO	47	NO
SF01 Dogfish Crk South Fork	Stationary	Stationary	NO	70	NO	38	NO
DF01 Dogfish Crk	Improving	Stationary	NO	42	NO	31	NO
AP01 Annapolis Crk	Improving	Stationary	NO	139	NO	64	NO
BJ01 Blackjack Crk	Stationary	Stationary	YES	57	NO	50	NO
KA01 Karcher Crk	Stationary	Stationary	NO	159	NO	115	YES
GR01 Gorst Crk	Improving	Stationary	YES	34	NO	26	NO
CA02 Carpenter Crk	Stationary	Stationary	YES	13	NO	19	NO
ST01 Steele Crk	Stationary	Stationary	NO	75	YES	51	NO
KL01 Kleibel Crk	Stationary	Stationary	YES	17	NO	21	NO
Overall Marine water	Improving	None	# Stations Meeting Standard	**32 of 41**		**41 of 41**	

Based upon the findings of the Kitsap Regional IDDE Clean Runoff Project, the Health District's Pollution Identification and Correction Program offers the following commitments and recommendations:

- The Health District will continue to provide support and guidance for IDDE activities to local permittees.
- The Health District and permittees will conduct joint follow-up site visits to remove the remaining 42 illicit discharges.
- The Health District encourages project partners to continue to conduct commercial property inspections to maintain and enhance the improvements gained by the Kitsap Regional IDDE Clean Runoff Project.
- Commercial property owners and their tenants are encouraged to be proactive in stormwater facility maintenance including regular maintenance of catch basins, and preventing contamination by properly maintaining/managing grease interceptors, grease traps, and food compactor areas.
- The Health District and permittees should increase education and outreach to all food and automotive establishments regarding source control and water quality.
- Permittees should continue annual training for all field staff to maintain an effective IDDE program.
- The Health District and permittees should utilize outreach strategies identified through market research to communicate with the business sector to improve water quality.
- The Health District will continue involvement through public complaint response and water quality trend monitoring. In addition, properties or businesses with ongoing concerns will be flagged in Health District records to assist future inspections.
- Local residents are encouraged to continue to be proactive in reporting stormwater concerns and spills to the Kitsap One call center.

1.0 BACKGROUND AND PROBLEM STATEMENT

In 2007, the cities of Bremerton, Bainbridge Island, Port Orchard, Poulsbo and unincorporated Kitsap County were issued a NPDES Phase II permit from the Washington State Department of Ecology (Ecology). The purpose of the NPDES permit is to improve stormwater quality from municipal, separate, storm and sewer systems (MS4) that discharge to waters of the state.

Pollutants found in local MS4s often result from illicit discharges resulting from connections, spills or illegal dumping events and/or neglected stormwater systems in both urban and rural areas. Examples of illicit discharges include spills from roadway accidents, inappropriate disposal of solid or liquid waste, commercial washing activities, and improper disposal of vehicle fluids. Neglected stormwater systems result in excess sediment transported to receiving waters or non-functioning flow control systems resulting in higher than designed flows.

In 1998, the urban bays of Dyes and Sinclair Inlets were identified as impaired for sediments on the Ecology 303(d) list for Arsenic (As), Silver (Ag), Copper (Cu), Lead (Pb) Zinc (Zn), Cadmium (Cd), Mercury (Hg), polychlorinated biphenyls (PCBs), Phthalates Phenol, and polycyclic aromatic hydrocarbon (PAHs) (Ecology, 1998). Monitoring by the Department of the Navy has shown that sediments in Dyes and Sinclair Inlets have improved markedly as a result of source control and cleanup activities by the Navy and local governments (Project ENVVEST, 2004). With the exception of PCBs in sediment, Ecology has removed these sediment chemical listing in 2004 (Ecology, 2004).

Although sediment quality has improved in Dyes and Sinclair Inlets, stormwater runoff is still considered a major threat impairing water and sediment quality. In 2009, Kitsap County Health District's (Health District) stormwater pilot project in north Dyes Inlet identified sediment deficient catch basins as a significant source for bacterial pollution. Fecal coliform (FC) concentrations during the dry season (May-October), were statistically significantly reduced after initiation of commercial property inspections (Fohn, 2009).

The Kitsap Regional IDDE Clean Runoff project was funded by a grant from Ecology's Stormwater Management Implementations Grant in 2008 to cooperatively perform IDDE activities in all local municipalities and unincorporated Kitsap County. To improve stormwater quality, the Health District and partnering jurisdictions designed the project to:

- Satisfy requirements for the county and Cities to meet NPDES Phase II requirement related to Illicit Discharge Detection and Elimination.
- Implement early corrective actions in the TMDL areas of Dyes/Sinclair Inlets, and pre-TMDL corrective actions in Liberty Bay.
- Provide guidance and support for existing and former cooperative projects between the Health District and Kitsap County Surface and Stormwater Management (KCSSWM), the Cities of Bremerton, Poulsbo, Port Orchard, and Bainbridge Island.
- Provide a coordinated approach to IDDE requirements.
- Address Kitsap County residents concern for water quality and invest in common goals with other local jurisdictions.

2.0 PROJECT AREA DESCRIPTION

Kitsap County is located in west Puget Sound and occupies the majority of the Kitsap Peninsula. The county comprises a total land mass of 396 square miles and includes the major urban centers of Bremerton, Bainbridge, Port Orchard, Poulsbo and Silverdale. Land use is predominately semi-rural residential and there are 251,133 residents (US Census, 2010). **Figure 1** provides a map of the project area.

The project area topography ranges from mean sea level (MSL) to 400 feet above MSL, an exception is Green and Gold Mountains located west of Bremerton which are approximately 1,600 feet above MSL. In general, Kitsap County soils are seasonally wet and subject to flooding (Soil Survey of Kitsap County Area, Washington, 1980).

Average annual rainfall in the project area ranges from 28 – 70 inches (Kitsap Public Utility District, 2011), with the majority of rainfall occurring between the months of October to May. This period of time is generally classified as the “wet season” (Kitsap Public Health District, 2011). See **Appendix A** for a detailed rainfall map of the project area.

Many of the 58 freshwater streams monitored by the Health District have been altered by development, increasing the demands on local government MS4s and existing onsite sewage systems (OSS), due to additional surface and groundwater flows.

