FINAL PROJECT REPORT

FOR

C17104

PC-00J88801/PC-00J32601

Pollution Identification and Correction (PIC)

Clallam County Environmental Health Services

Total Cost of Project:	$279,318
Grant or Loan Amount:	$279,318

Project Start Date: January 1, 2015

End Date: December 31, 2017

Jennifer Garcelon 4/20/18 DATE

Jacob Melly 4/20/18 DATE

Andy Perham 4/24/18 DATE

Washington State Department of Health

CLALLAM COUNTY Environmental Health SERVICES

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Final Department of Health Grant Contribution: $279,318

PIC Overview

In the late 1990s and early 2000s worsening bacterial pollution in and around Dungeness Bay prompted a series of shellfish bed closures or classification “downgrades.” Over 1,000 acres were downgraded in 2003, alone.

Various programs have tackled the problem over the past two decades. A Shellfish Protection District (SPD)/Marine Recovery Area (MRA) was created in eastern Clallam County. Here, special water quality protections remain in place. Improvements in irrigation techniques have reduced runoff from agricultural lands. Various grant projects have eliminated pollution sources.

Clallam County’s PIC program builds upon previous successes and seeks out upland sources of bacterial pollution in priority watersheds that discharge into marine waters. Water quality sampling and parcel surveys illuminate areas of concern while financial and technical assistance help correct problems.

In recent years marine water quality has improved in terms of bacterial pollution.

Dungeness Tidelands

Water Quality Sampling

Project Partners

Jamestown S’Klallam Tribe

Clallam Conservation District

Streamkeepers of Clallam County

Highlights

- 6,295 shellfish bed acres maintaining “approved” status (Dungeness Bay and Jamestown Growing Areas)
- 960 new shellfish acres with “approved” status
- 9 bacterial pollution “hot spots” discovered
- 13 onsite sewage (OSS) problems discovered
- 3 known OSS problems corrected
- Ongoing efforts to correct known problems

Water Quality Improvements

Water quality sampling commonly involves looking for fecal coliforms, an indicator associated with illness-causing bacteria. Bacteria levels in marine waters have decreased as evidenced by Washington State Department of Health (DOH) water quality sampling at stations around Dungeness Bay. Consequently, 960 acres of shellfish beds have received upgraded classification since 2015.

Clallam County Environmental Health (CCEH) and partners have focused on cleaning up various waterways that discharge into Dungeness Bay and the Strait of Juan de Fuca. In 2015 when investigative sampling began in one such waterway, Golden Sands Slough, fecal coliform colony-forming units (CFU) per 100 ml water sample commonly measured on the order of multiple thousands! This would indicate a very serious source of waste entering the water. More recent sampling in 2017 following some pollution correction efforts measured fecal coliforms on the order of multiple hundreds—a significant drop but still not ideal.

Various non-conforming sewage disposal methods exist within the project area and some upgrades have been made possible with technical assistance and cost-share programs. Some upgrades still need to happen and should lead to continued improvements in water quality.

Next Steps for Continued Success

Efforts to require upgrade of known non-conforming sewage systems will need to continue beyond the timeline of this grant-funded project. Greywater discharging into waterways also requires attention and correction. At least one likely failing septic system in the Meadowbrook (Dungeness) Slough waterway requires repair or replacement. Enforcement/compliance timelines initiated by Clallam County Environmental Health will continue.

Lessons Learned

Key components needed to make pollution correction efforts happen include technical and financial assistance. In this focus area, onsite sewage systems far outnumber agricultural operations. Many limitations including lot sizes, financial resources, and political will hamper needed OSS corrections. In those instances where needed upgrades have happened, low interest loans and cost-share have meant the difference between success and impasse.

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CLALLAM COUNTY
Environmental Health
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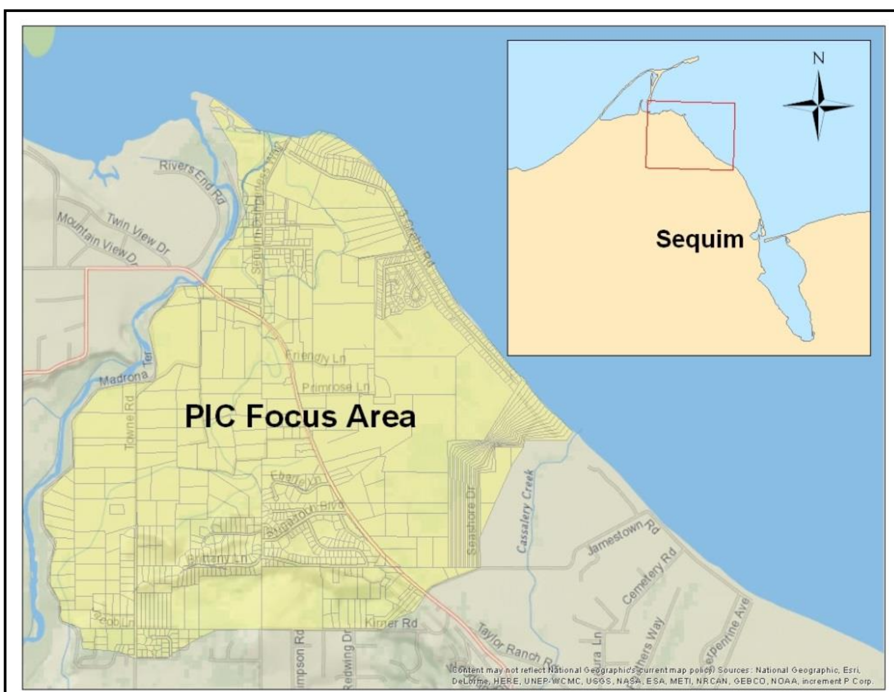


Project Area—Map Data from ESRI and Clallam County

Project Overview

Characterization of Project Area

Geography and Designations

The Pollution Identification and Correction (PIC) Project takes place within the Sequim-Dungeness Clean Water District (CWD), a shellfish protection district in the eastern portion of Clallam County, on the North Olympic Peninsula of Washington State. Boundaries of the district include Bagley Creek to the west, the County line to the south, the Sequim Bay watershed to the east, and the Strait of Juan de Fuca to the north (Chadd and Bond 2015). Washington State law provides for the creation of shellfish protection districts under Chapter 90.72 RCW where non-point pollution threatens shellfish beds.

The very same geographic area is also classified as a Marine Recovery Area (MRA) under Chapter 70.118A RCW. Such a designation envisions onsite sewage (OSS) management programs to reduce public health hazards and protect water quality.

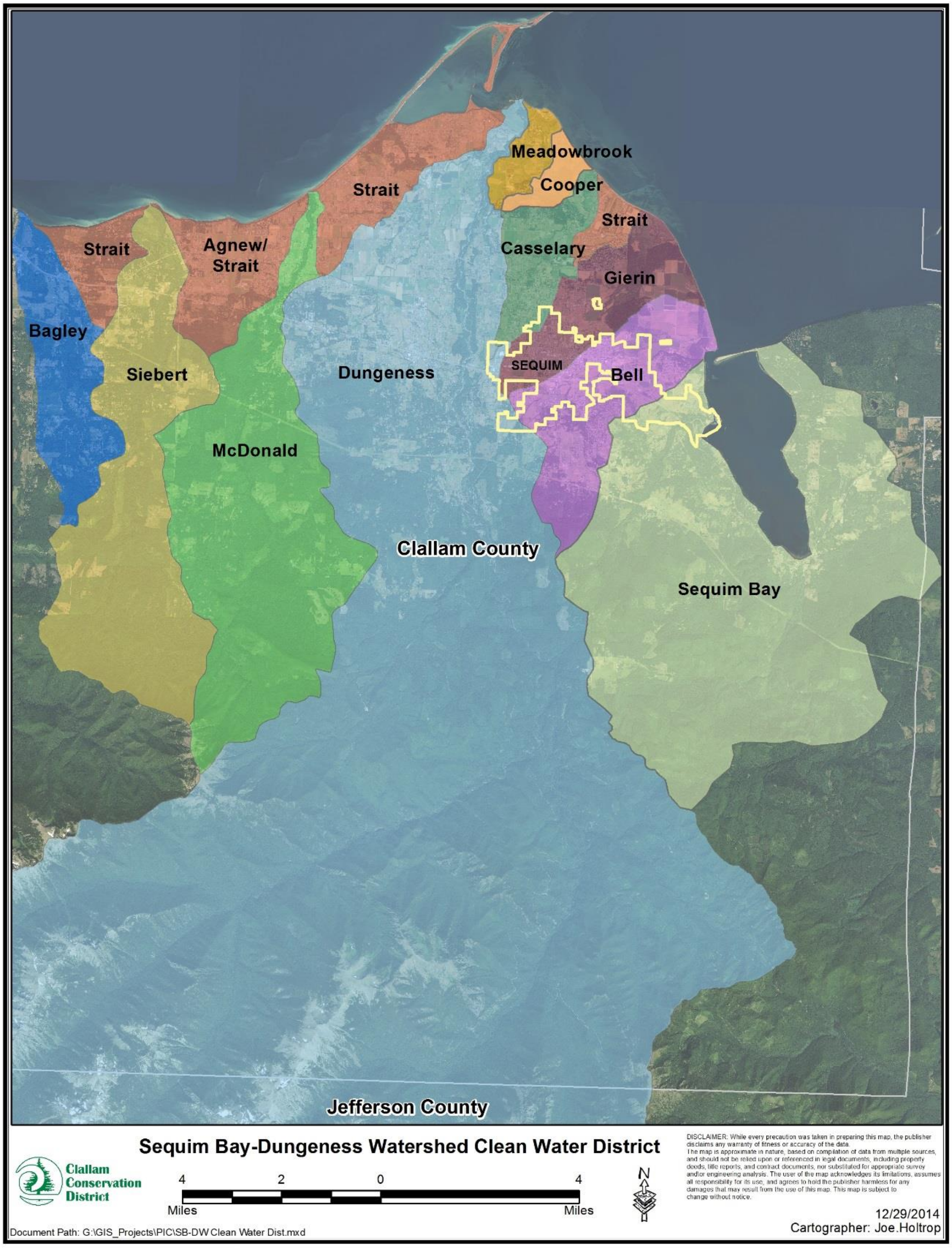
The project area includes the city of Sequim, agricultural lands, rural residential areas, forestlands, and the Carlsborg Urban Growth Area (UGA). This portion of the County generally receives less precipitation than other parts of the Olympic Peninsula due to a rain shadow effect produced by the Olympic Mountains: "[precipitation] varies from 15 inches near Sequim to 80 inches in the headwaters of the Dungeness River" (Soule and Chadd 2013).

The population of Clallam County grew from 56,210 to 64,525 between 1990 and 2000 with the greatest increases occurring in the Dungeness Watershed (Rensel 2003). The 2010 United States census puts the population of Clallam County at 71,404. Along with this growth has come a shift from forest lands and commercial agriculture to residential development and small farms (Rensel 2003).

Streams and Rivers

Many freshwater streams exist within the Sequim-Dungeness Clean Water District with the majority summarized from Chadd and Bond (2015) in the table below. The Dungeness River stands out as the primary fluvial feature within the District originating within the Olympic Mountains and draining 270 square miles (Jamestown S'Klallam Tribe 2007).

Figure 1. Sequim-Dungeness Clean Water District.



Sequim-Dungeness Clean Water District and its various constituent sub-watersheds. Map courtesy of Clallam Conservation District.

Table 1. CWD Streams and Rivers

Name	Receiving Waters	Comments
Chicken Coop Creek	Sequim Bay	3.1 miles long with 3.1 miles of tributaries
No Name Creek	Sequim Bay	Forested, short, steep; little development; little non-point pollution
Dean Creek	Sequim Bay	~4 miles long; drains ~4 miles^2
State Park Creek	Sequim Bay	Forestry, agriculture, residential land uses
Jimmycomelately Creek	Sequim Bay	Drains ~16 miles^2
Johnson Creek	Sequim Bay	Mainstem 5 miles long with 2 miles of tributaries; drains ~6.2 miles^2
Bell Creek	Sequim Bay	3.8 miles long; drains 8.9 miles^2; urban and rural development; historically conveyed irrigation water
Dungeness River	Dungeness Bay	32 miles long; drains 172,517 acres; major source of Dungeness Bay freshwater; upper river within National Park/National Forest
Matriotti Creek	Dungeness River	9.3 miles long; enters left bank of Dungeness at river mile 1.9
Lotzgesell Creek	Matriotti Creek	Matriotti Creek tributary
Hurd Creek	Dungeness River	~1 mile long; enters Dungeness at river mile 2.7
Meadowbrook Creek	Dungeness River or Dungeness Bay	Point of discharge varies
Meadowbrook (Dungeness) Slough	Dungeness River, Dungeness Bay, or Meadowbrook Creek	Point of discharge varies
Golden Sands Slough	Outer Dungeness Bay	Constructed channels in estuarine wetland
Cooper Creek	Outer Dungeness Bay	Straightened lower portion; tide gate; fed by wetland, upper portion undeveloped
Cassalery Creek	Dungeness Bay	4.2 miles long
Gierin Creek	Dungeness Bay	8.3 miles of stream/tributaries; drains 3.1 miles^2; Olympic Mountains groundwater discharge
Unnamed Intermittent Stream	Inner Dungeness Bay	Storm water conveyance, irrigation outflow
McDonald Creek	Strait of Juan de Fuca	13.6 miles long; drains ~23 miles^2; originates around 4,700 feet elevation; deeply-incised coastal upland and marine bluff
Agnew Ditch	Strait of Juan de Fuca	Part of irrigation ditch system; Dungeness River water conveyed by McDonald Creek; Irrigates Agnew area
Siebert Creek	Strait of Juan de Fuca	12.4 miles long; 31.2 miles, including tributaries; drains 19.5 miles^2; originates around 3,800 feet elevation; westernmost stream influenced by Dungeness area irrigation
Bagley Creek	Strait of Juan de Fuca	9.5 miles stream/tributaries; westernmost watershed of Clean Water District

Streams and rivers of the Clean Water District, loosely organized from east to west.

Characterization of Water Quality Problems

Bacterial Pollution

Tribal communities have relied on shellfish resources of Dungeness Bay and surrounding areas for many centuries. Over the past 150 years, the area has also become important for non-tribal recreational and commercial harvest of shellfish (Jamestown S'Klallam Tribe, 2007).

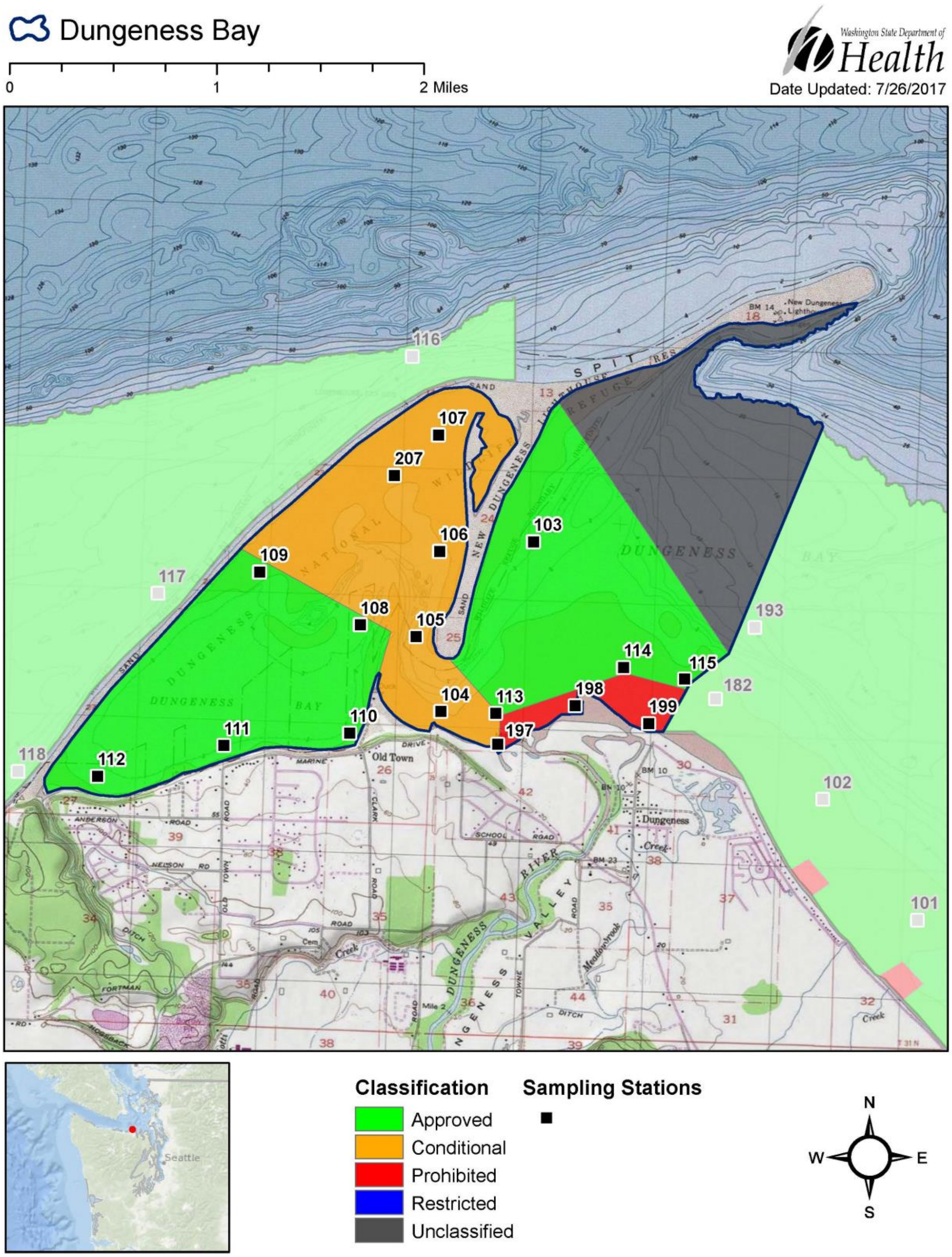
In the late 1990s and early 2000s regular Washington State Department of Health water quality sampling, for the purpose of classifying shellfish growing areas, documented increasing concentrations of fecal coliform bacteria in Dungeness Bay (Rensel 2003). Various studies also highlighted fecal coliforms in upland freshwater bodies (Rensel 2003, Sargeant 2002) and by 1996 Matriotti Creek had already been listed as "impaired" due to fecal coliform bacteria. Fecal coliforms commonly occur in human and animal wastes and their presence may indicate other, accompanying harmful bacteria and pathogens (DeBarry 2004).

Shellfish Downgrades

In 1998 an area immediately adjacent to the mouth of the Dungeness River was formally closed to shellfish harvest. This area was expanded toward inner Dungeness Bay in 2000 and again in 2001. By 2007 much of the area around the mouth of the Dungeness River was classified as "prohibited" for shellfish harvest and the majority of Dungeness Bay was classified "conditionally approved" (Jamestown S'Klallam Tribe 2007).

Various efforts to clean up freshwater bodies within the Clean Water District—including reductions in runoff from irrigation water—have led to a reversal in water quality trends (at least relating to bacteria in Dungeness Bay) and acres of shellfish beds have been upgraded in recent years. The map, below, summarizes the status of Dungeness Bay in 2017.

Figure 2. Status of Dungeness Bay Shellfish Beds in 2017.



Status of Dungeness Bay shellfish beds in 2017. Courtesy of Washington State Department of Health.

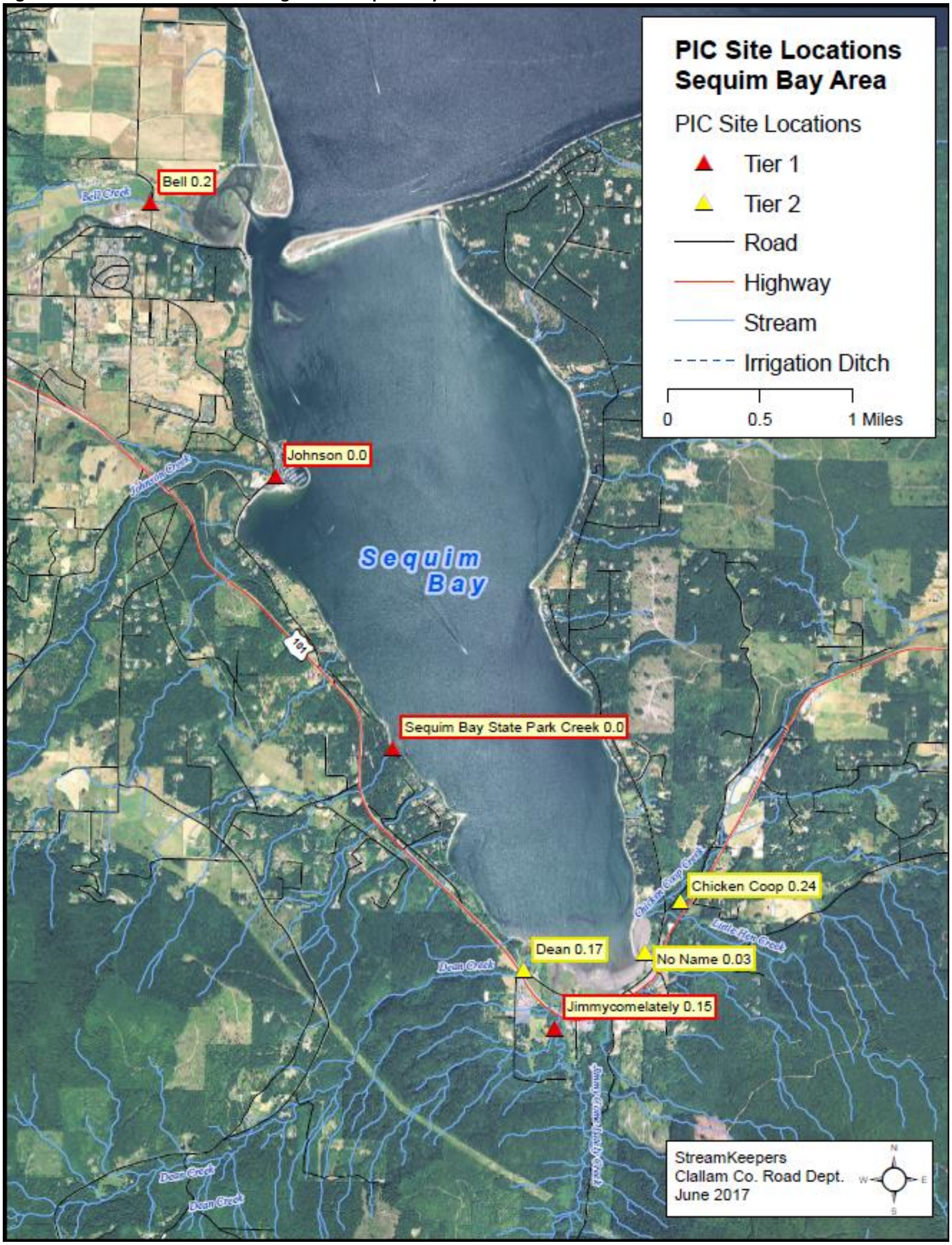
Plan of Action

Clallam County Environmental Health partnered with Clallam Conservation District, Jamestown S'Klallam Tribe, and Streamkeepers of Clallam County to implement the 2015-2017 Pollution Identification and Correction (PIC) Project designed to address ongoing bacterial pollution issues within the Clean Water District and build upon previous successes that lead to shellfish growing area upgrades in Dungeness Bay. Primary components of the PIC Project follow.

Baseline Trends Monitoring

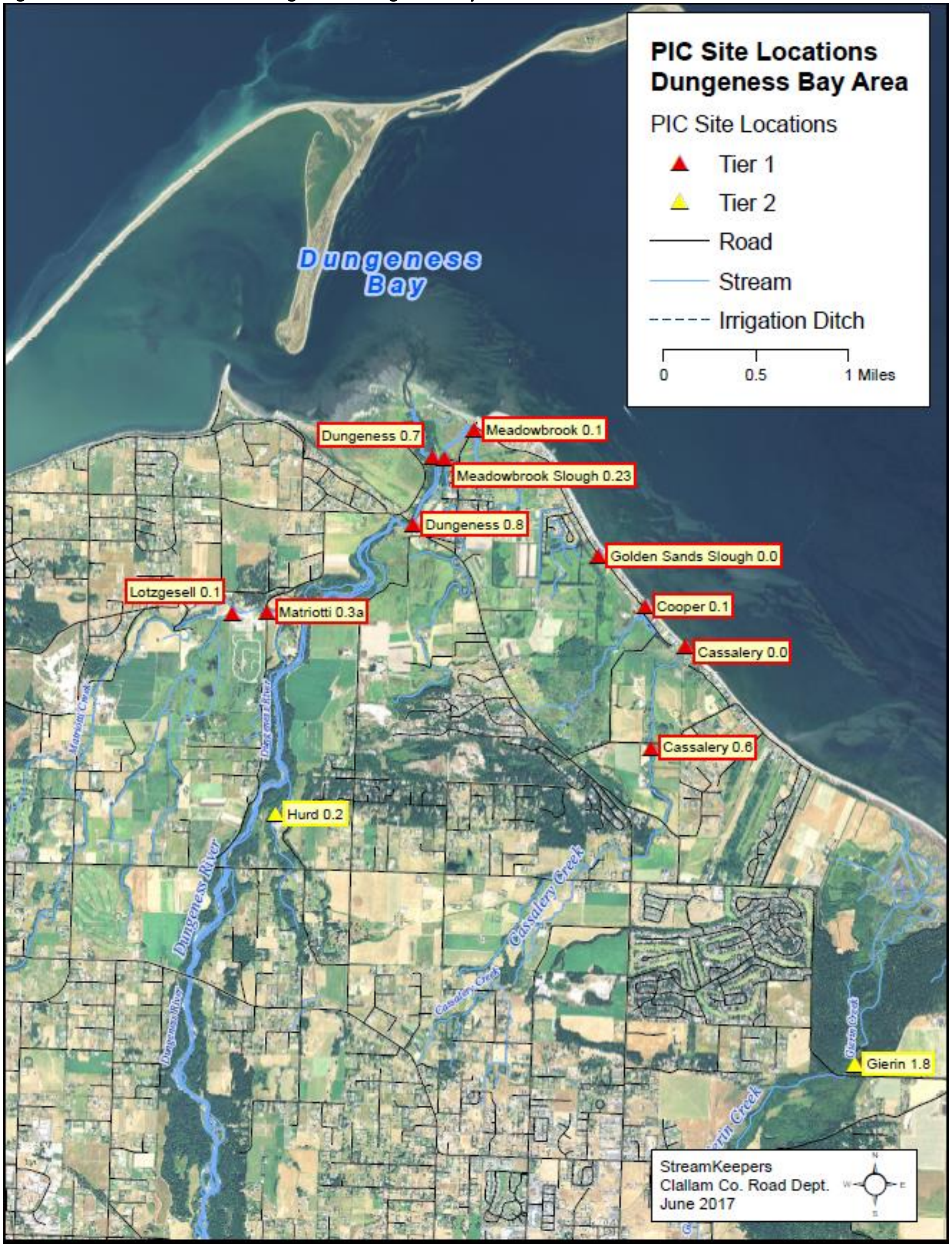
Streamkeepers of Clallam County took the lead on a baseline trends monitoring project to characterize chemical and physical properties of Clean Water District streams by sampling near each stream's point of discharge into receiving waters. Throughout the project period a dedicated team of Streamkeepers volunteers collected data on standard water quality parameters of district streams, along with grab samples for fecal coliform and nutrients analyses. Baseline Trends sites were grouped into two tiers: monitoring occurred monthly at Tier 1 streams while Tier 2 streams received quarterly visits (with few exceptions due to funding and/or scheduling). Information generated by the Baseline Trends Monitoring Program guided decisions on where to focus further investigation and remediation efforts within the district.

Figure 3. Baseline Trends Monitoring Sites—Sequim Bay Area.



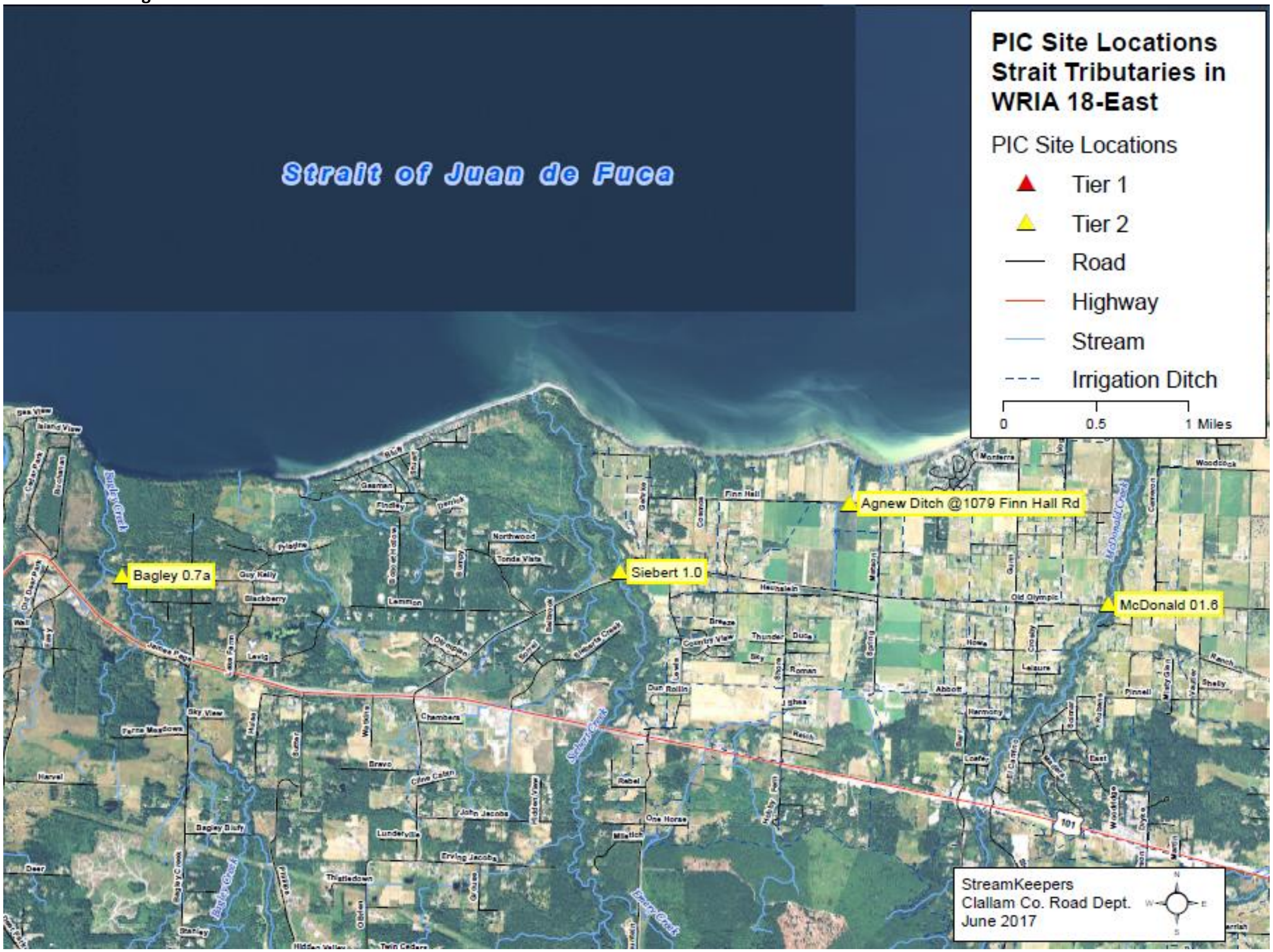
Baseline Trends Monitoring sites in the easternmost portion of Clallam County's Clean Water District. In general, Streamkeepers volunteers sampled Tier 1 sites monthly and sampled Tier 2 sites quarterly.

Figure 4. Baseline Trends Monitoring Sites—Dungeness Bay Area.



Baseline Trends Monitoring sites in the central portion of Clallam County's Clean Water District. In general, Streamkeepers volunteers sampled Tier 1 sites monthly and sampled Tier 2 sites quarterly. Note: alternate sites occasionally used in place of Meadowbrook 0.1 not shown to reduce map clutter.

Figure 5. Baseline Trends Monitoring Sites—Strait Tributaries Area.

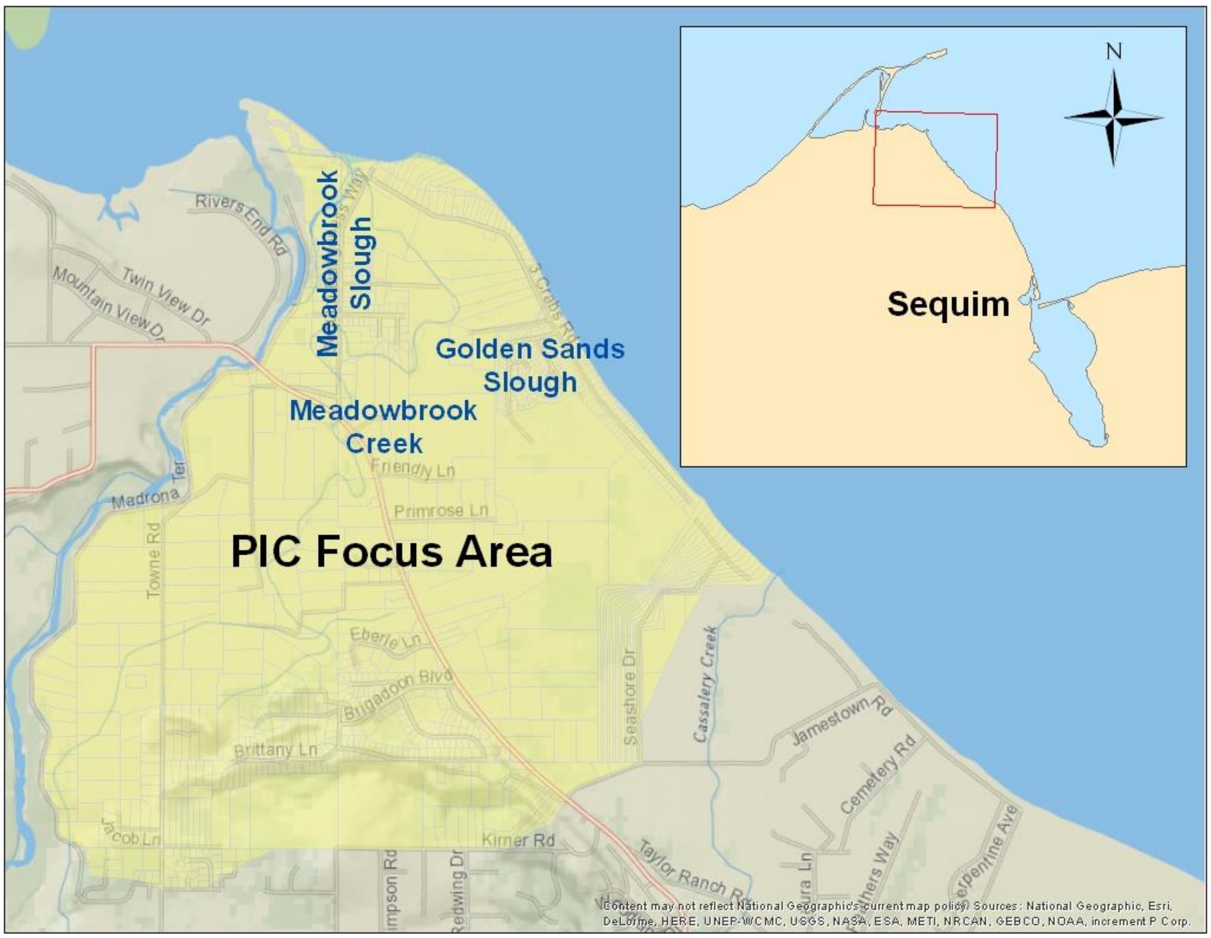


Baseline Trends Monitoring sites in the westernmost portion of Clallam County's Clean Water District. In general, Streamkeepers volunteers sampled Tier 1 sites monthly and sampled Tier 2 sites quarterly.

Coordination

PIC Project Partners coordinated efforts to address bacterial pollution in waters of the Sequim Dungeness Clean Water District. Often times this involved meeting with the Clean Water Work Group (CWWG), a subset of the Dungeness River Management Team (DRMT), for guidance. At regular work group meetings partners shared information and made decisions regarding PIC Project Direction. For example, the CWWG selected the first PIC Focus Area to include Meadowbrook Slough, Meadowbrook Creek, Golden Sands Slough, Cooper Creek, and the 3-Crabs area. Within the Focus Area more intensive pollution investigation and correction efforts aimed to uncover and remediate sources of bacterial water pollution.

Figure 6. 2015-2017 PIC Focus Area.