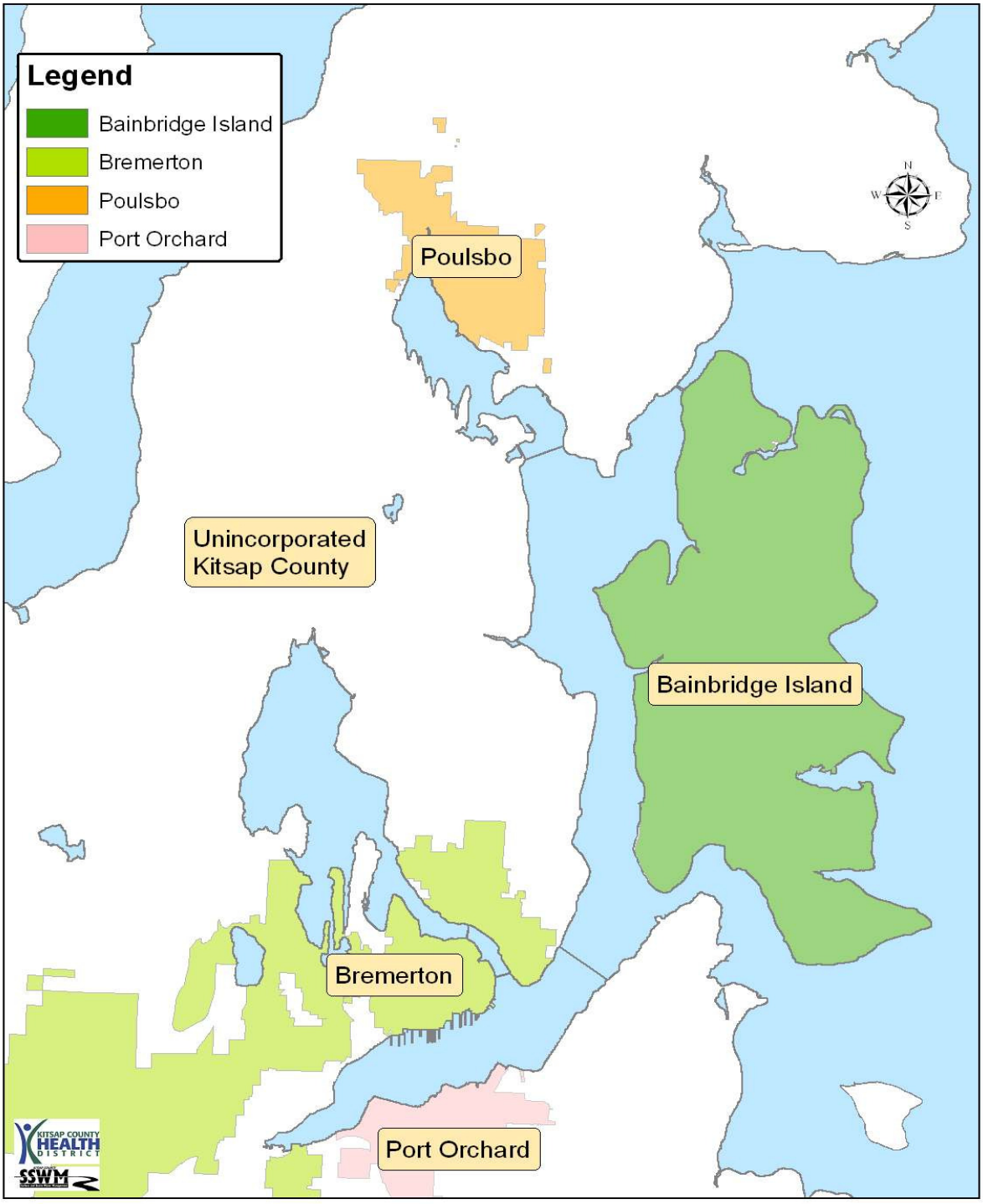
Water quality standards that apply in Kitsap County are described in Chapter 173-201A of the Washington Administrative Code (WAC). State water quality standards which apply in Kitsap County are further described in **Table 2**. Local fresh and marine water classifications are detailed in **Appendix B.**

TABLE 2. WASHINGTON STATE WATER QUALITY STANDARDS RELEVANT TO KITSAP COUNTY

	Freshwater Standard		**Marine Water Standard**	
Parameters	Extraordinary Primary Contact	Primary Contact	Extraordinary Aquatic, Primary Contact	Excellent Aquatic, Primary Contact
Fecal Coliform Bacteria (FC)	**Part 1**: **≤50 FC**/100 ml (geometric mean) **Part 2:** Not more than 10% of all samples obtained for calculating a geomean **>100 FC**/100 ml	**Part 1**: **≤100 FC**/100 ml (geometric mean) **Part 2:** Not more than 10% of all samples obtained for calculating a geomean **>200 FC**/100 ml	**Part 1: ≤14 FC**/100 ml (geomean) **Part 2:** Not more than 10% of all samples obtained for calculating a geomean **>43 FC**/100 ml	Same as Extraordinary Aquatic - Primary Contact waters
Dissolved Oxygen	> 9.5 mg/L	> 8.0 mg/L	> 7.0 mg/L	> 6.0 mg/L
pH	6.5 – 8.5 units	6.5 – 8.5 units	7.0 – 8.5 units	7.0 – 8.5 units
Temperature	≤16.0^0 C [1]	≤18.0^0 C [1]	≤13.0^0 C [1]	≤16.0^0 C [1]

1. Temperatures shall not exceed standard due to *human activities*. When natural conditions exceed these standards, no temperature increases are allowed which will raise the receiving water temperature by greater than 0.3^0 C.

FIGURE 1. PROJECT AREA



3.0 GOALS AND OBJECTIVES

The overall goals of this project are focused on:

- Removal of non-stormwater discharges to local MS4s.
- Implement stormwater activities, including source control, planning, mapping, education and outreach, and utility/ordinance development.
- Form a regional approach to common IDDE activities among five local Phase II municipalities.

The goals of the Health District, in partnership with local NPDES Phase II permittees, were to:

- Provide training workshops and supporting materials to all partnering agencies.
- Perform IDDE activities according to the Illicit Discharge Detection and Elimination Guidance Manual (Center for Watershed Protection, Pitt, 2004) for stormwater outfalls.
- Provide funds through ILAs to update and complete stormwater system mapping for select partners.
- Provide funds through ILAs to produce or refine written procedures related to IDDE.
- Inspect 80% of private commercial stormwater systems in each partner jurisdiction.
- Conduct follow-up site visits to confirm corrective actions related to identified maintenance deficiencies.
- Provide free technical assistance and guidance to property and business owners to address stormwater system structures, best management practices, and possible enforcement actions.
- Collaborate on business inspection activities and outreach.
- Develop outreach materials that can be used regionally.
- Apply social marketing research and methods for outreach to restaurants.

To accomplish these goals, the following objectives were completed:

- Identify sources of polluted stormwater sediments and illicit discharges from commercial properties and partnering agency's MS4s.
- Correct identified sources of polluted stormwater through education and enforcement.
- Reduce bacterial contamination by improving stormwater system maintenance and preventing pollution from reaching local receiving waters.
- Improve hydrologic function of neglected stormwater systems, such as ponds, flow control structures, and swales through repair, education and enforcement.
- Track, evaluate, and report on water quality improvements resulting from implementation and completion of the project.
- Completed mapping of stormwater systems for select partners.
- Developed regional stormwater business materials for vehicle washing and stormwater system maintenance.