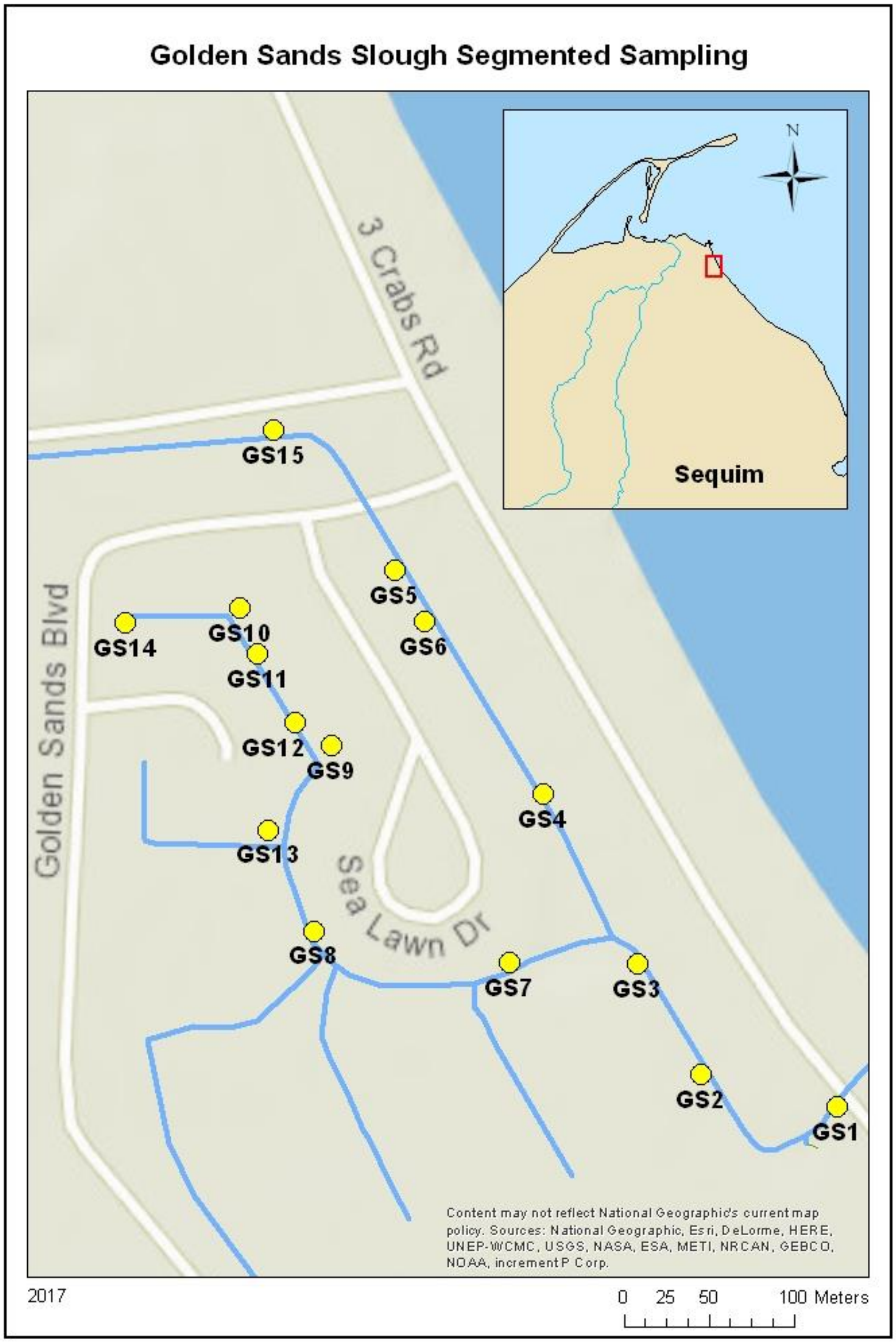


The Clean Water Work Group chose the initial PIC Focus Area to include Meadowbrook Slough, Meadowbrook Creek, Golden Sands Slough, Cooper Creek, and 3-Crabs Road. Baseline Trends Monitoring Data provided by Streamkeepers of Clallam County, coupled with the focus area's proximity to impacted marine waters and shellfish beds helped guide PIC Focus Area selection. Map data from ESRI and Clallam County.

Segmented/Targeted Monitoring

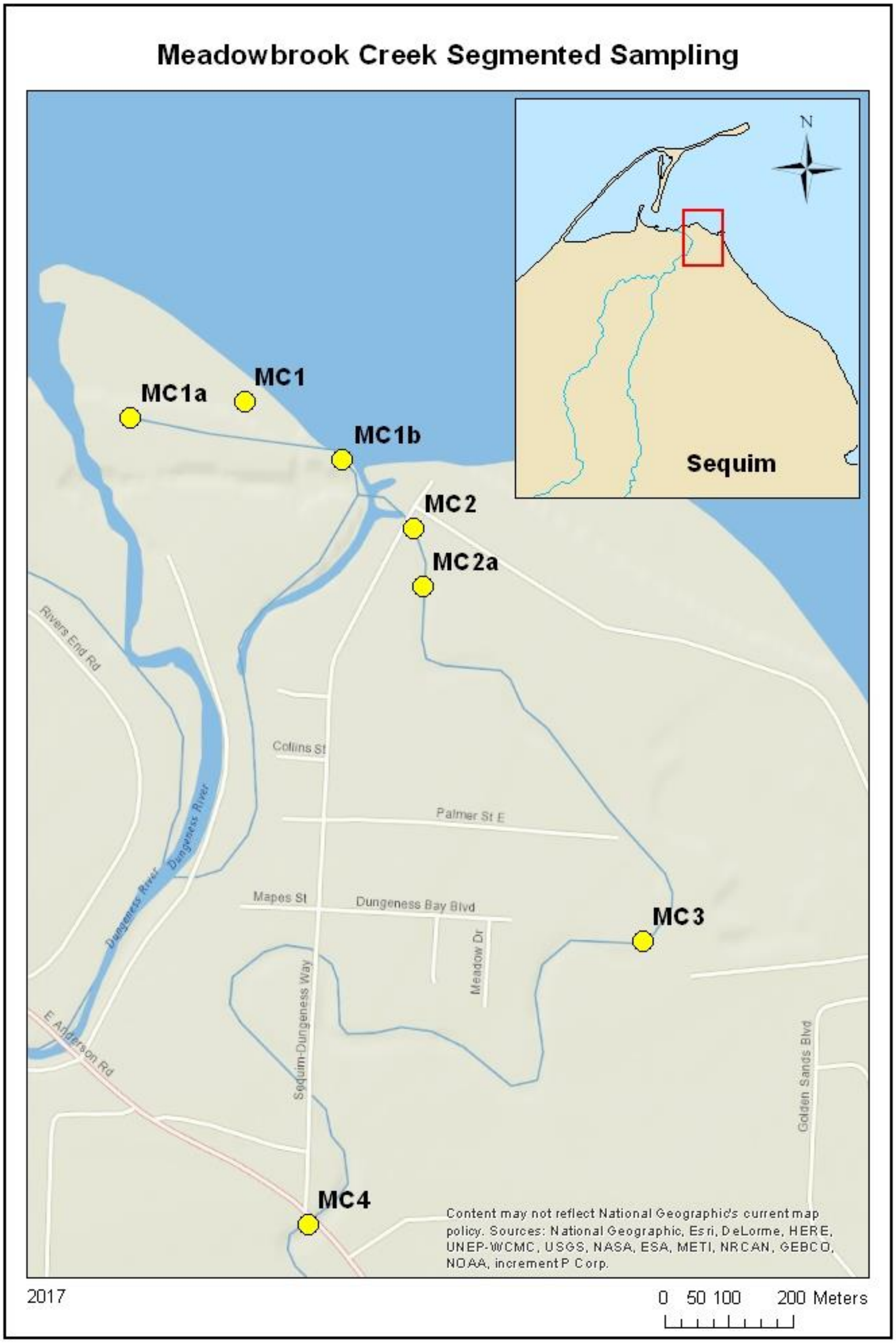
In order to narrow down the search for sources of pollution, targeted water quality sampling sites were set up along water bodies within the PIC Focus Area. Here, Jamestown S'Klallam Tribe and Clallam County Environmental Health collected water grab samples to measure fecal coliforms along with temperature and salinity data. By collecting information at multiple points along the length of a stream project partners should, ideally, be able to tell if a particular stream segment stands out in terms of poor water quality and requires remediation. Such information would enable Environmental Health to look more closely at the surrounding properties to determine if any corrections might benefit the waterway. Bacterial pollution could potentially come from storm water runoff, animal waste (both domesticated and wild), onsite sewage systems, or other unanticipated sources. Segmented water quality sampling sites for the PIC Focus Area follow.

Figure 7. Segmented Sampling Sites in Golden Sands Slough.



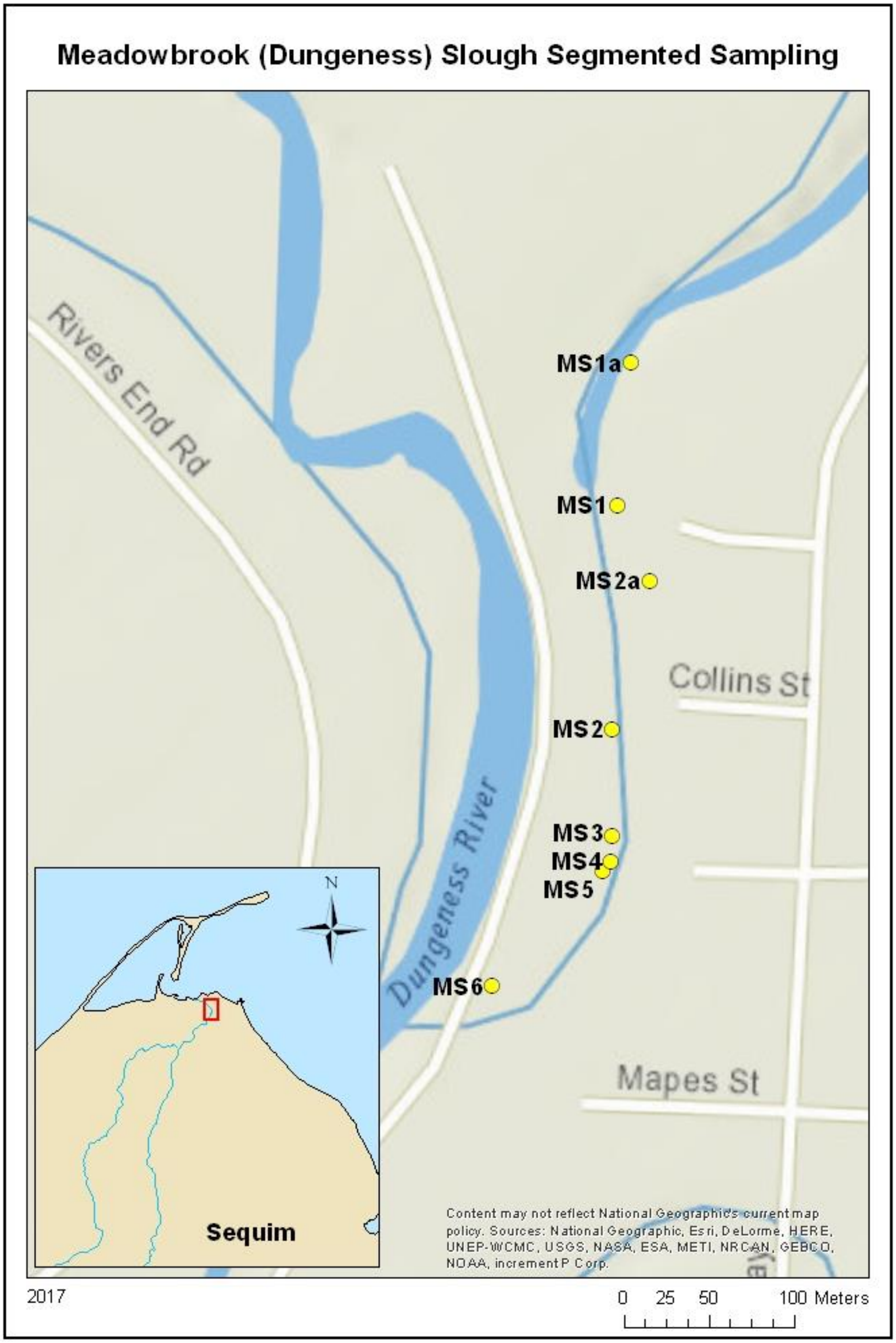
Segmented sampling sites in Golden Sands Slough set up to investigate any potential sources of bacterial pollution entering the waterway. Site GS06 was abandoned early in the project due to access issues. GS08 was also abandoned near the end of the project due to access issues. Map data from ESRI and Clallam County.

Figure 8. Meadowbrook Creek Segmented Sampling Sites.



Segmented sampling sites in Meadowbrook Creek set up to investigate any potential sources of bacterial pollution entering the waterway. Map data from ESRI and Clallam County.

Figure 9. Meadowbrook (Dungeness) Slough Segmented Sampling Sites.



Segmented sampling sites in Meadowbrook (Dungeness) Slough set up to investigate any potential sources of bacterial pollution entering the waterway. Map data from ESRI and Clallam County.

Further Investigation/Experimental Studies

Hot Spot Designation

Wherever elevated fecal coliform levels were found in PIC Focus Area waterways through segmented sampling, Environmental Health and Jamestown S'Klallam Tribe made an effort to return for multiple supporting observations in order to classify a particular segmented site as a "hot spot." The classification of a site as a hot spot triggered further investigation to include assessment of surrounding properties and use of other available investigative tools.

Optical Brightener Study

An experimental optical brightener (OB) study was attempted briefly in Golden Sands Slough. OB have successfully been demonstrated as a viable means to detect sewer misconnections and the presence of anthropogenic waste in waterways (Chandler and Lerner 2015). Various adsorptive substrates were placed in Golden Sands Slough then observed under UV light—fluorescence should indicate the presence of detergents or other components associated with household wastewater.

Canine Scent Tracking

Clallam County Environmental Health also tried using sewage-sniffing dogs to narrow down possible contributors of bacterial pollution to Golden Sands Slough. In some instances canine scent tracking has served as an effective tool to detect elicit discharge and human-specific waste in waterways (Murray et al. 2011). Here, water samples collected from Golden Sands Slough were shipped to Environmental Canine Services (ECS), LLC in Otisfield, Maine through a "ship and sniff" program. ECS presented the water samples collected from Golden Sands Slough to dogs trained to signal when scents unique to human waste are detected.

Parcel Assessment

Environmental Health used County records of properties within the PIC Focus Area to begin the analysis of land uses and consideration of any possible bacterial pollution sources. As-built drawings of onsite sewage systems, OSS inspection records (or lack thereof), structures, aerial photography, and property uses all informed an initial examination of the spectrum of influences on PIC Focus Area water quality.

Parcel Surveys

Parcel surveys delved a layer deeper than office-based parcel assessments: here, EH staff visited parcels of participating property owners to evaluate water uses, storm water management, sewage treatment methods, animal waste, and any other pertinent factors that could potentially impact surface waters. EH staff requested written permission from property owners within the PIC Focus Area and walked each selected parcel (ideally with the property owner present) using a PIC Survey Form to gather information on the above topics.

Tracer Dye Testing

Clallam County Environmental Health conducted three rounds of tracer dye testing in Golden Sands Slough in the summer of 2015 and two rounds of testing in Meadowbrook Slough in summer and fall of 2017. Fluorescent dyes were introduced into the water-consuming appliances of participating homeowners living immediately adjacent to these waterways. Packets of activated charcoal left in the waterways throughout the testing process were shipped to Ozark Underground Laboratory in Protem, Missouri for spectrofluorophotometric analysis: the detection of fluorescent dyes adsorbed to the charcoal alerts researchers to the existence of a hydraulic connection between the point of dye introduction and the waterway studied.

Beach Surveys

One large portion of the PIC Focus Area presented a unique challenge: a number of residences along 3-Crabs road have onsite sewage systems immediately adjacent to marine shoreline. Functioning properly, these OSS should not contribute excessive levels of bacteria to nearby waters, but a particular failing septic system would likely prove difficult to locate through any of the above-mentioned techniques. Here, project partners could not simply collect water samples from a freshwater stream to narrow down sources of bacterial pollution. As such, Clallam County Environmental Health performed a beach survey to look for any water seeping from the beach face on an outgoing tide from which to collect water samples.

Pollution Correction

Technical Assistance

Project partners provided technical assistance to landowners wherever possible to improve outcomes for water quality within the PIC Focus Area. Clallam County Environmental Health Registered Sanitarians and Certified Wastewater Inspectors were able to provide guidance to landowners regarding sewage treatment practices and pet waste management. Clallam Conservation District provides a host of services where animal-keeping practices or farming are involved. The Conservation District provides technical assistance to landowners regarding the implementation of best management practices (BMP) to protect waterways and the environment.

Financial Assistance

The primary mechanism to assist homeowners in need of septic repairs or upgrades involved low interest Clean Water Loans available through Craft 3. As a fallback, Clallam Conservation District also provided a cost-share program intended to ease the burden of septic costs. Homeowners with failing or non-conforming sewage systems at their primary residence and meeting specific financial criteria could apply for assistance from Craft3 in the form of loans with favorable terms. To bridge the gap for those not qualifying for loans or with excessive financial barriers, homeowners had the option to apply for grant funding from Clallam Conservation District to pay for a portion of septic designs and installations.

Compliance Timelines/Enforcement

Where water quality issues were documented and potentially responsible landowners took an antagonistic stance toward cleanup efforts, Clallam County Environmental Health resorted to compliance timelines and enforcement protocols developed in conjunction with the County Prosecuting Attorney's Office. EH used these tools to compel septic inspections by licensed inspectors as required by Washington State law. Full inspections greatly helped to sort the properly functioning, conforming sewage systems from those contributing to water pollution. Where verified failing septic systems are documented, EH initiates compliance timelines to compel repairs.

Outreach and Education

Success of the PIC Program in the 2015-2017 Focus Area greatly hinged upon the drive of residents within the project area to protect and value water resources. As such, project partners sought to engage the public early on and strove to keep landowners informed of PIC developments throughout the project period. To this end, project partners held various public meetings, sent direct mailings to the project area, produced press releases and news articles, and created a website to aggregate PIC literature.

Outcomes/Results

Water Quality Results

Trends Monitoring

PIC Trends Monitoring results guided Clean Water Work Group selection of PIC focus areas, continued the accumulation of baseline data begun through previous projects, and provided an overall picture of the chemical and physical properties of district streams near their points of discharge into receiving waters.

In general, data collection occurred monthly for Tier 1 streams and quarterly for Tier 2 streams, though funding constraints occasionally led to less frequent monitoring for Tier 2 sites during the project period. Tier 1 streams include Bell Creek, Cassalery Creek, Cooper Creek, Dungeness River, Golden Sands Slough, Jimmycomelately Creek, Johnson Creek, Lotzgesell Creek, Matriotti Creek, Meadowbrook (Dungeness) Slough, Meadowbrook Creek, and Sequim Bay State Park Creek. Tier 2 streams include Agnew Ditch (Creek), Bagley Creek, Chicken Coop Creek, Dean Creek, Gierin Creek, Hurd Creek, McDonald Creek, No Name Creek, and Siebert Creek.

Measurements gathered through PIC Trends Monitoring include: ammonia as nitrogen, barometric pressure, dissolved oxygen, dissolved oxygen percent saturation, fecal coliforms, discharge (where stream gages facilitate calculation), nitrate as N, nitrite as N, pH, phosphate as P, salinity, silicate as Si, specific conductivity (at 25 deg. C), stream or river stage, water temperature, total persulfate nitrogen, total persulfate phosphorous, and turbidity.

In order to quantify fecal coliform concentrations, field teams collected grab samples in sterile plastic bottles that were transported on ice for same-day analysis. Clallam County Environmental Health Water Laboratory performed fecal coliform analyses following the membrane filter method, for which the laboratory is accredited. Standard water quality parameters were collected using a YSI ProDSS multi-meter. Nutrient samples were shipped, chilled, by overnight courier, for analysis at University of Washington School of Oceanography Chemistry Laboratory.