4.0 PROJECT DESIGN AND METHODS

IDDE investigations were conducted according to methods contained in the "Pollution Source Identification and Correction Protocol" (Kitsap Public Health District, 2011). In addition to the Health District's source tracking protocol, the Center for Watershed Protection guidance manual for Illicit Discharge Detection and Elimination was adopted and provided guidance for written procedures (Center for Watershed Protection, Pitt, 2004). Stormwater facility inspections were conducted according to maintenance guidelines in the Kitsap County Stormwater Management Manual (Kitsap County, 1997). The project design consisted of the following components:

4.1 IDENTIFICATION AND REMOVAL OF ILLICIT DISCHARGES

4.1.1 WRITTEN IDDE PROCEDURES

The Health District provided funds through inter-local agreements (ILAs) to partnering agencies to produce or refine written procedures as outlined in the NPDES Phase II permit (USEPA, 2000). Written procedures incorporated the following measures:

- Develop a storm sewer map and location of receiving waters.
- Prohibit through ordinance, or other regulatory mechanism, illicit discharges into the MS4.
- Develop and implement plans to perform IDDE.
- Inform public employees, businesses, and the general public of hazards associated with illicit discharges.

The intent of developing or refining written procedures is to assist in implementation of IDDE programs to comply with NPDES Phase II permits.

4.1.2 STORMWATER SYSTEM MAPPING

Mapping is a necessary component to all IDDE activities. The Health District provided funds through ILAs to partnering agencies to update and complete GIS-based stormwater system mapping as outline in the NPDES Phase II permit (Section S5.C.3). Mapping of local Phase II MS4s includes, at a minimum:

- Location of all known MS4 outfalls, receiving waters, and structural BMPs owned, operated, or maintained by jurisdictions and private properties.
- Tributary to conveyances (type, material, size) leading to outfalls that are 24" or larger (or have an equivalent cross-sectional area).
- Locations of new connections to stormwater drainage system.
- Drainage areas within the permitees MS4 that do not discharge to surface waters (i.e. "closed depressions").

Partnering agencies satisfied mapping requirements by utilizing common surveying equipment with Global Positioning System (GPS) receivers. After data was collected in the field, location

and attributes of stormwater facilities were then downloaded and imported to Geographic Information System (GIS) files. For partner jurisdictions with completed mapping, this project served as an opportunity to collect private system data, and verify accuracy of existing maps.

4.1.3 IDDE INVESTIGATIONS

Health District staff, along with project partners, investigated complaints from the public and referrals from other agencies related to illicit discharges. Investigations involved hazardous waste dumping or spills, sewage or chemical spills, biomedical waste dumping, or other complaints which involved an imminent threat to public health or the environment. IDDE investigations were not conducted based on water quality monitoring for this project. However, historical data collected by project partners was used for the purposes of source tracking.

Staff members from both the Health District and partnering agencies were required to: 1) log the complainant's name and phone number, complaint description, and directions to the incident; 2) immediately forward the information to Kitsap One or 911; and, 3) forward all information to code enforcement staff within appropriate jurisdictions. See **Appendix C** for Kitsap One reporting procedures and regional code enforcement contact list.

Complaint investigations also included a strong educational component to educate commercial property owners about how to properly maintain their systems and offered site-specific BMPs, which addressed outdoor areas, disposal of wash water, and basic stormwater system maintenance. Industry specific BMPs also included referrals and joint site visits with other programs such as EnviroStars (a program to reduce, recycle and manage hazardous wastes) and Local Source Control (a program to assist small businesses in addressing possible causes of pollution at the source of use).

4.2 PROPERTY INSPECTIONS

Inspections performed included private stormwater facility inspections for inadequate maintenance.

4.2.1 COMMERCIAL PROPERTY INSPECTIONS

The Health District, with assistance from project partners, performed commercial property inspections to identify and correct pollution sources in private stormwater facilities. Field staff from each jurisdiction was trained in data management, property inspections, identifying non-stormwater discharges, and procedures to correct illicit discharges. The Health District utilized procedures developed for a previous pilot study in north Dyes Inlet (Fohn, 2009) to assist in this task.

Commercial property inspections included identification and correction of deficient stormwater facilities that included catch basins, retention/detention facilities, and other various components of the storm drain system. The inspection consisted of a stormwater records search, field inspection, and source tracking when an illicit discharge was suspected.

The purpose of the inspection was to identify deficiencies related to facility condition, control structures, and source control. These three categories addressed various deficiencies such as excess sediment, removal of vegetation, access improvements, and illicit discharges from dumpster/equipment washing areas.

The goal was to complete eighty percent (80%) of the total commercial properties in each Phase II community. Commercial property owners were notified by letter about the project and the potential for stormwater related pollutants. The commercial property inspection consisted of a stormwater facilities inspection to assure compliance with established maintenance standards (Kitsap County, 1997 Appendix 8A). See **Appendix D** for Kitsap County Maintenance Standards. Information was provided to the property owner about the type of facilities present, including a site map (if available), and maintenance requirements needed to minimize the release of pollutants into the stormwater system.

Commercial property inspections were performed between May 2009 and November of 2011. If deficiencies were identified, the property owner was notified by letter. Follow-up inspection confirmed the deficiency correction.

4.3 WATER QUALITY MONITORING

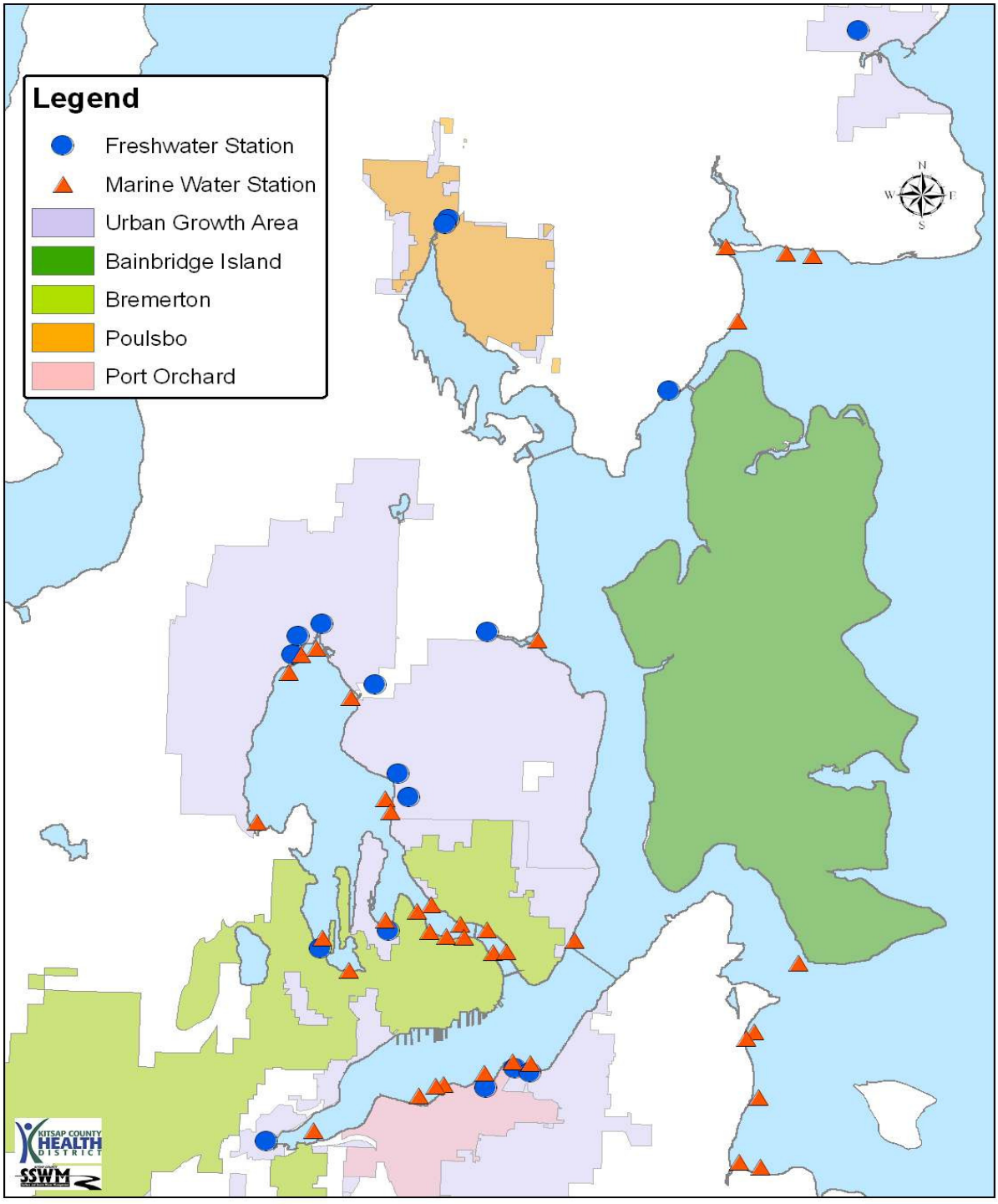
Water quality monitoring was conducted pursuant to the "Kitsap Regional Illicit Discharge Detection and Elimination Clean Runoff Project Quality Assurance Project Plan (QAPP)" (May 2009).

4.3.1 TREND MONITORING

The Health District has conducted trend monitoring of Kitsap county streams and marine waters since 1996, through KCSSWM funding, the program assesses monthly water samples from 120 stations in 58 streams, 65 stations in 12 marine embayments, and 24 stations on 17 lakes at targeted sampling stations. Monitoring is conducted pursuant to the Health District's Trend Monitoring Plan, see **Appendix E** for Trend Plan.

This project utilized Health District conducted monthly trend monitoring for 17 stream stations and 41 marine stations that were chosen based on influence from stormwater runoff. Samples may fluctuate due to lack of flow during the dry season, hazardous weather conditions, equipment failures, or other circumstances. Please see **Appendix F** for a list of monitoring stations and **Figure 2** for a map of their locations.

FIGURE 2. STREAM AND MARINE TREND MONITORING STATIONS



4.3.2 OUTFALL SCREENING

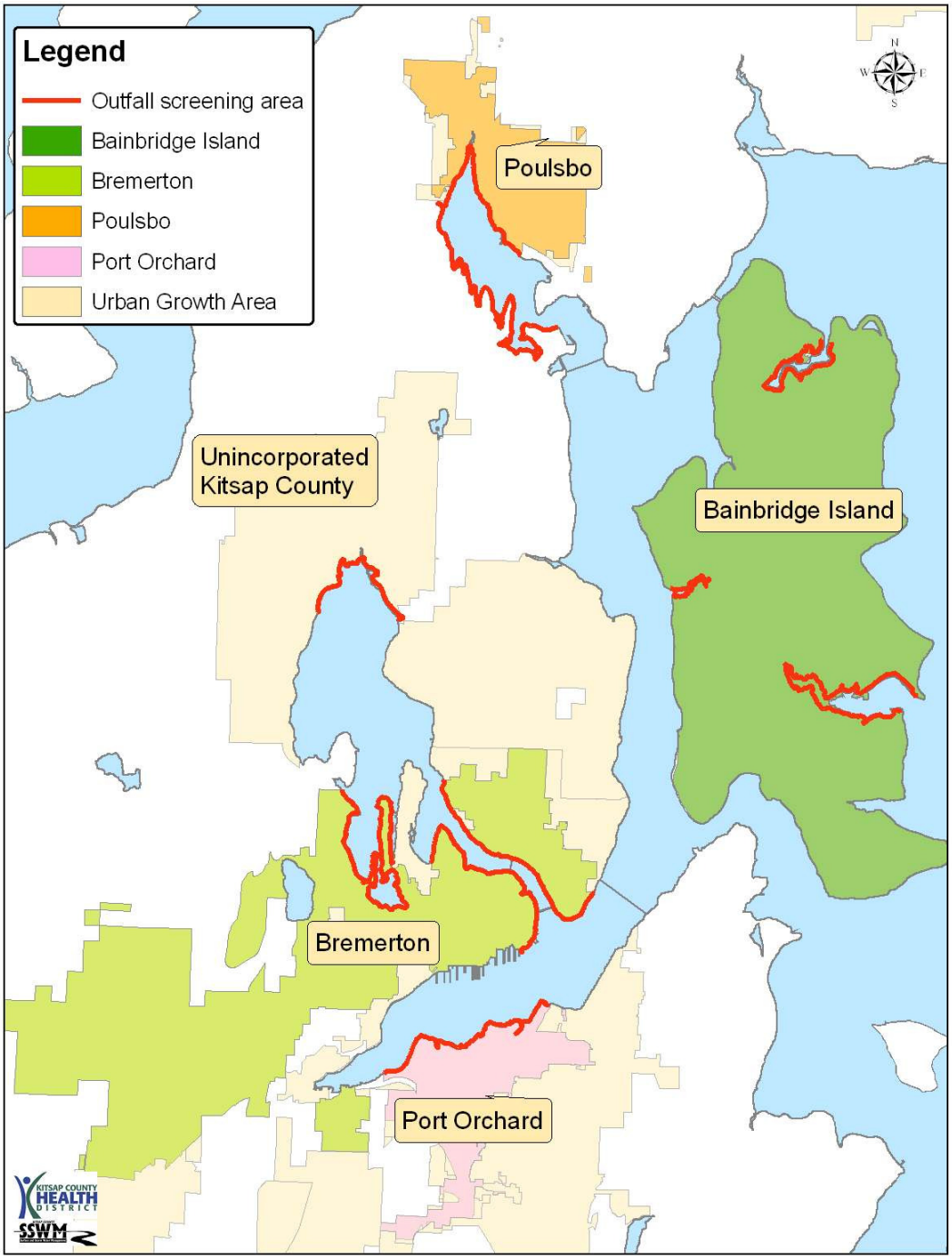
Outfall screening was performed to detect non-stormwater discharges in the Cities of Poulsbo, Bainbridge Island, and Port Orchard. In the City of Bremerton and unincorporated Kitsap County, outfalls not already screened were inventoried.