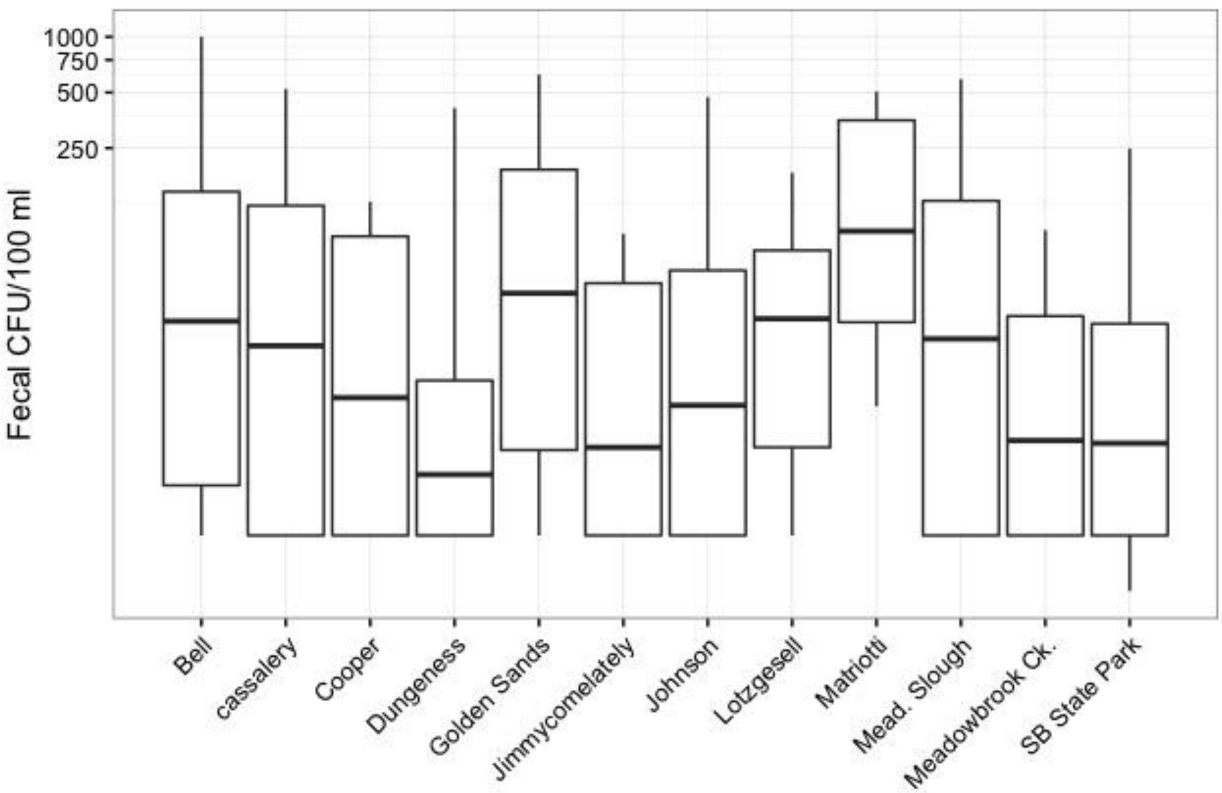
All data were verified and entered into the Clallam County Water Resources Database. All standard water quality parameter data, including fecal coliforms, were forwarded to Washington State Department of Ecology's Environmental Information Management System (EIM). Nutrient data were not submitted to EIM as Ecology does not recognize the laboratory methods used as accredited for regulatory purposes.

PIC Trends annual reports (Streamkeepers 2017, Streamkeepers In Press) review, in depth, all physical and chemical data collected through the Trends Monitoring Program along with discussion on data quality analysis. Here, we focus on select water quality parameters—specifically fecal coliforms, temperature, and salinity—collected over the entire project period as they relate to the investigation of bacterial pollution sources. Summary graphics of fecal coliform, salinity, and temperature data follow.

For our purposes, below, sites Cassalery 0.0 and Cassalery 0.6 were grouped and called “Cassalery” to facilitate analyses. Dungeness 0.7 and Dungeness 0.8 received similar treatment and were named “Dungeness.” Sites McDonald 01.6 and McDonald 03.1 were grouped into “McDonald”. Finally, all Meadowbrook Creek Trends sites were grouped into “Meadowbrook Ck.” Such allowances were necessary as preferred Trends sites were occasionally inaccessible due to circumstances such as construction, insufficient stream flow, tidal influence, or other factors. For these same reasons, fewer observations were recorded at Sequim Bay State Park Creek than at other Tier 1 Trends Monitoring sites.

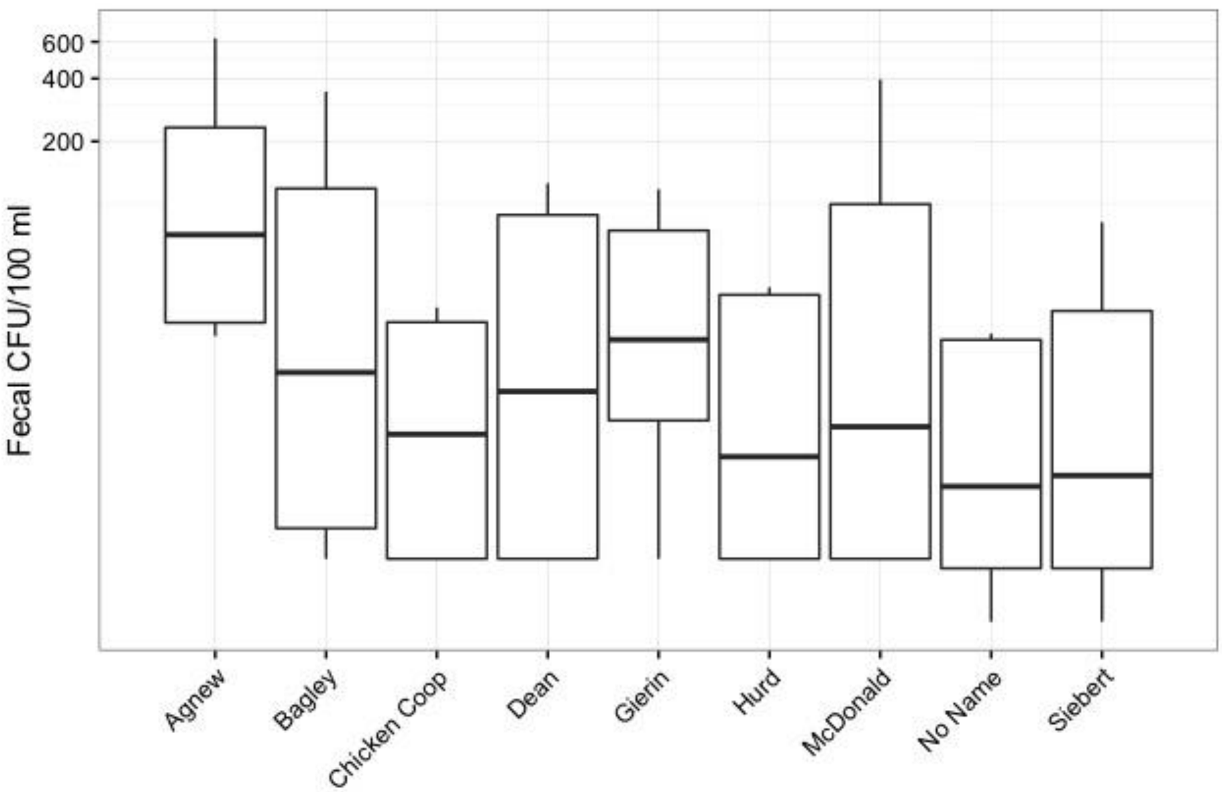
Analyte non-detects were substituted with the minimum detection limit (MDL) to facilitate the below analyses. As an example, the MDL of the membrane filter method used to quantify fecal coliform concentrations is usually one (the smallest number of colonies an observer can detect using a microscope and assuming a sample dilution factor of one). If no fecal coliform colonies are counted the result is reported as the number “one” with a “less than” qualifier and the number “one” is used in any analyses. All fecal coliform data are reported as “colony-forming units per 100 milliliters,” abbreviated to CFU/100 ml.

Figure 10. Tier 1 Streams Trends Fecal Coliform Summary.



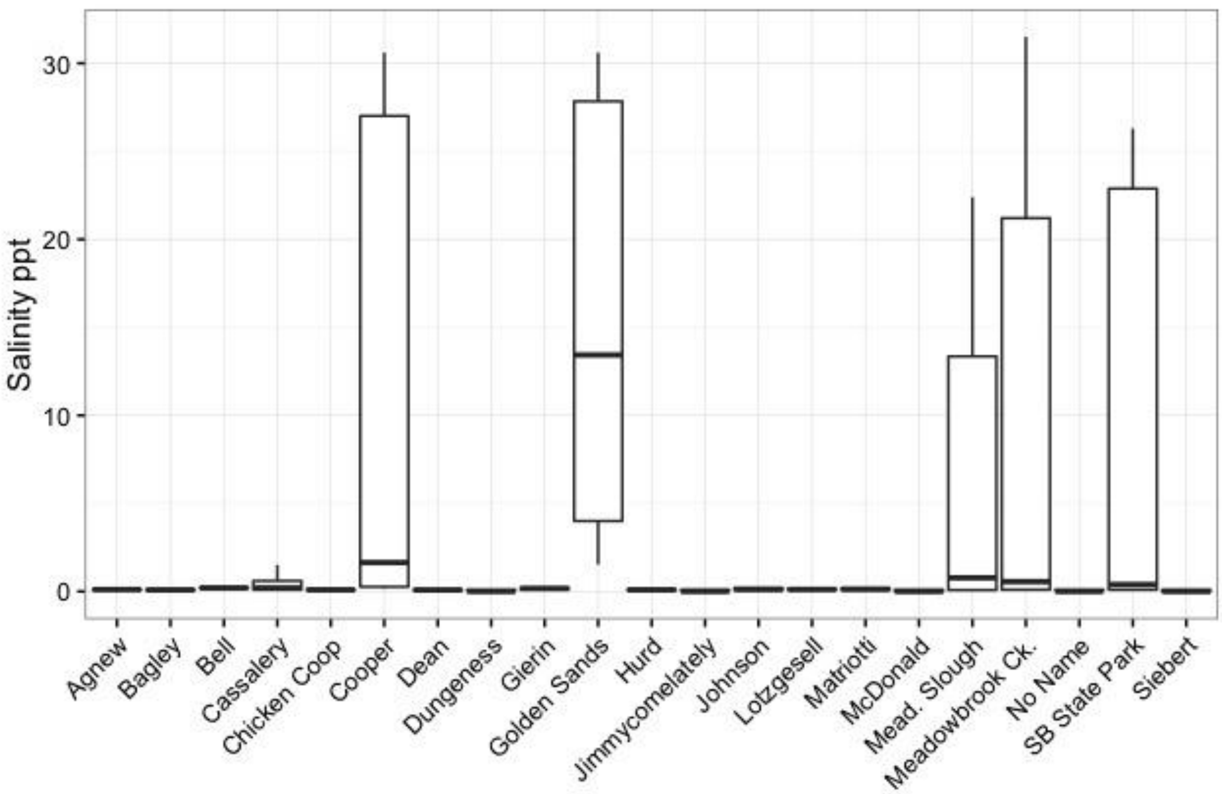
Summary of Tier 1 stream fecal coliform data collected from May 2015 through December 2017. Box and whisker plots denote 10th percentile, geometric mean, 90th percentile and minimum/maximum values. Note y-axis log scale. (Bell N = 29, Cassalery N = 33, Cooper N = 32, Dungeness N = 32, Golden Sands N = 32, Jimmycomelately N = 29, Johnson N = 29, Lotzgesell N = 32, Matriotti N = 33, Mead. Slough N = 32, Meadowbrook Ck. N = 32, SB State Park N = 20).

Figure 11. Tier 2 Streams Trends Fecal Coliform Summary.



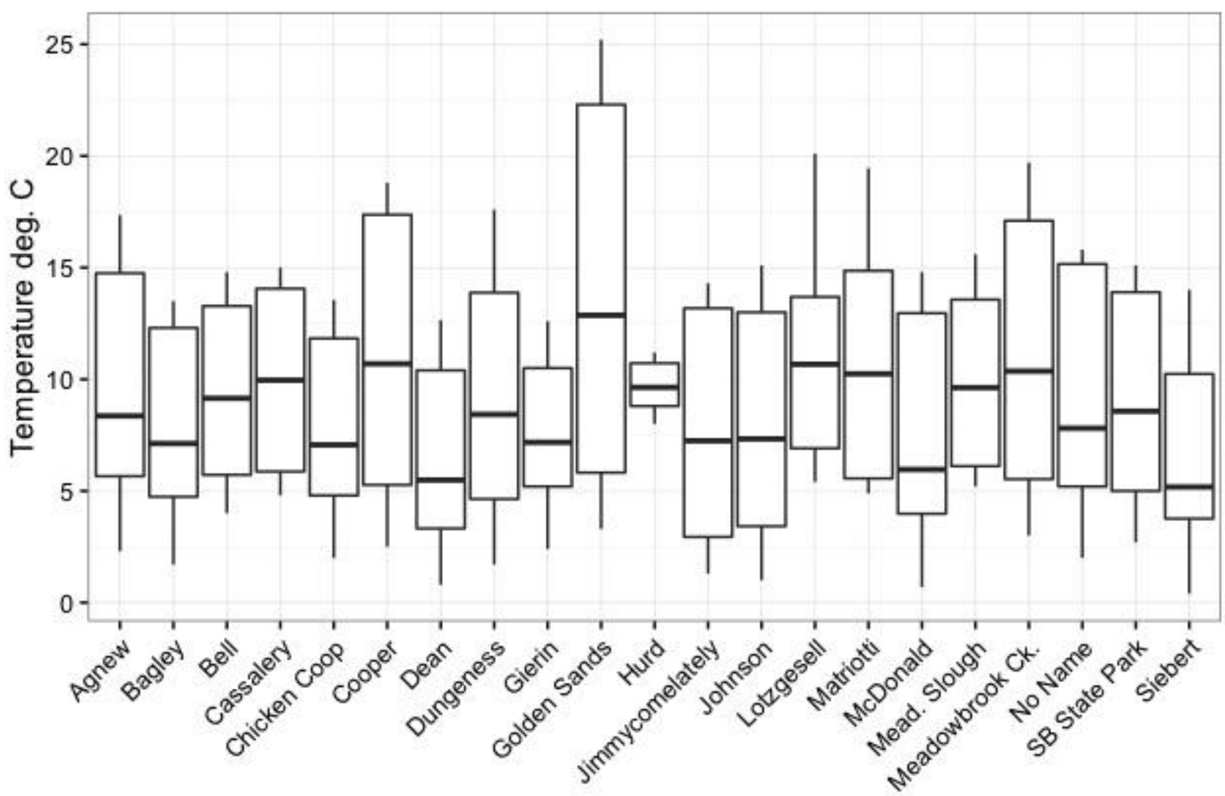
Summary of Tier 2 stream fecal coliform data collected from May 2015 through December 2017. Box and whisker plots denote 10th percentile, geometric mean, 90th percentile and minimum/maximum values. Note y-axis log scale. (Agnew N = 9, Bagley N = 9, Chicken Coop N = 9, Dean N = 7, Gierin N = 10, Hurd N = 9, McDonald N = 9, No Name N = 9, Siebert N = 9).

Figure 12. All Streams Trends Salinity Measurements.



Summary of all streams salinity data collected from May 2015 through December 2017. Box and whisker plots denote 10th percentile, geometric mean, 90th percentile and minimum/maximum values. (Agnew N = 9, Bagley N = 9, Bell N = 29, Cassalery N = 31, Chicken Coop N = 9, Cooper N = 32, Dean N = 7, Dungeness N = 32, Gierin N = 8, Golden Sands N = 32, Hurd, N = 9, Jimmycomelately N = 29, Johnson N = 29, Lotzgesell N = 32, Matriotti N = 32, Mead. Slough = 32, Meadowbrook Ck. N = 32, No Name N = 9, SB State Park N = 20, Siebert N = 9).

Figure 13. All Streams Trends Temperature Measurements.



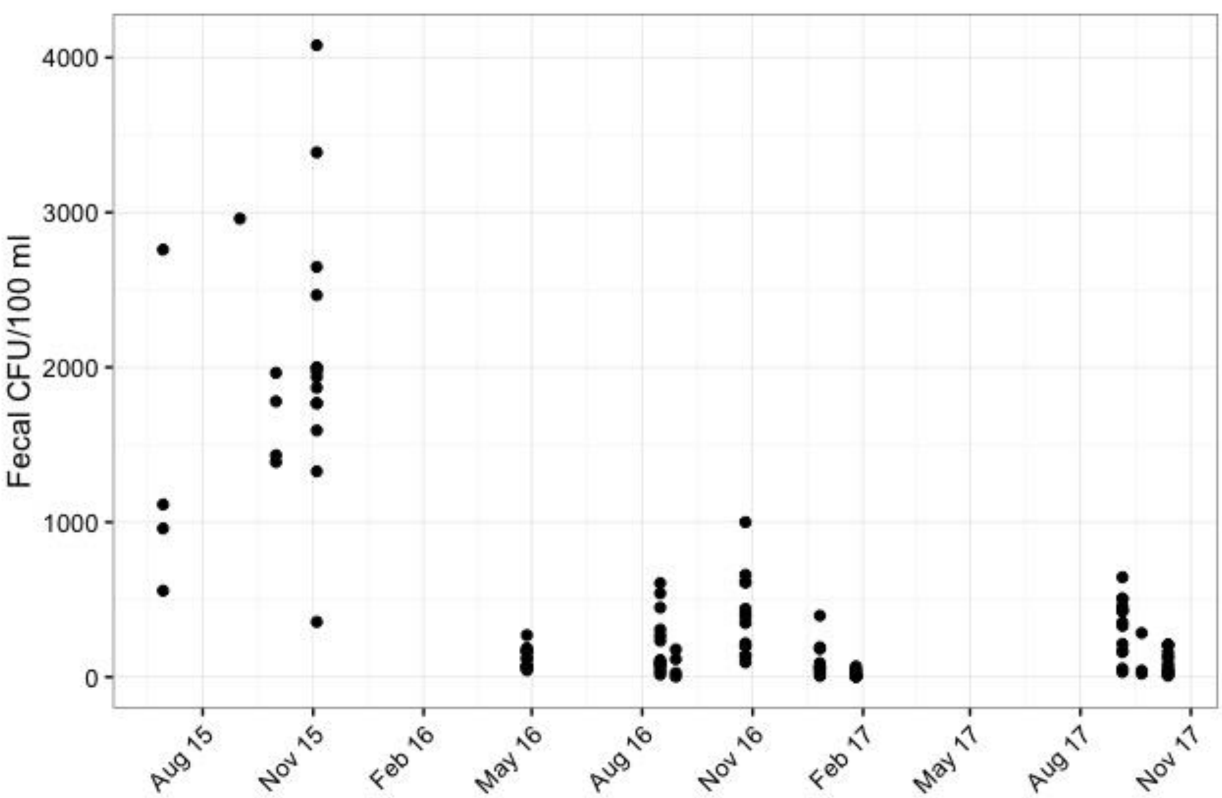
Summary of all streams temperature data collected from May 2015 through December 2017. Box and whisker plots denote 10th percentile, geometric mean, 90th percentile and minimum/maximum values. (Agnew N = 9, Bagley N = 9, Bell N = 29, Cassalery N = 32, Chicken Coop N = 9, Cooper N = 32, Dean N = 7, Dungeness N = 32, Gierin N = 8, Golden Sands N = 32, Hurd N = 9, Jimmycomelately N = 29, Johnson N =29, Lotzgesell N = 32, Matriotti N = 32, McDonald N = 9, Mead. Slough N = 32, Meadowbrook Ck. N = 32, No Name N = 9, SB State Park N = 20, Siebert N = 9).

Segmented/Targeted Monitoring

The Clean Water Work Group chose a focus area for heightened non-point source pollution investigation and remediation that included Golden Sands Slough, Meadowbrook Creek, and Meadowbrook Slough. Each waterway was divided into segments where fecal coliforms, temperature, and salinity were measured periodically throughout the project.

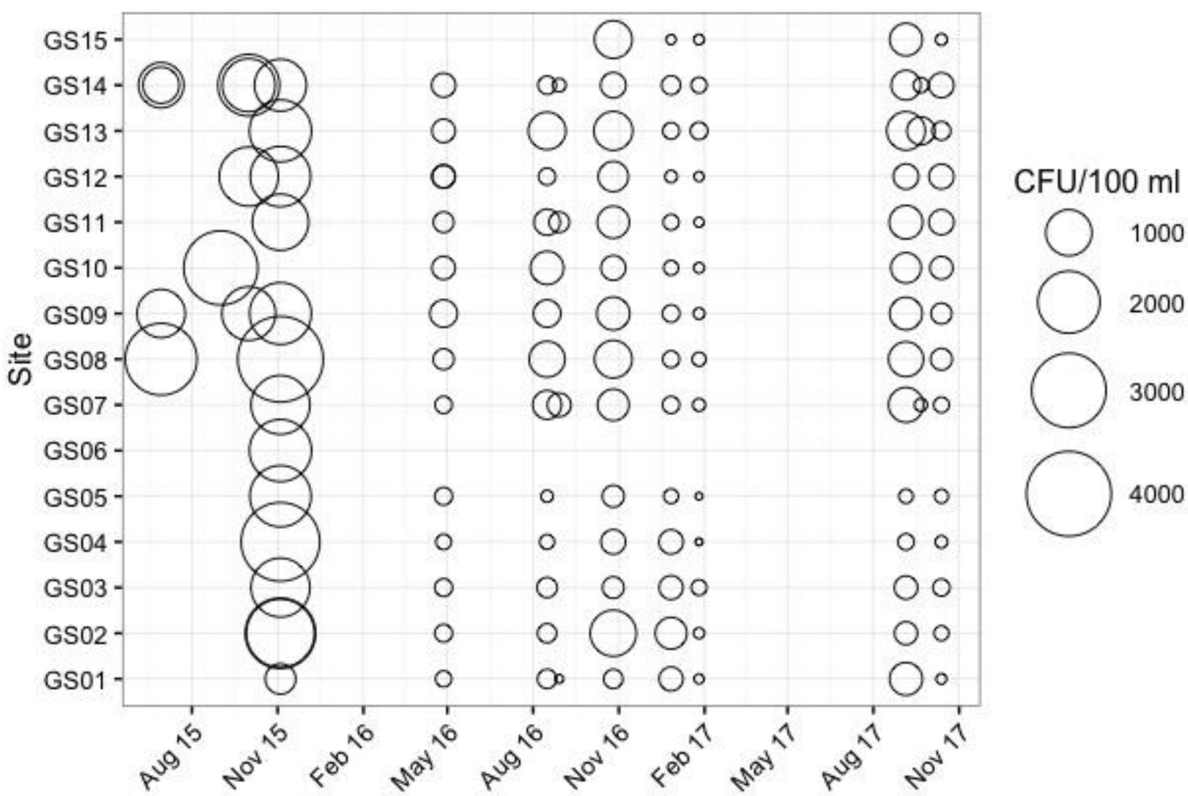
Summaries of segmented sampling fecal coliform, salinity, and temperature data follow along with calculations for the purpose of classifying hot spots. Again, Clallam County Environmental Health Water Laboratory analyzed grab samples for fecal coliforms following the membrane filter method. In order to facilitate the analyses below, the minimum detection limit was used in place of any non-detects. Further, primary results were averaged with any laboratory duplicates and reported as a composite result. Salinity and temperature measurements were recorded in-situ using a YSI multi-meter. Segmented sampling data were uploaded to United States Environmental Protection Agency's (EPA) STOrage and RETrieval (STORET) data warehouse.

Figure 14. Golden Sands Segmented Sampling Fecal Coliform Levels.



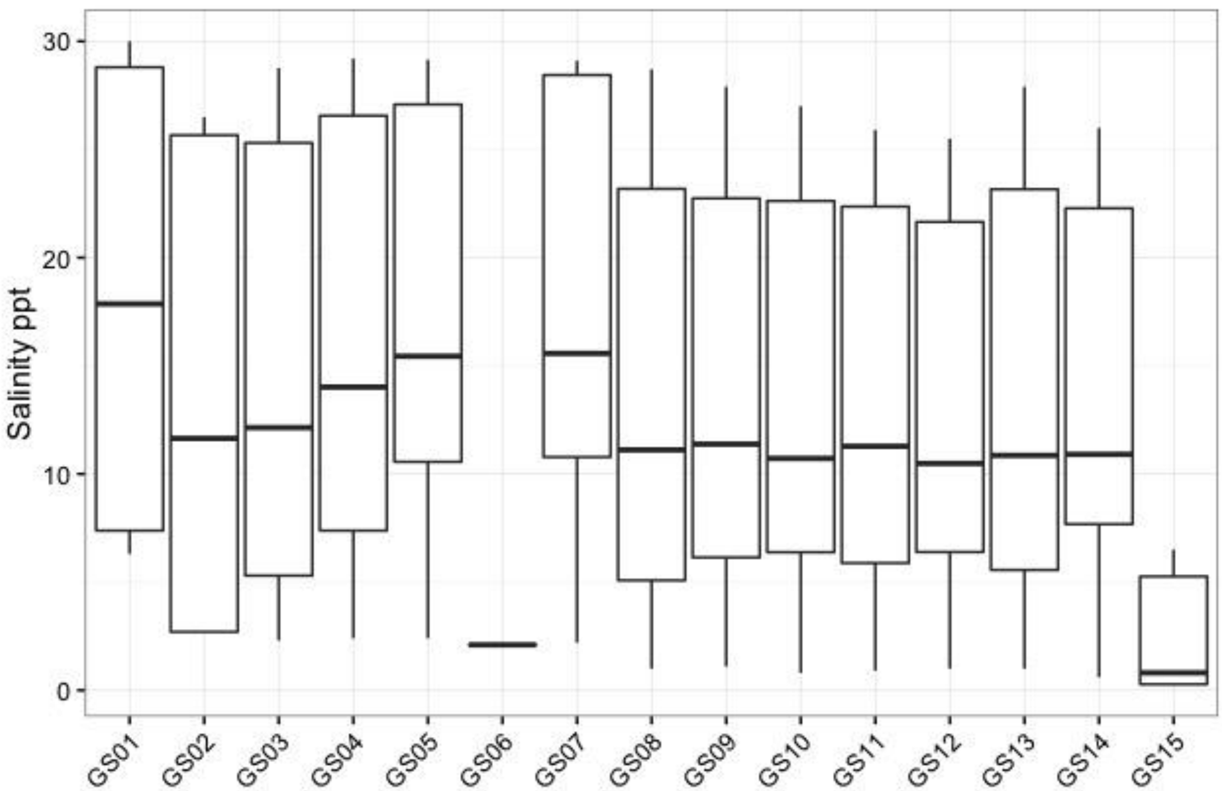
Golden Sands fecal coliform counts measured in colony-forming units per 100 ml sample at 15 established segmented sampling sites. Regular-scheduled segmented sampling, response to reports of apparent sewage plumes, and follow-up sampling included. Three observations omitted that did not correspond to well-defined sample sites (>1,064 CFU/100 ml, >3,276 CFU/100 ml, and 53 CFU/100 ml measured on 6/29/2015, 10/01/2015, and 8/29/2016 respectively). With this visualization, information on individual sample sites is lost. (N = 127).

Figure 15. Golden Sands Dates Segmented Sites Sampled and Fecal Coliform Levels.



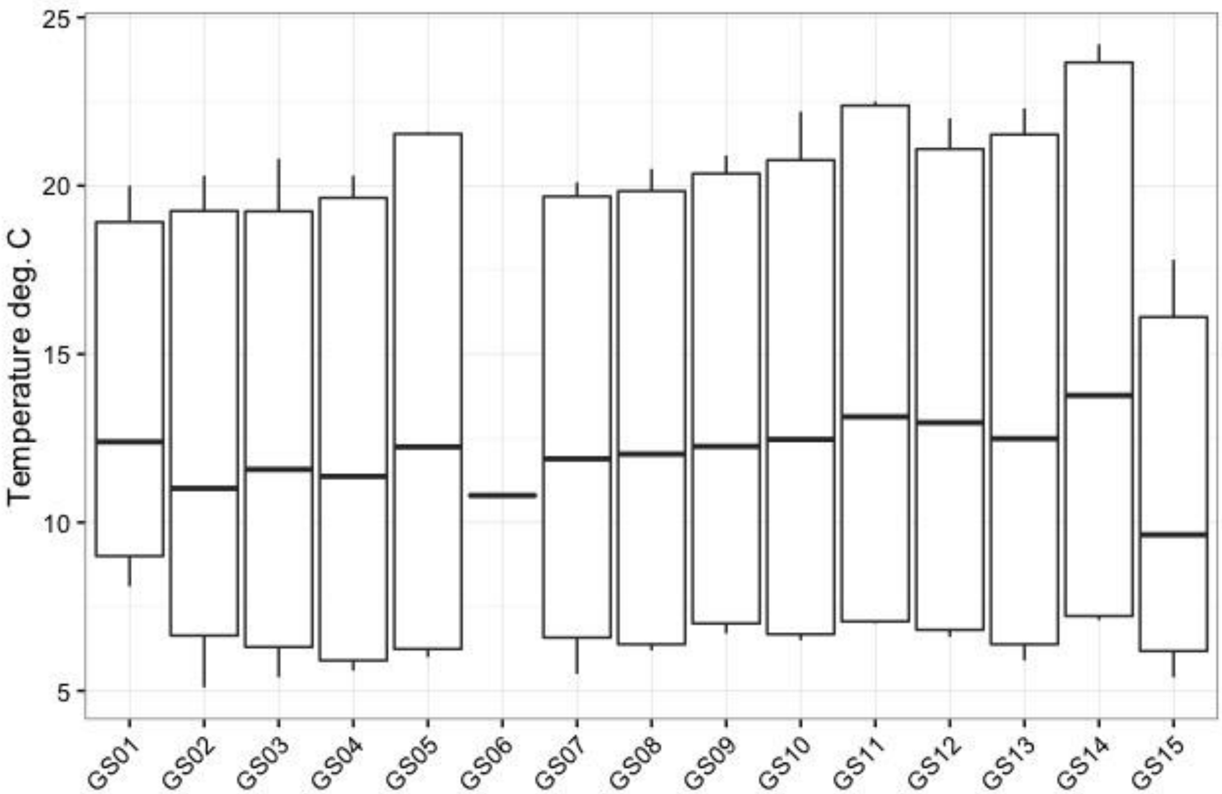
Golden Sands segmented samplings sites plotted vs. sampling date. Circle radii proportional to fecal coliform concentrations. Regular-scheduled segmented sampling, response to reports of apparent sewage plumes, and follow-up sampling included. Sites GS14 and GS14b grouped into "GS14" to facilitate analysis. Three observations omitted that did not correspond to well-defined sample sites (>1,064 CFU/100 ml, >3,276 CFU/100 ml, and 53 CFU/100 ml measured on 6/29/2015, 10/01/2015, and 8/29/2016 respectively). At least one observation omitted here was used to help characterize a hot spot, however, and all three observations remain in the data set presented in the appendices. Site GS06 abandoned early in the project as site access was rescinded. (N = 127).

Figure 16. Summary of Golden Sands Segmented Sampling Salinity Data.



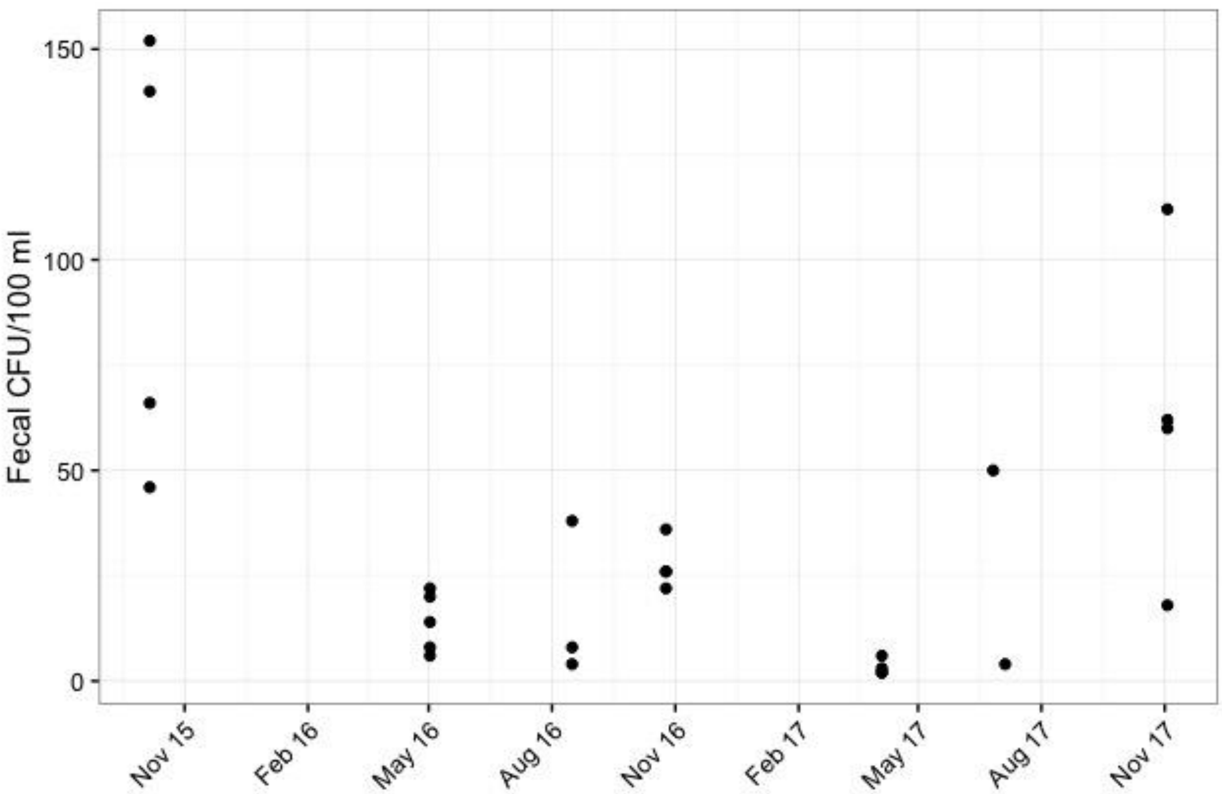
Summary of all Golden Sands Slough salinity data collected from May 2015 through December 2017. Box and whisker plots denote 10th percentile, geometric mean, 90th percentile and minimum/maximum values. Sites GS14 and GS14b grouped into “GS14” to facilitate analysis. Site GS06 abandoned early in the project as site access was rescinded. (GS02 N = 8, GS06 N = 1, GS12 N = 8, GS15 N = 3, all other sites N = 7).

Figure 17. Summary of Golden Sands Segmented Sampling Temperature Data.



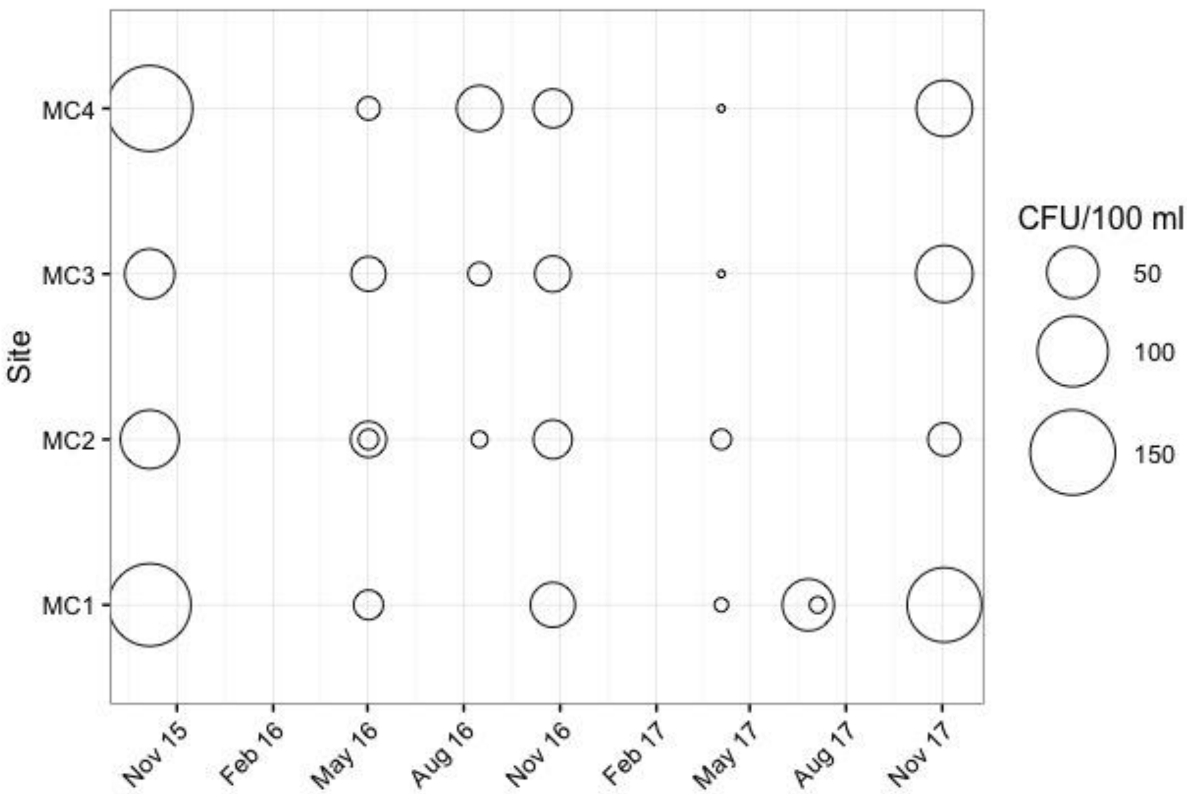
Summary of all Golden Sands Slough temperature data collected from May 2015 through December 2017. Box and whisker plots denote 10th percentile, geometric mean, 90th percentile and minimum/maximum values. Sites GS14 and GS14b grouped into "GS14" to facilitate analysis. Site GS06 abandoned early in the project as site access was rescinded. (GS02 N = 8, GS06 N = 1, GS12 N = 8, GS15 N = 3, all other sites N = 7).