Field assessment of selected outfalls was performed using the Outfall Reconnaissance Inventory (ORI) procedures as described in chapters 11 and 12 of the IDDE Guidance Manual (Center for Watershed Protection, Pitt, 2004). Data, such as description, type, material, number designation, photograph, and GPS coordinates were collected. See **Appendix G** for the IDDE Guidance Manual for Program Development and Technical Assistance.

Non-flowing outfalls were inspected for indications of historical discharges and subsequently investigated using techniques to locate intermittent discharges. Flowing outfalls were sampled for water quality parameters chosen by project partners. Please see **Figure 3** for a map of outfall screening areas.

Screening was not intended to produce analytical data that is comparable with each agency, but utilized by partnering agencies for detection and tracking of illicit discharges. Analytical methods used were from an in-house laboratory, field test kits, or a contract laboratory. The QAPP recognized methods utilized by partner agencies and served to standardize outfall screening for NPDES Phase II requirements.

FIGURE 3. OUTFALL SCREENING AREAS BY JURISDICTION



4.3.3 WATER QUALITY BEST MANAGEMENT PRACTICE MONITORING

When illicit discharges were identified, water quality sampling was performed (if possible) before and after removal of the illicit discharge. Five (5) FC water samples and flow estimates were collected at the initial site of poor water quality before and after removal of the discharge. BMPs in the project included management of waste disposal areas, maintenance of stormwater facilities, and animal waste from agricultural operations. The intent of BMP monitoring is to verify whether or not the BMP implementation was successful in reducing bacterial contamination.

4.4 SEDIMENT QUALITY MONITORING

Sediment sampling was conducted according to the standard protocols used by the Health District Solid Waste Division Site Hazard Assessment Program Ecology-approved QAPP and the Standard Operating Procedures: Guidance for Sampling of Catch Basin Solids (SOP). Both documents can be found in **Appendix H.**

4.4.1 SEDIMENT CATCH BASIN BEST MANAGEMENT PRACTICE MONITORING

Commercial properties with poor housekeeping practices resulting in illicit discharges were evaluated for TPH (Dx), FC, and total metals. Catch basin solids were collected during the dry season (May – October) since this is the time when contaminant concentrations are at the highest (Ecology, 1993). Composite samples were collected from the most downstream catch basin before implementation of BMPs and again prior to the next scheduled storm drain cleaning cycle, one year later, after BMP implementation.

BMPs were “structural” (i.e. devices installed or constructed on site) and “non-structural” i.e. procedural changes) recommendations. Each property received site specific BMP recommendations based on site-specific business practices. BMP recommendations were generally non-structural and included various methods such as catch basin filter inserts, curbing, routine stormwater maintenance, spill plans/kits, and secondary containment. Approximate sediment volume and depth of sediment relative to the outlet pipe elevation was determined at each sample site.

In order to determine if significant improvements were achieved as a result of the implementation of BMPs, samples were drawn from selected impact (site to be restored) and control sites (reference site) both before and after the implementation of BMPs. Both locations removed sediment from catch basin following initial sampling and prior to implementation of BMPs. Please see **Appendix I** for a detailed description of statistical assessment procedures for catch basin sediment sampling.

4.5 EDUCATION AND OUTREACH

Commercial property inspections and public complaint response included a strong educational component to educate property and business owners about the high costs of illicit discharges and deficiencies, how to identify them, how to report spills, and maintain neglected stormwater system ponds, flow control structures, and swales.

Health District and KCSSWM staff conducted a regional eight hour workshop to provide guidance materials and support for stormwater managers and field inspectors related to IDDE activities. All project partners and other local NPDES Phase II permitees were invited. The regional training addressed topics related to education and enforcement, commercial property inspections, IDDE investigations, and field visits.

In addition to the regional workshop, Kitsap Health provided funds through ILAs to conduct restaurant focus groups with the Cities of Everett, Lacey, and King County. Partner agencies conducted focus groups with restaurant staff—one with employees and one with owners/managers. Social marketing strategies for stormwater business outreach were also studied. This work outlined six different research projects recently completed in the Puget Sound region focusing on business practices that can pollute stormwater runoff.

The Health District sought out additional educational opportunities whenever possible. This included attending Kitsap Peninsula Clean Runoff Collaborative meeting and promoting IDDE related webcast and regional training opportunities.

5.0 RESULTS AND DISCUSSION

5.1 IDENTIFICATION AND REMOVAL OF ILLICIT DISCHARGES

5.1.1 WRITTEN PROCEDURES FOR IDDE ACTIVITIES

Written procedures for IDDE were completed by all project partners and implemented by August 2011 as outlined in the NPDES Phase II permit. Written procedures outlined storm sewer mapping, local ordinance, reporting, and guidance for source tracking, public education, record-keeping, and staff training. Please see **Appendix J** for written IDDE procedures organized by local Phase II communities.

5.1.2 STORMWATER SYSTEM MAPPING

The NPDES Phase II Permit (Section S5.C.3) outlines minimum information that should be included in permitted MS4 areas. The following is a summary of results organized by local Phase II communities:

CITY OF BAINBRIDGE ISLAND

The City of Bainbridge Island has the required stormwater data in their GIS database as outlined in the NPDES Phase II permit. The City plans to continue with inventory of storm facilities and maintenance of existing mapping data. Map data is available upon request.

CITY OF BREMERTON

Prior to 2009, Bremerton's stormwater mapping was computer-aided design (CAD) drawings. A small amount of project funds was used to improve stormwater system mapping by using GPS in the field. The City estimates that approximately 90% of the surface assets and about 70% of the piping infrastructure have been inventoried and transferred to a GIS format. The mapping system is available through a web portal for city employees and to the public through an information request form available on the city's website at www.ci.bremerton.wa.us.

CITY OF PORT ORCHARD

The City has completed mapping of private systems and plans to continue mapping all public drainage systems through 2011. As-built drawings from recent developments and requirements of existing systems have helped the city to meet NPDES Phase II requirements. Map data is available upon request.

CITY OF POULSBO

Storm sewer maps of the City's MS4 existed prior to this project; however, they were not GIS-based. Data gathering for conversion to GIS-based maps is approximately 95% complete. Mapping for the City of Poulsbo will continue using other grant resources and is expected to be 100% complete by December 31, 2011. Upon completion of base mapping, annual updates and maintenance will continue with City funding.

UNINCORPORATED KITSAP COUNTY

No mapping activities were conducted under this project as KCSSWM fulfilled requirements in advance of the February 15, 2011 deadline as outlined in the NPDES permit. The County's mapping is available at www.kitsapgov.com/sswm/sitemap.

5.1.3 IDDE INVESTIGATION RESULTS

Illicit discharges identified during commercial property inspections were numerous as were reports from the general public. Common illicit discharges identified through commercial property inspections were related to outdoor cleaning, vehicle washing/charity car washes and outdoor storage of solid and hazardous wastes. Please see **Appendix K** for examples of illicit discharges. See **Table 3** for a summary of IDDE investigation results.