Figure 18. Meadowbrook Creek Segmented Sampling Fecal Coliform Levels.



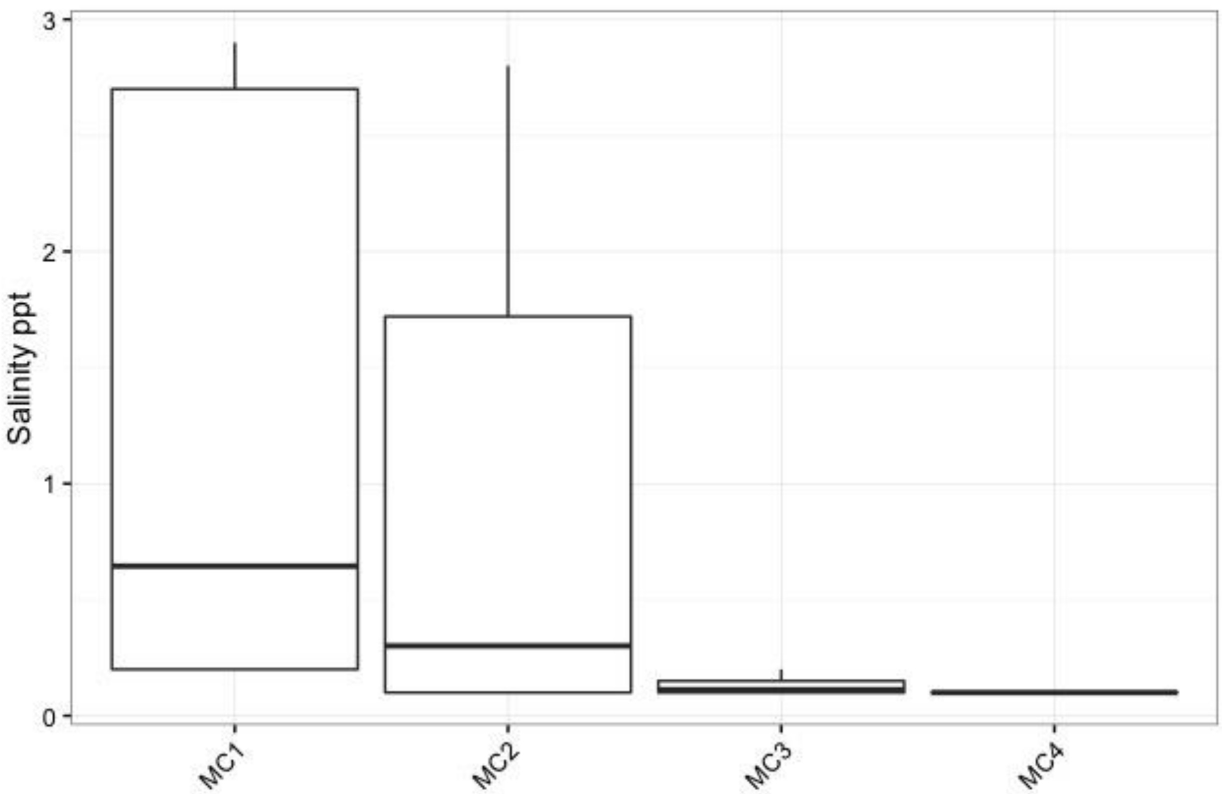
Meadowbrook Creek fecal coliform counts measured in colony-forming units per 100 ml sample at established segmented sampling sites. Regular-scheduled segmented sampling and follow-up sampling included. With this visualization, information on individual sample sites is lost. (N = 26).

Figure 19. Meadowbrook Creek Dates Segmented Sites Sampled and Fecal Coliform Levels.



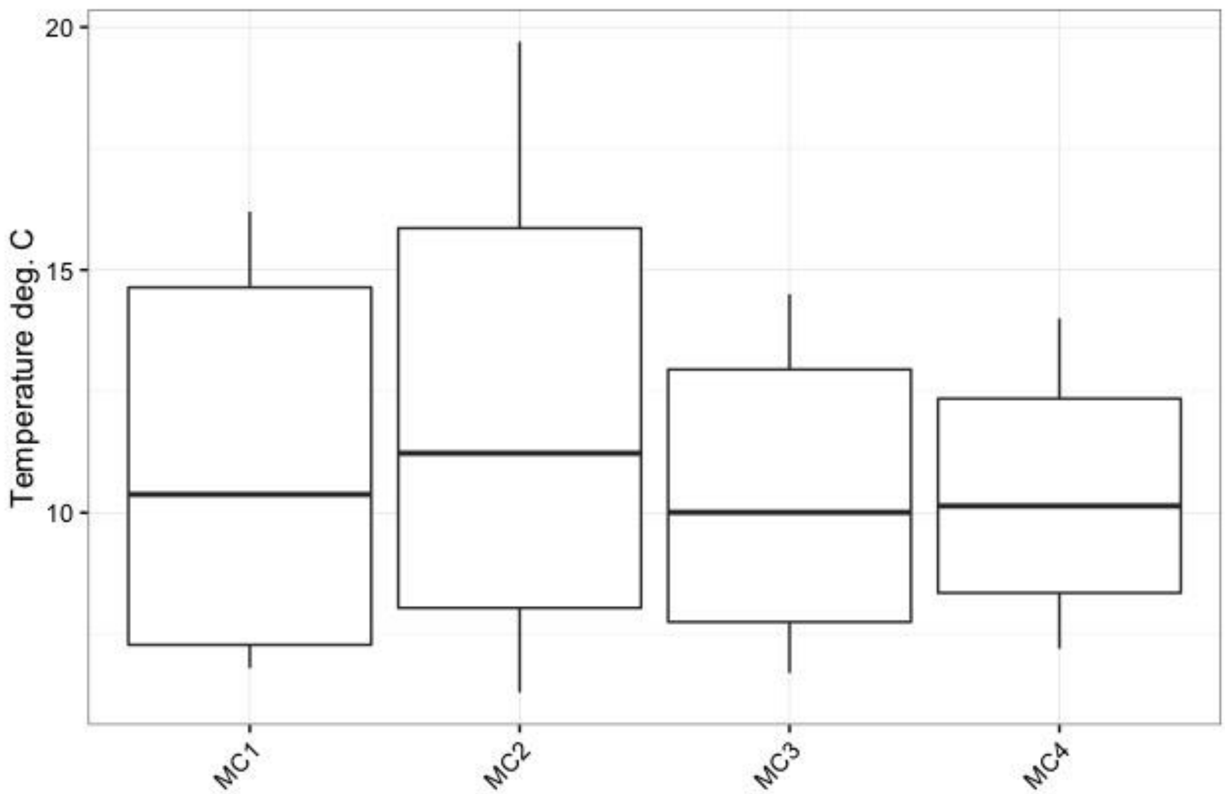
Meadowbrook Creek segmented samplings sites plotted vs. sampling date. Circle radii proportional to fecal coliform concentrations. Regular-scheduled segmented sampling and follow-up sampling included. Meadowbrook Creek mouth migrated as the stream meandered throughout the project period. Unique creek mouth sites MC1, MC1a, and MC1b grouped as “MC1” to facilitate visualization here. Sites MC2 and MC2a used alternately to avoid 3-Crabs Road construction and grouped here as “MC2” to further visualization. (N = 26).

Figure 20. Summary of Meadowbrook Creek Segmented Sampling Salinity Data.



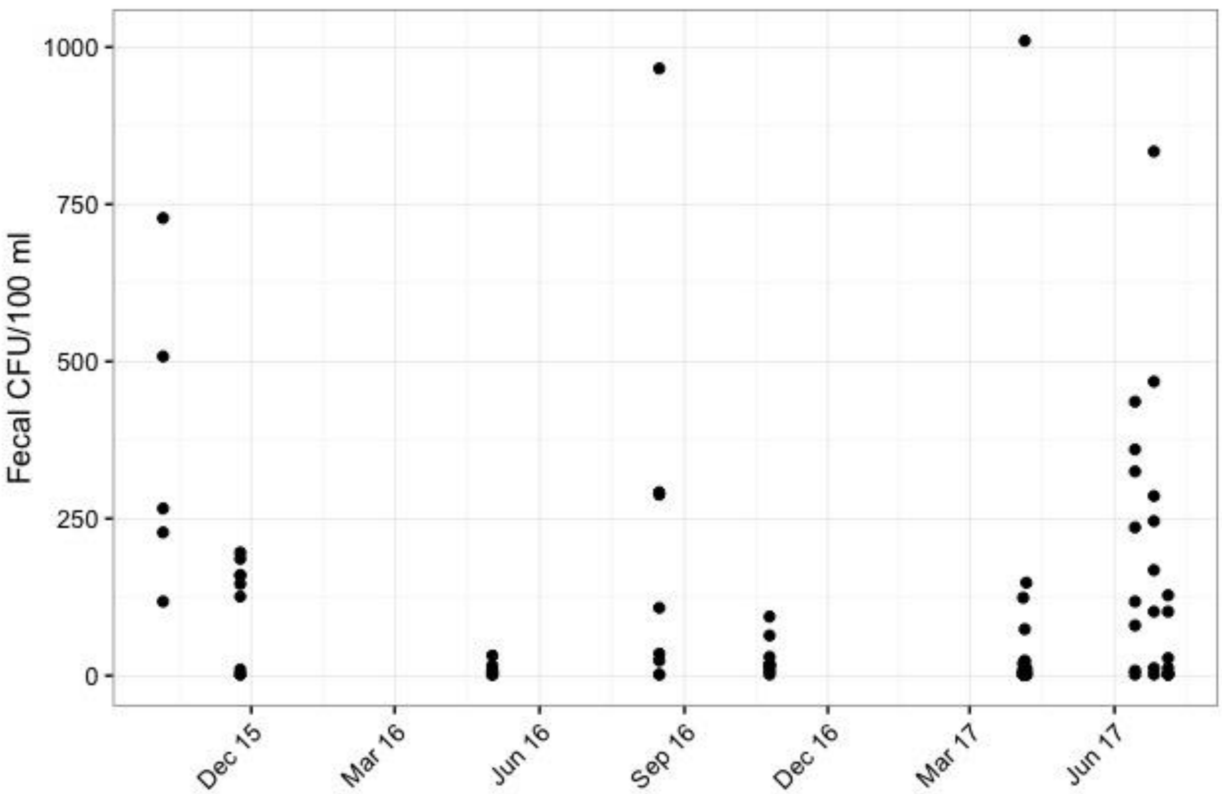
Summary of all Meadowbrook Creek salinity data collected from May 2015 through December 2017. Box and whisker plots denote 10th percentile, geometric mean, 90th percentile and minimum/maximum values. Sites MC1, MC1a, and MC1b grouped into "MC1" to facilitate analysis. Similarly, sites MC2 and MC2a grouped as "MC2." (MC1 N = 5, MC2 N = 7, MC3 N = 6, MC4 N = 6).

Figure 21. Summary of Meadowbrook Creek Segmented Sampling Temperature Data.



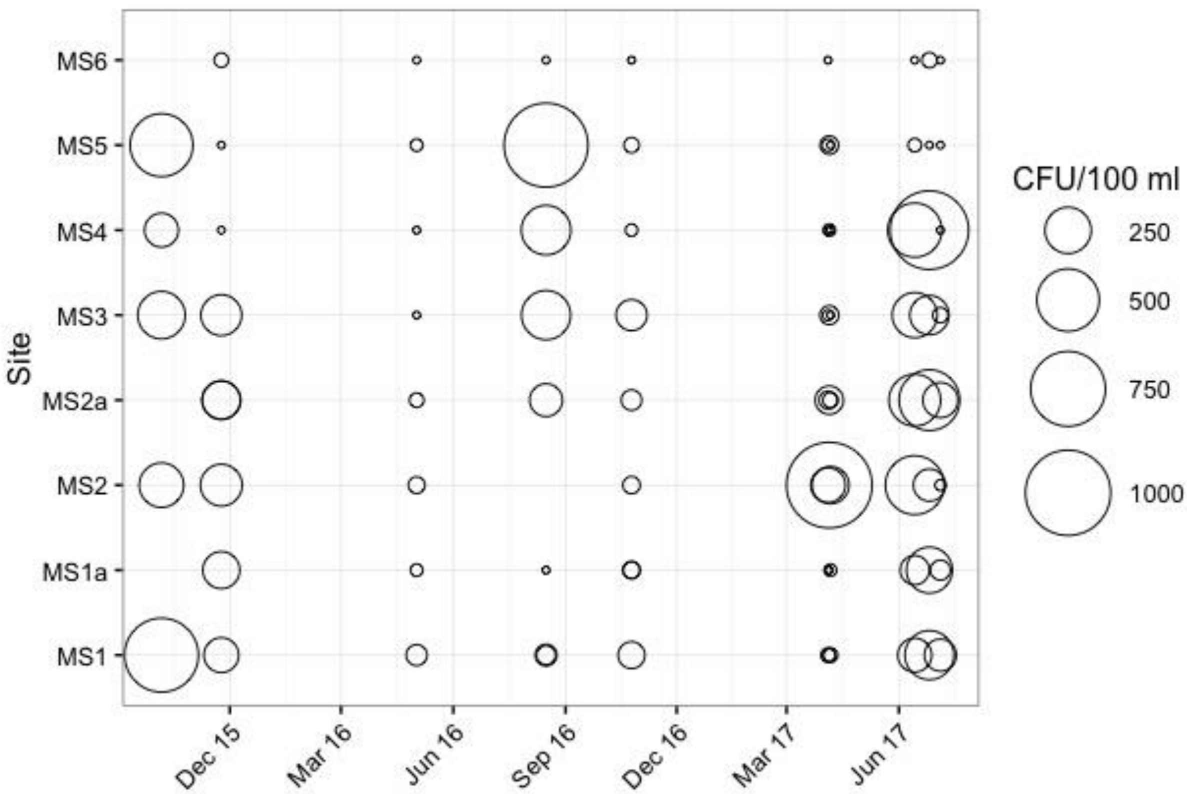
Summary of all Meadowbrook Creek temperature data collected from May 2015 through December 2017. Box and whisker plots denote 10th percentile, geometric mean, 90th percentile and minimum/maximum values. Sites MC1, MC1a, and MC1b grouped into “MC1” to facilitate analysis. Similarly, sites MC2 and MC2a grouped as “MC2.” (MC1 N = 5, MC2 N = 7, MC3 N = 6, MC4 N = 6).

Figure 22. Meadowbrook Slough Segmented Sampling Fecal Coliform Levels.



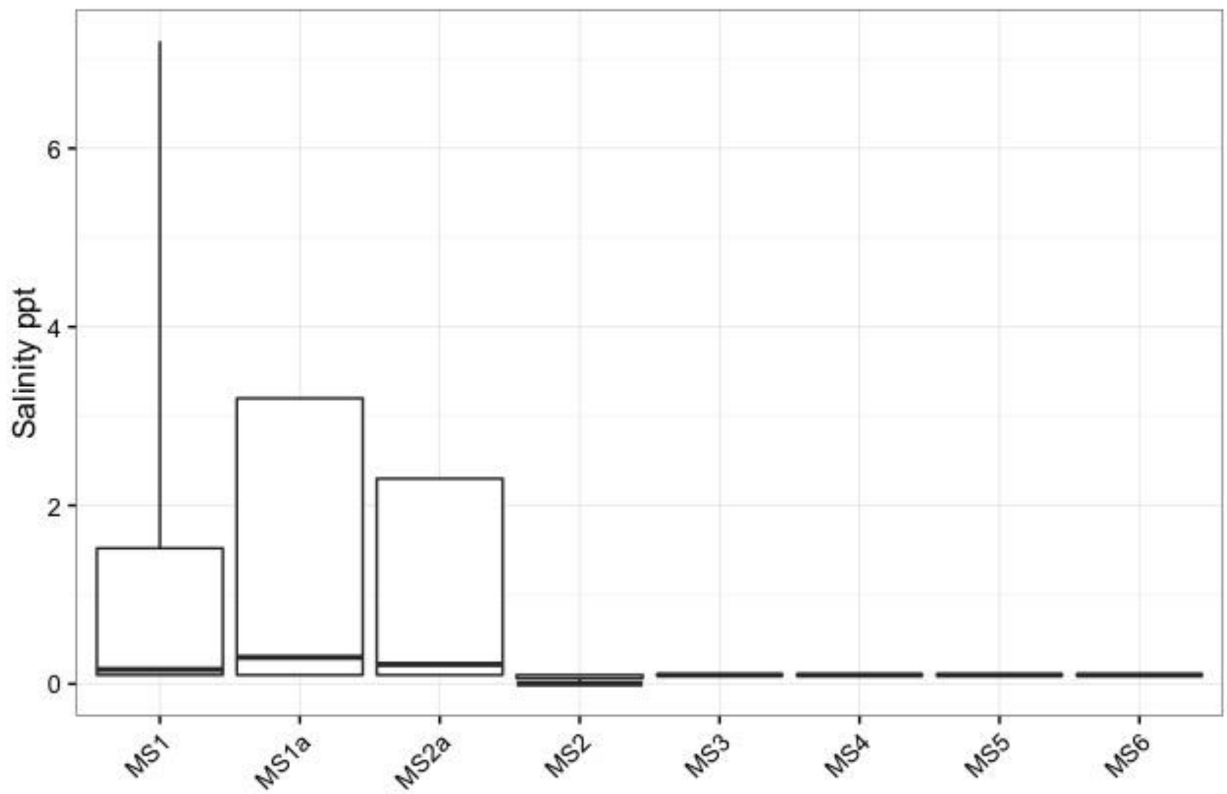
Meadowbrook Slough fecal coliform counts measured in colony-forming units per 100 ml sample at established segmented sampling sites. Regular-scheduled segmented sampling and follow-up sampling included. With this visualization, information on individual sample sites is lost. (N = 85).

Figure 23. Meadowbrook Slough Dates Segmented Sites Sampled and Fecal Coliform Levels.



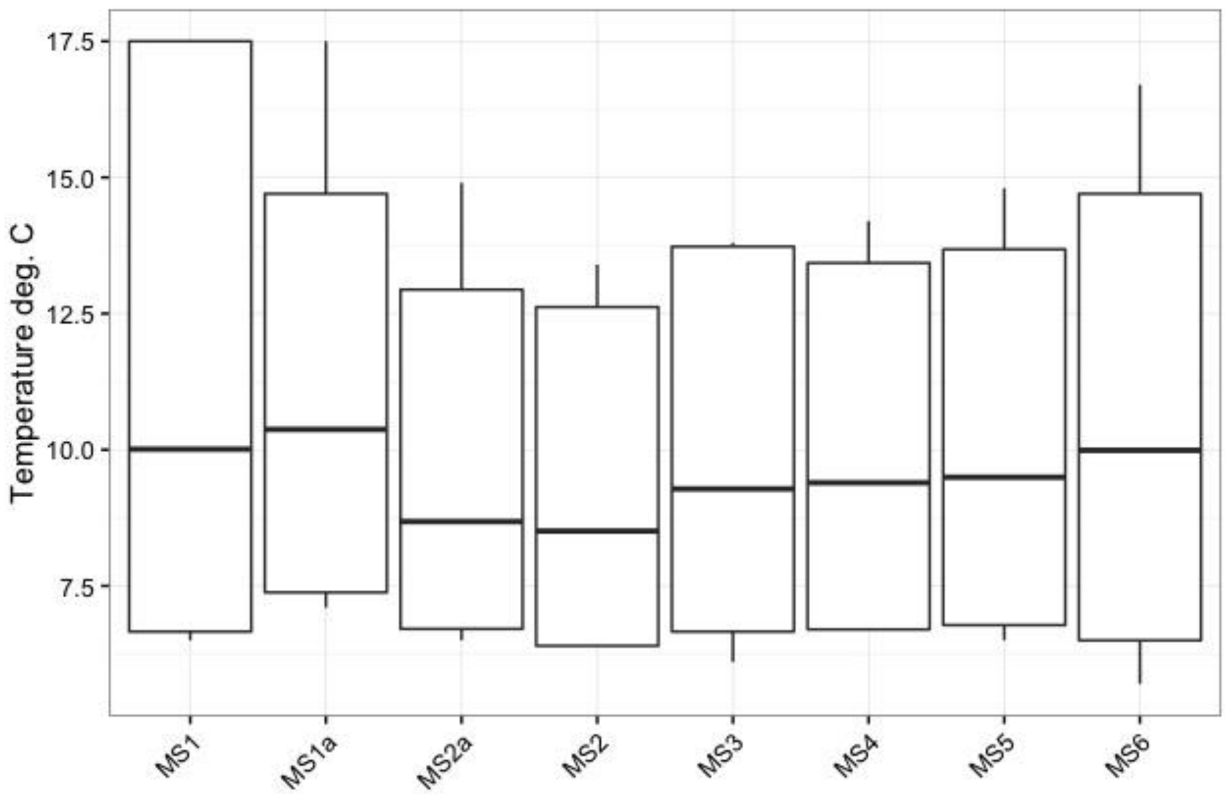
Meadowbrook Slough segmented samplings sites plotted vs. sampling date. Circle radii proportional to fecal coliform concentrations. Regular-scheduled segmented sampling and follow-up sampling included. (N = 85).

Figure 24. Summary of Meadowbrook Slough Segmented Sampling Salinity Data.



Summary of all Meadowbrook Slough salinity data collected from May 2015 through December 2017. Box and whisker plots denote 10th percentile, geometric mean, 90th percentile and minimum/maximum values. (MS1 N = 9, MS1a N = 8, MS2a N = 8, MS2 N = 7, MS3 N = 8, MS4 N = 8, MS5 N = 8, MS6 N = 5).

Figure 25. Summary of Meadowbrook Slough Segmented Sampling Temperature Data.



Summary of all Meadowbrook Slough temperature data collected from May 2015 through December 2017. Box and whisker plots denote 10th percentile, geometric mean, 90th percentile and minimum/maximum values. (MS1 N = 9, MS1a N = 8, MS2a N = 8, MS2 N = 7, MS3 N = 8, MS4 N = 8, MS5 N = 8, MS6 N = 5).

"Hot Spot" Investigation

Where heightened bacteria levels were found (generally over 50 fecal coliform CFU/100 ml) field teams made an effort to return for multiple sampling visits. At least three sequential measurements were needed to calculate the geometric mean of fecal coliforms and characterize a site as a "hot spot" for closer scrutiny. Ideally, sampling visits for the purpose of hot spot designation should occur in succession, each at least within 30 days apart (though this was not always possible given staff availability). If multiple hot spots were found, the following prioritization scheme was implemented: low priority—50 CFU/100 ml to 99 CFU/100 ml, medium priority—100 CFU/100 ml to 399 ml, high priority—greater than 400 CFU/100 ml.

Equation 1. Geometric Mean Calculation for the Purpose of Hot Spot Designation.

$$\sqrt[n]{sample_1 \times sample_2 \times \ldots \times sample_n}$$

For the purpose of classifying a segmented sampling site as a hot spot at least three sequential fecal coliform concentration measurements are needed. The geometric mean takes the n^{th} root of the product of *n* samples.

Table 2. Segmented Sampling Values Used for "Hot Spot" Designation.

Date	Site	Fecal Coliform CFU/100 ml
06/29/2015	GS08	2,760
10/1/2015	GS08	3,276
11/4/2015	GS08	4,080
06/29/2015	GS09	1,114
10/1/2015	GS09	1,432
11/4/2015	GS09	1,972
06/29/2015	GS14	959
10/1/2015	GS14	1,964
11/4/2015	GS14	1,328
4/4/2017	MS2	124
4/5/2017	MS2	1,010
4/6/2017	MS2	148
6/14/2017	MS1	118
6/26/2017	MS1	286
7/5/2017	MS1	102
6/14/2017	MS1a	80
6/26/2017	MS1a	246
7/5/2017	MS1a	28
6/14/2017	MS2a	325
6/26/2017	MS2a	468
7/5/2017	MS2a	128
6/14/2017	MS3	236
6/26/2017	MS3	168
7/5/2017	MS3	12
6/14/2017	MS4	360
6/26/2017	MS4	834
7/5/2017	MS4	2

Subset of segmented sampling data used for geometric mean calculations in order to classify hot spots.

Three hot spots were characterized in Golden Sands Slough in 2015. At least one observation was used in the below calculations that was excluded from the Golden Sands Slough Segmented Sampling graphics, above, as the field data sheet listed the sample site as a residential address that the authors struggled to interpret in late 2017.

Equation 2. Geometric Mean Calculation Used in Segmented Site GS08 Hot Spot Designation

$$\sqrt[3]{2{,}760 \times 3{,}279 \times 4080} \approx 3{,}329 \text{ CFU/100 ml}$$

Site GS08 in Golden Sands Slough was sampled for fecal coliforms on three successive occasions in 2015 resulting in a high priority hot spot designation.

Equation 3. Geometric Mean Calculation Used in Segmented Site GS09 Hot Spot Designation

$$\sqrt[3]{1{,}114 \times 1{,}432 \times 1{,}972} \approx 1{,}465 \text{ CFU/100 ml}$$

Site GS09 in Golden Sands Slough was sampled for fecal coliforms on three successive occasions in 2015 resulting in a high priority hot spot designation.

Equation 4. Geometric Mean Calculation Used in Segmented Site GS14 Hot Spot Designation

$$\sqrt[3]{959 \times 1{,}946 \times 1{,}328} \approx 1{,}357 \text{ CFU/100 ml}$$

Site GS14 in Golden Sands Slough was sampled for fecal coliforms on three successive occasions in 2015 resulting in a high priority hot spot designation.

The Following hot spots were characterized within Meadowbrook Slough in spring and summer of 2017.

Equation 5. Geometric Mean Calculation Used in Segmented Site MS2 Hot Spot Designation

$$\sqrt[3]{124 \times 1{,}010 \times 148} \approx 265 \text{ CFU/100 ml}$$

Site MS2 in Meadowbrook Slough was sampled for fecal coliforms on three successive days in April 2017 resulting in a medium priority hot spot designation.

Equation 6. Geometric Mean Calculation Used in Segmented Site MS1a Hot Spot Designation

$$\sqrt[3]{80 \times 246 \times 28} \approx 82 \text{ CFU/100 ml}$$

Site MS1a in Meadowbrook Slough was sampled for fecal coliforms on three days in late June and early July of 2017 resulting in a low priority hot spot designation.

Equation 7. Geometric Mean Calculation Used in Segmented Site MS1 Hot Spot Designation

$$\sqrt[3]{118 \times 286 \times 102} \approx 151 \text{ CFU/100 ml}$$

Site MS1 in Meadowbrook Slough was sampled for fecal coliforms on three days in late June and early July of 2017 resulting in a medium priority hot spot designation.

Equation 8. Geometric Mean Calculation Used in Segmented Site MS2a Hot Spot Designation

$$\sqrt[3]{325 \times 468 \times 128} \approx 269 \text{ CFU/100 ml}$$

Site MS1 in Meadowbrook Slough was sampled for fecal coliforms on three days in late June and early July of 2017 resulting in a medium priority hot spot designation.

Equation 9. Geometric Mean Calculation Used in Segmented Site MS3 Hot Spot Designation

$$\sqrt[3]{236 \times 168 \times 12} \approx 78 \text{ CFU/100 ml}$$

Site MS3 in Meadowbrook Slough was sampled for fecal coliforms on three days in late June and early July of 2017 resulting in a low priority hot spot designation.

Equation 10. Geometric Mean Calculation Used in Segmented Site MS4 Hot Spot Designation

$$\sqrt[3]{360 \times 834 \times 2} \approx 84 \text{ CFU/100 ml}$$

Site MS4 in Meadowbrook Slough was sampled for fecal coliforms on three days in late June and early July of 2017 resulting in a low priority hot spot designation.

Further Investigation Results

Dye-testing Investigations

Golden Sands Slough Dye Testing

In an effort to track down pollution sources in Golden Sands Slough, Clallam County Environmental Health asked for cooperation from homeowners immediately adjacent to the slough in three rounds of tracer dye testing.

Fluorescent tracer dyes were introduced to sinks, toilets, showers, and OSS components of participating homeowners. Charcoal packets were placed in the slough a week prior to tracer dye introduction, and were exchanged weekly through each round of testing (generally lasting 3-4 weeks). Charcoal packets were stored, isolated, in plastic baggies and chilled to retard growth of algae or other confounding biota. All collected charcoal packets were shipped on ice to Ozark Underground Laboratory in Protem, Missouri where they were analyzed for the presence of the fluorescent tracer dyes.

Figure 26. Fluorescent Dye Introduced in Golden Sands Septic System Diverter Valve.

Fluorescent dyes were used to explore connections between household plumbing and Golden Sands Slough. Dyes were introduced to water-consuming household fixtures such as sinks and toilets as well as available OSS components.

The dyes Rhodamine WT, Fluorescein, and Eosine were used at three residences adjacent to Golden Sands Slough the Week of August 11, 2015. The same three dyes were used in a second round of testing at three additional residences the week of August 25, 2015. Finally, Rhodamine WT and Fluorescein were used to test two final residences the week of September 15, 2015.

Though non-negligible amounts of Fluorescein and Eosine were detected in charcoal packets collected from the first round of Golden Sands Slough dye testing, Clallam County Environmental Health staff in consultation with Ozark Underground Laboratory chose to interpret the results as inconclusive given background fluorescence detected in charcoal packets placed in the slough and collected prior to the introduction of tracer dyes.

Meadowbrook Slough Dye Testing

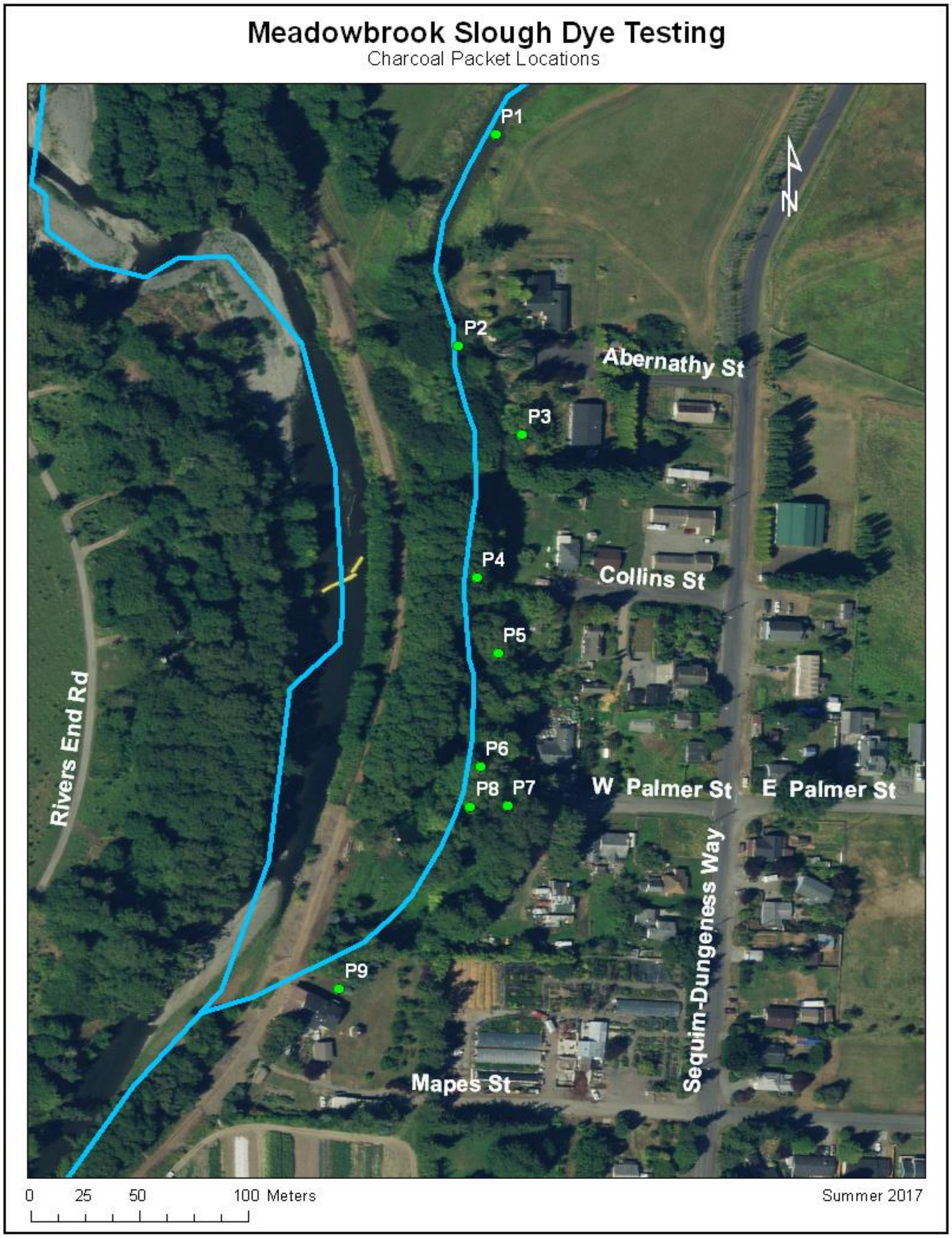
Similar fluorescent tracer dye testing was used in Meadowbrook Slough in the summer of 2017 after bacterial pollution was documented in the slough. Six households total were tested in two rounds of three households. These residences made up the entirety of the properties immediately adjacent to Meadowbrook Slough. Rhodamine WT, Fluorescein, and Eosine were used on July 19, 2017 and again on September 13, 2017.

Rhodamine WT introduced at a residence on Mapes Street on July 19, 2017 showed up in Meadowbrook Slough with a strong signal. Charcoal packets collected on August 9, 2017 contained amounts of Rhodamine WT many orders of magnitude above background levels.

Also of note, low yet non-negligible levels of Fluorescein were documented in Meadowbrook Slough through the dye testing process. In consultation with Ozark Underground Laboratory, Environmental Health staff interpreted the Fluorescein result as inconclusive, though Meadowbrook Slough neighbors were advised that antifreeze from vehicles can confound tracer dye testing efforts as antifreeze contains fluorescein.

Full dye testing certificates of analysis appear within the appendices, below.

Figure 27. Map of Charcoal Packet Placement for Meadowbrook Slough Tracer Dye Testing.



Charcoal packets were placed in Meadowbrook Slough a week prior to introducing fluorescent tracer dyes at households tested. Packets were exchanged weekly throughout the testing round, generally lasting four weeks. Packets collected from sites P3, P6, and P7 on August 9, 2017 contained Rhodamine WT introduced at a residence on Mapes Street on July 19, 2017.

Canine-Sniffing Study

Clallam County Environmental Health hired Environmental Canine Services (ECS) to conduct canine scent tracking as a qualitative screening method to identify potential sources of human wastewater. Environmental health opted for the "ship and sniff" method, as opposed to canine scenting at field sites, due to funding constraints. 500 ml water samples were taken in tandem with Trends sampling and Segmented sampling, and were shipped to ECS when fecal coliform results were greater than 50 fecal CFU/100 ml. 14 samples were sent from four different sample locations over three days, along with five field blanks and two lab blanks. Clallam County Environmental Health determined the results inconclusive due to the presence of false positives in multiple field blanks, and lab blanks. Other Local Health Organizations have had positive results from canine scent tracking in the past, but mainly used the "in-field" method, which consists of trained dogs present and working at a site of concern.