TABLE 3. SUMMARY OF ILLICIT DISCHARGE RESULTS 2009 – 2011.

Partner Jurisdiction (MS4 areas)	# of IDDEs Investigated	# of IDDEs Confirmed		# of IDDEs Removed		# of IDDEs related to sewage		# of IDDEs related to "other"	
		#	%	#	%	#	%	#	%
City of Bainbridge Island	29	21	72	14	67	4	19	17	81
City of Bremerton	86	75	87	67	89	3	4	72	96
City of Port Orchard	35	24	69	22	92	2	8	22	92
City of Poulsbo	26	14	54	14	100	1	7	13	93
Unincorporated Kitsap County	58	42	72	34	81	7	17	35	83
Totals	**234**	**176**	**75**	**151**	**86**	**17**	**10**	**159**	**90**

From May 2009 thru December of 2011, a total of 234 illicit discharges or connections were investigated. Of the 234 illicit discharges or connections investigated, 176, or 75% were confirmed. Of the 176 confirmed illicit discharges, 17 (or 10%) were associated with OSS, and 159, or 90% were categorized as "other type". The nature of "other type" discharges were related to solid waste which includes all liquids, solids and semi solid materials.

Health District and project partners made an intensive effort to provide BMPs to local food establishments where inadequate waste containers (i.e. grease bins, dumpsters), equipment washing and trash compactors were problematic.

5.2 COMMERCIAL PROPERTY INSPECTION RESULTS

The goal was to complete eighty percent (80%) of the total commercial properties in each local Phase II community. From May 2009 thru November 2011, a total of 1486 properties with stormwater facilities were inspected. The most common deficiency identified during inspections was excess sediment buildup in catch basins. Four hundred fifty eight (458), or 98%of the 469 properties inspected were identified as sediment deficient. The other remaining 11 or 2% of the deficiencies were related to structural problems, foreign debris and noxious weeds. By December 2011, 305, or 65% of properties identified with deficiencies, met maintenance compliance. See **Table 4** for a summary of commercial property inspection results by jurisdiction.

TABLE 4. SUMMARY OF COMMERCIAL PROPERTY INSPECTION RESULTS 2009 – 2011.

Partner Jurisdiction (MS4 areas)	**Participating Properties**	**# of functioning Systems**		**# of Deficient Systems**		**# of Sediment Deficient Systems**		**# of "other " Deficient Systems**		**# of Corrected Systems**	
		#	%	#	%	#	%	#	%	#	%
City of Bainbridge Island	197	90	46	107	54	106	54	1	0.5	63	59
City of Bremerton	516	358	69.4	158	31	157	30	1	0.2	58	37
City of Port Orchard	225	176	78	49	22	47	21	2	0.8	33	67
City of Poulsbo	311	202	65	109	35	106	34	3	1	105	96
Kitsap County	237	191	81	46	19	42	18	4	2	46	100
Totals	**1486**	**1017**	**68**	**469**	**32**	**458**	**98**	**11**	**2**	**305**	**65**

5.3 WATER QUALITY TREND MONITORING RESULTS

The Health District has conducted trend monitoring of Kitsap county streams and marine waters since 1996. For the purposes of this project, 17 stream stations and 41 marine stations have been identified to be influenced by stormwater flows. These stations characterized FC water quality in upland and marine areas.

Several marine stations not adjacent to MS4 areas, but could potentially be influenced by stormwater, are included, specifically near Port Washington Narrows, Yukon Harbor, and Agate Pass in Port Orchard Passage.

5.3.1 TREND ANALYSIS

Statistical analysis of FC data was performed on 17 fresh water streams and 41 marine stations in the following watersheds; Dyes Inlet, Sinclair Inlet Port Orchard Passage/Burke Bay, Liberty Bay/Miller Bay; and Foulweather Bluff/Appletree Cove. A summary of the fresh and marine water trend results by water year are listed in **Appendix L**

For a trend to be significant the p-value for the Seasonal-Kendall Test statistic must be less than 0.05 and the 12 monthly Kendall Tests must be homogenous with a common trend. If the Seasonal Kendall Test statistic is significant, the magnitude of the trend is given by the Kendall Slope. A negative slope corresponds to an improving condition; a positive slope corresponds to a worsening condition. The Kendall Slope is only provided if there is a significant trend. Kendall Seasonal z-value is provided only if the monthly tests show a homogeneous and common trend.

FC data for each of the 17 stream and 41 marine stations were also separated by dry season (June – September) and wet season (October - May) for seasonal analysis. This analysis indicates that FC levels are significantly higher during the dry season than during the wet season. The reasons for this are not clear but are likely related to dilution from rainfall. **Appendix M** contains a seasonal analysis of the FC data.

In addition to the overall trend analysis, a second analysis with the objective to determine if there was any global change in FC concentrations in both fresh and marine receiving waters was completed. FC data for each of the 17 stream and 41 marine stations were evaluated to determine if any improvements were gained through various IDDE activities.

The analysis looked at trends during the months of June through October from 2006 to the year 2011. **Appendix N** provides the global trend analysis for both fresh and marine water stations. The analysis is divided into the five MS4 areas with associated trend stations and additional data provided by the cities of Bainbridge Island and Bremerton. Analysis was completed for both fresh and marine receiving water. Results of the analysis are summarized below:

CITY OF BREMERTON

The City's MS4 contains the marine stations DY05, DY07 and DY15. The level of significance for the global trend analysis at each station is 0.05. At the 0.10 level of significance, Bremerton marine waters had a stationary global FC trend. Analysis of freshwater data could not be completed due to insufficient data.

CITY OF PORT ORCHARD

The City's MS4 contains the marine stations SN12, SN13, and SN22. The level of significance for the global trend analysis at each station is 0.05. At the 0.10 level of significance, Port Orchard marine waters had a stationary global FC trend. The level of significance for stream stations APO1, KA01, and BJ01 is 0.05. At the 0.10 level of significance, freshwater stream stations resulted in a stationary global FC trend.

CITIES OF BAINBRIDGE ISLAND & POULSBO

A global analysis could not be done for Bainbridge Island or Poulsbo due to insufficient fresh and marine water data.

UNINCORPORATED KITSAP COUNTY

Data from major drainages and associated marine receiving waters in the urban growth area were used for analysis in unincorporated Kitsap County. Data from marine stations DY25, DY27, PO13, and SN05 were evaluated. The level of significance for the trend analysis at each station is 0.05. At the 0.10 level of significance, marine waters had a stationary global FC trend. For freshwater streams, stations CC01, SR01, KW01, CA02, DE01 and GR01 had a level of significance of 0.05 for each station. At the 0.10 level of significance, all stream stations had a significantly improving global FC trend.

In conclusion, the results show a significantly improving trend for unincorporated Kitsap County and stationary trends for Port Orchard, Bremerton and Bainbridge Island freshwater streams during the time IDDE activities were conducted. As for marine stations, there does not appear to be any significant change in FC concentrations. Results indicate stationary trends for all selected marine stations.

Incomplete data and insufficient time elapsed were limiting factors in this analysis to demonstrate water quality improvements by various project activities. It is expected that a post project assessment of trend data will provide sufficient data to run a complete analysis to determine if water quality improvements have been achieved. This post project assessment will have a brief summary regarding key project results and will be provided no later than December 31, 2014.

5.4 OUTFALL SCREENING RESULTS

Outfall screening was performed by all project partners for detection and tracking of illicit discharges. This project and its QAPP helped standardize outfall screening for Kitsap NPDES Phase II permittees by providing several acceptable options for water quality sampling of stormwater outfalls during dry weather screening activities. The cities of Bainbridge Island and Port Orchard had not yet initiated an outfall screening program prior to this project. **Appendix O** contains a list of outfalls and water quality results. The following is a summary of screening activities organized by partner jurisdiction:

CITY OF BAINBRIDGE ISLAND

Outfall screening was conducted in the high priority areas of Eagle Harbor and Port Madison Bay from 2009 thru 2011. A total of 82 outfalls were inventoried and 14 samples for metals, nutrients and FC were taken. Five outfalls required follow up due to high bacteria results and are currently being investigated with assistance from the Health District.

CITY OF BREMERTON

Bremerton has had an ongoing dry weather outfall reconnaissance inventory program since 1996. All outfalls discharging to marine waters and fresh water in urban areas have been inventoried, inspected, and screened. Bremerton has a total of approximately 65 stormwater outfalls. Of these, 53 outfalls were evaluated for flow and other physical-chemical parameters.

CITY OF PORT ORCHARD

The Health District, on behalf of the City, prioritized monitoring to outfalls discharging to marine waters as high priority for IDDE screening. Starting in 2010, Health District staff conducted sampled 28 outfalls discharging to the marine shoreline. Field assessment included direct measurements of flowing outfalls, such as flow, temperature, pH, ammonia, detergent, salinity, and conductivity.

Additionally, E.coli samples were taken at all flowing outfalls. Outfall screening identified three drainages with elevated levels of bacteria. These drainages have been referred to the City for further investigation.

CITY OF POULSBO

The Health District, in partnership with the City, updated the 2003 IDDE inventory and conducted screening of high priority areas, annually from 2009 – 2011. A total of 15 outfalls discharging to fresh or marine receiving waters were sampled. Field assessment included direct measurements of flowing outfalls, such as temperature, pH, ammonia, orthophosphates, nitrate/nitrite, detergent, salinity and conductivity. Additionally, E.coli samples were taken at all flowing outfalls.

Outfall screening identified five drainages with elevated levels of bacteria. Follow up of these priority outfalls are being investigated by the Health District and the City through the Liberty Bay Restoration Project.

UNINCORPORATED KITSAP COUNTY

As of 2008, KCSSWM completed field assessments of all outfalls discharging to water bodies in unincorporated Kitsap County. Outfall screening was initiated in Liberty Bay in response to the anticipated FC TMDL in 2010. Seventy seven outfalls in Liberty Bay were screened for EC, nitrate, phosphate, alkalinity, hardness, turbidity, conductivity, detergent, glycol, ph, ammonia and temperature. Five outfalls were referred to the Health District for elevated E.coli levels, two were previous referrals from 2004, and three were new. Referrals and follow up investigations are currently being investigated through the Liberty Bay Restoration Project.

5.5 WATER QUALITY BEST MANAGEMENT PRACTICE MONITORING RESULTS

Collecting water quality data to document site specific water quality improvements from sites with identified illicit discharges was not achieved. This was due to the transitory nature of discharges and lack of flow during the dry season.

5.6 SEDIMENT CATCH BASIN BMP MONITORING RESULTS

Health District staff collected data for 10 variables (total metals, TPHDx and FC) at selected catch basins to determine if there was a significant improvement as a result of the implementation of BMPs. A before-after-control-impact design (BACI) was used. Analysis was done using Factorial ANOVA, an analysis of variance. Of particular importance in the analysis was the interaction between the time (before/after) and location (impact/control) variables. Because there was a maximum of 4 samples taken in each time/location, a level of significance of 0.10 was used.

That is, if the p-value is less than 0.10, the conclusion will be that there was an interaction between time and location with respect to the variable. **Table 5** provides the 10 variables, the p-value for interaction and the determination of significance.

TABLE 5. CATCH BASIN SEDIMENT DETERMINATION OF SIGNIFICANCE

Variable	Unit	p – value	Significance
Arsenic (As)	mg/kg	0.70	Not Significant
Cadmium (Cd)	mg/kg	0.68	Not Significant
Chromium (Cr)	mg/kg	0.25	Not Significant
Copper (Co)	mg/kg	0.88	Not Significant
Lead (Pb)	mg/kg	0.39	Not Significant
Mercury (Mr)	mg/kg	0.40	Not Significant
Nickel (Nc)	mg/kg	0.45	Not Significant
Zinc (Zn)	mg/kg	0.21	Not Significant
Total Petroleum Hydrocarbons (NWTPH-DX)	mg/kg	0.22	Not Significant
Fecal coliform (FC)	MPN/100ml	0.71	Not Significant

From the graphs and the p-values provided in **Appendix P**, it is evident there were no statistically significant changes. Had there been a desirable effect, the red impact line on the graphs would have shown a significantly greater decline following BMP implementation than was shown in the blue control line. In conclusion, the evidence from this analysis is that BMP implementation did not have a significant impact on catch basin sediment quality. Although the level of significance indicates no improvements from BMPs, the majority of impact and control sites show a practical difference (reduction) in contaminant concentrations. This outcome is an

indication of incomplete data, where available data is not enough to meet the demands of the analysis producing inaccurate or biased conclusions.

5.7 EDUCATION AND OUTREACH RESULTS

5.7.1 COMMERCIAL PROPERTY EDUCATION & OUTREACH

Educating field staff, property owners and their tenants on potential pollutants associated with stormwater runoff and how to prevent discharges to the MS4 was a primary focus of the Kitsap Regional IDDE Clean Runoff Project. Health District staff and partnering agencies provided property owners and their tenants with educational brochures, stormwater facility drawings (if available) and technical assistance during site inspections.

Materials were developed and used by all project partners including the Vehicle Was Fact Card and the Guide for Stormwater Maintenance brochure. See appendix Q for all education materials developed through this project. These materials were helpful in providing consistent BMPs to property owners and their tenants that proper operations and maintenance is imperative to reducing pollution sources transported by stormwater to surface waters.

During commercial property inspections and complaint investigations, Health District and project partner staff shared site-specific ideas on how to prevent deficiencies related to debris, sediment, noxious vegetation and structural concerns. Any practice that might result in a discharge to the MS4 was identified and possible solutions were provided.

In addition, the Health District sought out additional educational opportunities whenever possible, working with EnviroStars, Local Source Control, and homeowners associations. An effort was made to reasonably link prevention to lower costs and long term risks.

5.7.2 KITSAP REGIONAL IDDE TRAINING WORKSHOPS

Health District and KCSSWM staff coordinated a regional workshop for local Phase II communities. This training was held on April 28, 2009 from 8:30-4:00. Over 85 attendees were present from local Phase II communities and Ecology. The interactive workshop included a variety of presenters, as well as field visits to several stormwater components. Participants were introduced to the Kitsap Regional IDDE Clean Runoff Project and how to perform IDDE activities. The Regional training included topics related to:

- IDDE investigations
- Local enforcement & technical assistance
- Implementing commercial property inspections
- Local Source Control program activities
- Kitsap One spill reporting procedures
- Field visits – examples of stormwater controls

Please see **Appendix Q** for a Resource Guide DVD from the Kitsap Regional IDDE Clean Runoff Project Workshop.

5.7.3 MARKET RESEARCH AND SOCIAL MARKETING STRATEGIES

In addition to the regional workshop, focus group studies identified motivators and barriers to BMPs, messaging, and improved communication with the food establishment industry. This research also gathered information about their practices that affect stormwater runoff, specifically dumpster use, grease handling, cleaning mats and equipment, and hosing down alleys. See **Appendix R** for the Restaurant Focus Group final report.

Social marketing strategies for stormwater business outreach were also studied. This work outlined six different research projects recently completed in the Puget Sound region focusing on business practices that can pollute stormwater runoff. This compilation of recent studies helped to provide a summary of recommended and undesirable outreach strategies that have been tested through surveys, interviews, and focus groups as well as some that have been piloted and evaluated.

Data gathered through market research activities have been shared with Stormwater Outreach for Regional Municipalities (STORM) and West Sound Stormwater Outreach Group (WSSOG). These shared strategies will help permitees to develop and implement stormwater outreach targeting business to meet NPDES requirements. See **Appendix S** for the Social Marketing Strategies for Stormwater Business Outreach final report.

6.0 CONCLUSIONS

The goals of the Kitsap Regional IDDE Clean Runoff Project have been achieved:

- Health District trend monitoring between 2008 and 2011 indicated that water quality is improving in the 17 freshwater drainages and 41 marine stations.
- 113 non-stormwater discharges to MS4's were removed.
- Coordinated and facilitated required elements of Phase II stormwater permits for local jurisdictions including: source control, mapping, ordinance development and educational outreach.

The Health District played a key role in providing ongoing technical, field, and administrative assistance to help local jurisdictions adapt their stormwater inventory and assessment programs into IDDE programs as required by Phase II stormwater permittees. The Health District also led the commercial inspection program field and administrative work with the Cities.

The regional eight-hour workshop assisted staff and managers by providing extensive reference materials from other successful IDDE projects, stormwater system inspection programs, and education al materials. The field visits were particularly helpful to quickly orient to stormwater system infrastructure. A reference compact disk was distributed and proved to be very helpful for reference throughout the project. The project QAPP standardized outfall screening for Kitsap Phase II permittees by detailing acceptable screening options.

This was a great opportunity for project partners to develop a common resource foundation between water quality and stormwater infrastructure programs. Partners worked to develop regional education and source control approaches for common problems.

Analysis of sediment sampling results collected before and after catch basin maintenance showed no sediment quality improvements. Due to lack of data completeness, assumptions can only be made that there is a consistent source of pollutants to catch basins and ongoing inspections and regular maintenance is necessary.

Small Phase Ii communities in the West Sound were challenged to meet the NPDES IDDE permit requirements. This project provided assistance to meet conditions of the permit. In addition, commercial property inspections were performed, which are not a permit requirement at this time. Maintenance of Stormwater System in both the right-of-way and on private commercial properties has been shown to be an effective method to reduce FC pollution in urban areas (Fohn, 2009). All the participating municipalities are involved with FC TMDL clean up plans in various stages, and this project assisted the smaller jurisdictions to take a proactive approach in managing upcoming TMDL requirements.

There are several “lessons learned” from this project where a regional approach to IDDE was implemented:

- Small Phase II communities did not have trained and experienced staff to track and conduct IDDE activities like outfall screening and commercial inspections. This is especially critical after years of local government budget reductions.
- Small Phase II communities do not view IDDE as a primary focus due to other competing stormwater permit requirements. Large, better funded jurisdictions are able to provide a lead and mentoring role to smaller jurisdictions.
- Necessary tasks like mapping are labor, detail and equipment intensive
- Coordinate with other stormwater professionals to ensure the results of BMP studies meet the projects specifications.

Analysis of trend monitoring data indicates that FC levels are significantly higher during the dry season than during the wet season in most freshwater drainages. Decreased stream flow, illicit discharges and other FC sources may contribute to higher bacterial levels during dry weather. Commercial inspections were an effective method of finding illicit discharges and stormwater deficiencies, although most jurisdictions were not staffed to lead these inspections.

Some of the illicit discharges found were repeat offenses, mainly from garbage bins and compactors, grease bins, and carwashes. Many of these operations were located in close proximity to stormwater systems. Food source control problems were prevalent in all partner jurisdictions. Food waste attracts and concentrates urban wildlife around stormwater systems and has been found to result in excessive FC concentrations from the wildlife and food waste. Work accomplished through market research and social marketing strategies have provided a summary of recommended outreach strategies to help prevent and control food source control problems.

The major deficiency identified was excess sediment in stormwater facilities. The average deficiency rate for local Phase II communities ranges from 22% to 54%. Project partners experienced correction rates ranging from 37% to 96%.

7.0 RECOMMENDATIONS

Based upon the conclusions of the Kitsap Regional IDDE Clean Runoff Project, the Health District's PIC Program offers the following recommendations:

- Complete correction of the remaining 164 properties with deficient stormwater systems.
- Complete correction of the remaining 42 illicit discharges
- Continue to track water quality data for post-corrective analysis and prepare post-corrective report.
- Utilize larger, more experienced jurisdictions to provide technical and educational support to smaller jurisdictions.
- Work with project partners to continue to protect public health and prevent shellfish downgrades.
- Continue to improve and implement education and outreach strategies as outlined in the market research and social marketing studies conducted under this project.

An effective IDDE program needs to:

- Conduct ongoing regional workshops
- Focus inspections on targeted businesses that have a higher potential for an illicit discharge.
- Partner with Kitsap Health to review data from water quality stations on a periodic basis.
- Continue or further develop a commercial property inspection program.
- Have the political will necessary for long-term source control.
- Emphasize to decision makers and Public Works management the importance of stormwater system maintenance and the relationship to water quality.
- Continue to research, develop and test effectiveness of public education and outreach methods and materials for specific industries like food and automotive services.
- Share project results with other NPDES Phase II communities and continue to seek technology and methods to better identify and correct pollution sources.
- Continue to work to build public trust by providing accurate and representative data upon which to base regulations and legislation.

8.0 REFERENCES

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