Optical Brighteners Study

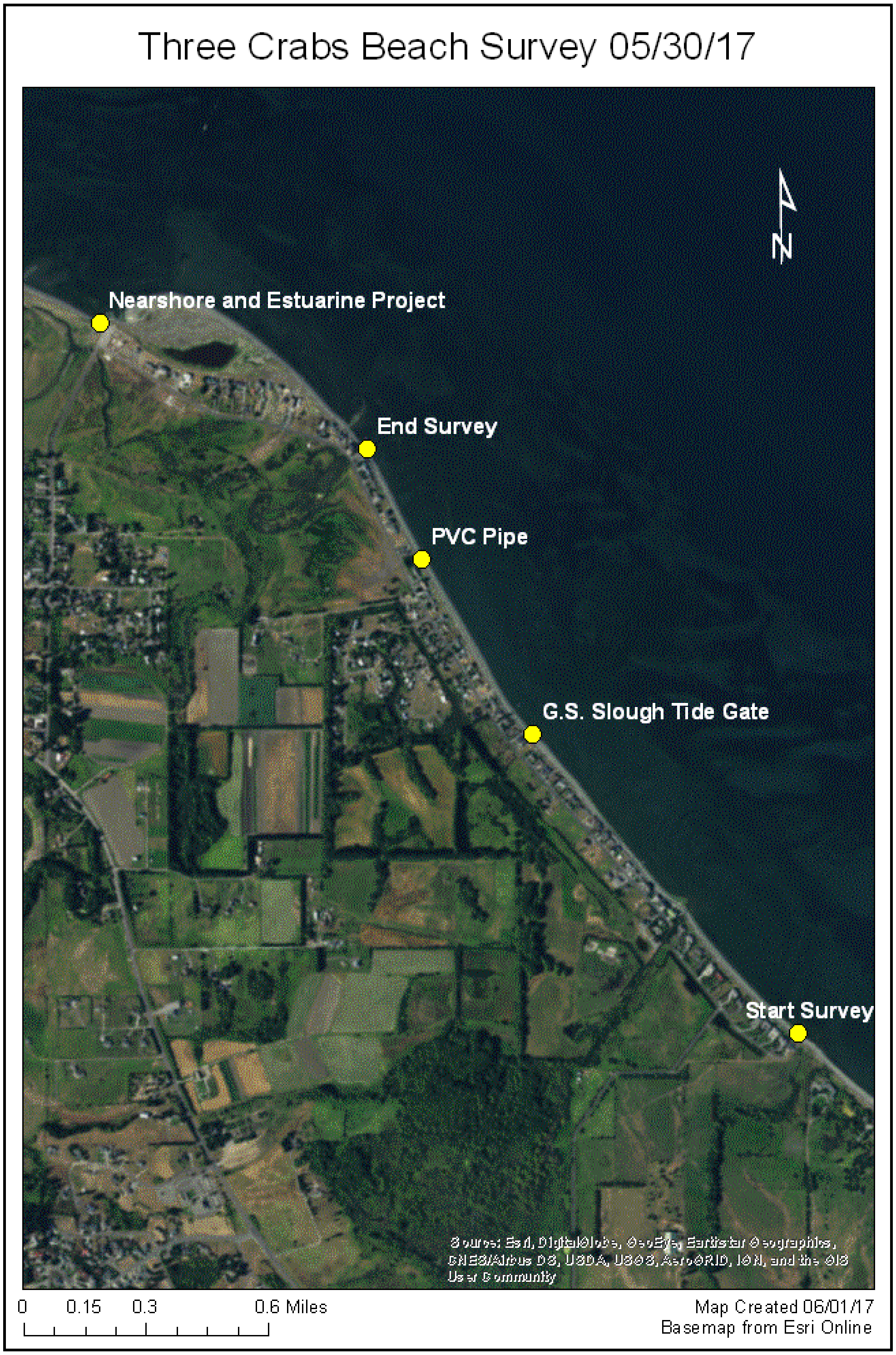
An optical brightener (OB) test was attempted in the Golden Sands Slough in December of 2016, but was compromised due to sub-freezing temperatures that allowed the slough to completely freeze over. The optical brightener pads were frozen in place for approximately four weeks, and the pads were significantly fouled upon extraction. The upside is that unconventional methods were established for an OB test in a brackish water body with tidal influence (as opposed to a traditional stream), and materials were generated for future OB tests if warranted.

Beach Survey

The 3-Crabs portion of the PIC focus area presented a unique challenge as a substantial number of homes occupy the marine shoreline, each with its individual onsite sewage system. On May 30, 2017 Clallam County Environmental Health conducted a shoreline survey to look for any potential sources of bacterial pollution. EH staff walked the shoreline at low tide, looking for any water seeping out of the beach face from which to collect a water sample.

During this beach survey no obvious seeps were observed and no water samples were collected. The Golden Sands Slough tide gate was observed and photographed. One apparent PVC apparatus was documented sticking out of the sand which turned out to be a remnant from a previous Jamestown S'Klallam Tribe environmental study. An electrical storm ended the beach survey just as EH staff reached the end of the walkable sand beach marked by shoreline armoring.

Figure 28. 3-Crabs Beach Survey Map.



Map of 3-Crabs Beach Survey conducted on May 30, 2017. Primary points of interest include the Golden Sands Slough tide gate and a PVC apparatus discovered in the sand. Survey of the sand beach ended where a rock-armored point begins.

Figure 29. Golden Sands Slough Tide Gate.

Point of discharge of Golden Sands Slough onto 3-Crabs beach observed during May 30, 2017 beach survey.

Figure 30. PVC Pipe on 3-Crabs Beach.

This apparent PVC apparatus discovered during May 30, 2017 beach survey turned out to be a remnant of a previous Jamestown S'Klallam Tribe environmental study.

Land Use/Parcel Analysis

Offsite Parcel Assessments

Within the 2015-2017 PIC Focus Area 909 unique parcels exist, according to County GIS data. Of these parcels, 224 were reviewed using available information such as aerial photos, tax records, land use classifications, building permits, and onsite sewage system records. This review assisted in the prioritization of efforts for further investigation as to influences upon waterways within the project area. In general, proximity to surface waters, type of land use, and factors such as septic systems without as-built drawings or regular inspections on file led to closer scrutiny.

Site Investigations/Parcel Surveys

Clallam County Environmental Health performed parcel surveys in particularly high-risk portions of the 2015-2017 PIC Focus Area, flagged by previous parcel analysis. This involved on-the-ground visits to the properties in question—especially those adjacent to Meadowbrook and Golden Sands Sloughs, where ongoing bacterial water pollution concerns had been documented. EH staff, using a PIC Survey Form developed by project partners as part of the PIC Plan, evaluated aspects of each property that could potentially impact waters of the project area. Specifically, evaluators considered: 1) storm water/run-off from impervious surfaces, 2) any pet/animal waste present, 3) sewage disposal methods, and 4) any other factors that could lead to water pollution. Through this process, 13 onsite sewage problems were identified.

Corrections Made

BMPs Implemented

Residential land uses prevail immediately adjacent to waterways within the 2015-2017 PIC Focus Area. Animal-keeping operations are less prevalent, especially in close proximity to the most impaired surface waters. As such, no livestock or animal-keeping operation referrals were made to Clallam Conservation District or Washington Department of Ecology. No best management practices were implemented on working farms and no enforcement was initiated with any farms.

Inspections

Regular Operation and Maintenance (O&M) inspections serve as an important tool to uncover failing onsite sewage systems and prevent failures. This rings especially true for the 2015-2017 PIC Focus Area. Clallam County Environmental Health developed an enforcement protocol, with guidance from the County Prosecuting Attorney’s Office, in order to cause regular inspections to happen.

Initially, this inspection enforcement protocol was implemented with a limited group of 14 property owners adjacent to Meadowbrook Slough. By the end of the project period, only four of the initial 14 property owners contacted still require septic inspections and administrative penalties have been applied. Environmental Health will pursue compliance with these four remaining property owners until septic inspections occur. Ultimately, this process was directly responsible for uncovering, in December 2017, a non-permitted drain field discharging effluent directly into groundwater that feeds Meadowbrook Slough.

Given the process established through Meadowbrook Slough septic inspection compliance efforts, EH staff applied the same model to a new, larger cohort of property owners on 3-Crabs road where onsite sewage systems abut sensitive marine shoreline. A compliance timeline was started with 37 property owners on November 1, 2017. Some of these property owners have come into compliance and the timeline will have to continue past the end of the 2015-2017 PIC Project. In early 2018 21 property owners will likely receive notices of violation outlining when administrative penalties will start to accrue. Through this process at least one septic system requiring repair was discovered.

Upgrades

Of the above-mentioned 13 onsite sewage system problems identified through the 2015-2017 PIC Program, three upgrades to conforming septic systems were implemented. In two instances, Clallam Conservation District was able to fund a portion of design and installation through a cost share program. This meant two property owners were able to move from non-permitted sewage storage/disposal methods to conforming septic systems. A third homeowner had the means to pay for design and installation of a septic system, and was able to upgrade to a conforming system without financial assistance.

In various other instances, measures were put in place to mitigate potentially harmful sewage storage and disposal practices. For example, use of multiple in-ground storage tanks, above-ground storage tanks, and portable toilets was discontinued. At least two in-ground sewage storage tanks were excavated and filled with crushed rock and one portable toilet was removed. Owners of recreational vehicles with onboard holding tanks and claiming only temporary residence were instructed to use valid RV dump stations for disposal. At least one recreational vehicle owner with non-permitted structures preventing transport to a suitable dump station entered into a service contract with a licensed septage pumper/transporter.

Evaluation/Discussion

Interpretation of Water Quality Results

Trends Discussion

Over the course of this study we see Bell Creek, Golden Sands Slough, Lotzgesell Creek, Matriotti Creek, and Meadowbrook Slough stand out among the Tier 1 streams in terms of highest fecal coliform concentrations measured, 90^{th} percentile of fecal coliform concentrations, and geometric mean of fecal coliform concentrations (figure 10).

Very generally, these relative comparisons support the Clean Water Work Group's decision to give specific attention to a PIC Focus Area including Golden Sands Slough and Meadowbrook Slough (Meadowbrook Creek sits between these two waterways and was included in the 2015-2017 PIC Focus Area by virtue of its geographic location). Ultimately, selection of the 2015-2017 PIC Focus area took into account: 1) available data, 2) scope/logistic feasibility, 3) direct connection to desired benefits (proximity to marine waters impacted by shellfish bed downgrades).

Ultimately, Dungeness Bay water quality likely stood to benefit most readily from cleanup efforts concentrated in the PIC focus area before addressing other waterways in need of attention such as Bell Creek, Lotzgesell Creek, and Matriotti Creek. Similarly, Agnew Ditch stood out for elevated fecal coliform concentrations among the Tier 2 streams (Figure 11) and should receive cleanup efforts though it didn't fit nicely within a single manageable 2015-2017 PIC Focus Area.

PIC Baseline Trends Monitoring aims to gain a picture of Clean Water District streams at their points of discharge into receiving waters. Ideally, the project aims to describe the physical and chemical properties of upland contributors impacting receiving waters. In Figure 12 we see various Baseline Trends Monitoring sites exhibit (at least occasionally) high salinity. Sample sites on Cooper Creek, Golden Sands Slough, Meadowbrook Slough, Meadowbrook Creek, and Sequim Bay State park vary greatly in salinity. This tells us we likely have marine water influence at these Trends sites and our observations here do not always relate solely to upland influence. At Sequim Bay State Park, in particular, this has become a recent (2017) phenomenon as very low stream flows have been observed during the dry months and measurements collected during these periods likely represent an outsized influence of Sequim Bay marine water.

Water temperature (Figure 13) seems to vary at all Baseline Trends Monitoring sites and we don't often observe excessive temperatures (generally not exceeding 16 deg. C, the Washington State 7-day average of daily maxima for salmonid core summer habitat). Anecdotally, Golden Sands Slough was observed to have frozen at least once during the project period and we see extreme lows approaching 0 deg. C in some waterways at least once during the project period.

Baseline Trends Monitoring Program Annual Reports (Streamkeepers 2017, Streamkeepers In Press) review all chemical and physical Trends data in depth and provide further analysis of year-over-year changes in Clean Water District waterways.

Segmented Discussion

Golden Sands Slough

Quickly glancing at Golden Sands Slough segmented sampling results (Figure 14) we immediately see a striking feature: bacteria concentrations repeatedly measured on the order of multiple thousands of colony-forming units per 100 ml sample in 2015. During this period Clallam County Environmental Health received various calls to investigate apparent sewage plumes in the slough. On-the-ground observations coupled with the extremely high levels of fecal coliforms measured in the slough support the hypothesis that observed plumes likely originated from illicit wastewater discharges. 4,080 fecal coliform CFU/100 ml were counted at segmented sampling site GS08 on November 4, 2015 (in reality this number is an estimate, likely lower than the actual value, as the colonies were too numerous to count)!

Moving into 2016 the high levels of fecal coliforms in Golden Sands Slough seemed to taper off somewhat. Follow-up sampling in the second half of 2017 following various pollution correction measures shows a drop to fecal coliform concentrations measured on the order of multiple hundreds of colony-forming units per 100 ml sample. On September 5, 2017 506 CFU/100 ml were measured from segmented sampling site GS07. It would appear water quality has improved significantly in Golden Sands Slough since the initiation of the 2015-2017 PIC Project though bacteria levels are still not ideal and require further improvements.

One possible explanation for the decrease in Golden Sands Slough bacteria levels includes cessation of illicit wastewater discharges due to increased presence of PIC Project Partners in the PIC Focus Area coupled with increased awareness/interest of residents within the Golden Sands neighborhood.

Figure 15 allows us to compare relative fecal coliform concentrations against segmented sampling sites and sampling date. Again, we see a relative decrease in bacteria levels from those regularly observed in 2015. Further we can see that results from site GS01 (equivalent to Baseline Trends Monitoring site Golden Sands Slough 0.0) do not tell the whole story of the slough: while the entire slough seems to have marine water influence (Figure 16), site GS01 may significantly underestimate bacteria levels within the rest of the slough.

Meadowbrook Creek

Meadowbrook Creek received significantly less attention than nearby Meadowbrook and Golden Sands Slough, in terms of segmented water quality sampling and investigations throughout the 2015-2017 PIC Project period, due primarily to the relatively low levels of bacteria measured in this waterway.

Figures 18 and 19 show an absolute single highest value of 152 CFU/100 ml measured at segmented sample site MC4 on October 6, 2017. Within this waterway no hot spots were designated. Meadowbrook Creek does probably represent a more traditional stream than other waterways within the 2015-2017 PIC Focus Area in that it fits the mold of a low gradient, lowland stream with directional flow draining upland areas. Only sites MC1 and MC2 show potential marine water influence (Figure 20), hence, sampling results obtained from Meadowbrook Creek sampling sites probably better represent stream conditions than marine water conditions.

Meadowbrook Slough

Similar to Golden Sands Slough, Meadowbrook Slough showed elevated fecal coliform concentrations and multiple hot spots were discovered within the waterway (Figures 22 and 23). Meadowbrook Slough water originates in the Dungeness River and passes through a gate in the river levee just above segmented sampling site MS6 (Figure 9). Figure 23 illustrates the relatively low bacteria levels consistently observed at Site MS6. Downgradient, sites MS1 through MS5 showed concerning bacteria levels at times with a highest single value of 1,010 CFU/100 ml collected at site MS2 on April 5, 2017.

Figure 22 underscores the intermittent nature of bacteria levels observed in Meadowbrook Slough. In December 2017 it was finally discovered that a septic system had been installed by a property owner without a permit adjacent to Meadowbrook Slough. This same property had been flagged by tracer dye testing which demonstrated a connection between wastewater originating from the property and Meadowbrook Slough. The bacteria levels displayed in Figures 22 and 23 may follow a pattern of untreated effluent pulses arriving in the slough from the problematic septic system in question.

Within Meadowbrook Slough, marine water influence likely does not extend “upstream” beyond site MS2a (Figure 24).

Hot Spot Calculations

Segmented sampling sites GS08, GS09, and GS14 were officially designated as hotspots in Golden Sands Slough while sites MS1, MS1a, MS2a, MS2, MS3, and MS4 were designated as hotspots in Meadowbrook Slough.

While project partners attempted to follow the PIC Plan as closely as possible, staffing limitations prevented follow-up visits to the waterways in question, on occasion. As such, hotspot designation may appear somewhat arbitrary: site MS5, for example, showed very troubling fecal coliform concentrations on August 16, 2016 (966 CFU/100 ml) though no sequential follow-up measurements are available for the purposes of characterizing a hot spot. During the summer of 2016 project partners focused much time and effort on the Golden Sands Slough with its multiple hot spots and many issues requiring correction. More staff time and resources were freed up, starting in April of 2017 for the Meadowbrook Slough campaign. At this time more of the segmented sampling sites earned hot spot designation as more information was available regarding environmental conditions within the slough.

Both Golden Sands Slough and Meadowbrook Slough feature multiple residences distributed closely around a relatively small waterway. Further, these water bodies do not always display directional flow associated with the traditional idea of a stream the drains upland areas and discharges into receiving waters below. Golden Sands Slough, especially, tends to behave as a mass of water that occasionally moves out toward the Strait of Juan de Fuca through a tide gate on 3-Crabs Beach. Other times, the slough fills with marine water as evidenced by the high salinity measurements collected through segmented sampling. Anecdotal observations of ostensible sewage plumes within Golden Sands slough further support the characterization of the slough as a mass of water that occasionally stagnate and does not “flush” downgradient.

For these reasons the number and location of individual hotspots in Golden Sands Slough and Meadowbrook Slough may not provide much benefit in directing further investigative efforts. Thus far, a single failing septic system seems to produce intermittent hotspots within Meadowbrook Slough and the location of this failure was not determined until after all households adjacent to the slough had been subjected to tracer dye testing. As such the presence of elevated fecal coliform levels within a waterbody such as Golden Sands Slough or Meadowbrook Slough probably warrants close scrutiny of all the properties immediately adjacent and the particular location and number of official hotspots likely offer only limited additional clues as to the provenance of contaminants.

Tracer Dye Testing

Tracer dye testing proved a valuable tool in bringing a likely failing septic system to light in Meadowbrook Slough. Here, a positive connection was shown between household fixtures and the waterway and effluent from the household in question likely does not receive proper treatment before reaching the waterway. In this instance the fluorescent dye Rhodamine WT was measured in Meadowbrook Slough at many orders of magnitude above background levels—a strong signal of a hydraulic connection between a household’s wastewater system and the slough.

The use of tracer dyes in Golden Sands Slough proved less valuable. Here, while positive results were measured at very low levels, staff consulted with Ozark Underground Laboratory and made the decision to interpret the results as inconclusive given background fluorescence levels.

Inspection Enforcement

Often times within the 2015-2017 PIC Focus Area septic inspection requirement enforcement helped uncover problems and complemented investigative efforts. In Meadowbrook Slough, for example, high bacteria levels were documented in the slough, tracer dye testing had shown a positive hydraulic connection between one household and the waterway, and still project partners did not have confirmation of a septic system failure from a licensed Operations and Maintenance (O&M) Provider. Clallam County Environmental Health had to initiate an enforcement timeline, developed in conjunction with the County Prosecuting Attorney’s Office, and moved as far as applying administrative penalties before the property owner finally acknowledged contact and came to the table to discuss a repair permit for a non-permitted septic system.

Similarly, septic inspection requirement enforcement became important on 3-Crabs Road where compliance timelines were started with 28 property owners in December 2017 (following a series for friendly reminder letters and various other forms of correspondence). In early 2018 21 property owners will likely receive notice of violation letters after which administrative penalties will start to accrue. So far this process has uncovered various septic problems adjacent to the marine shoreline that otherwise would not have been discovered through beach surveys alone.

Septic system inspections have also helped to rule out particular conforming systems as contributors to bacterial pollution in the Golden Sands Slough neighborhood. In this area, may non-conforming sewage holding and/or disposal methods prevail and most needed corrections involve moving away from non-permitted holding tanks, direct discharge of greywater, and other non-conforming forms of sewage treatment.

Corrections Discussion

Within the 2015-2017 PIC Focus Area technical assistance to farmers and implementation of best management practices in agricultural operations played a negligible role in pollution correction efforts. Here, residential land uses prevail immediately adjacent to the waterways studied. Further, small lot sizes around Golden Sands Slough and Meadowbrook Slough make for higher density residential areas than in the much of the rest of rural Clallam County.

Small lot sizes compounded with financial resources of property owners placed significant barriers in the way of many needed pollution correction efforts within the project area. Where non-conforming sewage disposal methods are employed by property owners, physical limitations can place significant constraints on the type of conforming onsite sewage system available as a solution. Further, financial means of property owners can place possible pollution correction solutions out of reach without significant assistance.

Craft 3 Clean Water Loans and cost share assistance provided by Clallam Conservation District made various pollution correction measures in the form of upgrades to conforming onsite sewage systems possible. With the design and installation of conforming OSS, non-permitted sewage holding tanks were removed, non-permitted transport of septage was eliminated, direct greywater discharges into the environment were stopped, and do-it-yourself solutions to sewage conveyance and storage were reduced.

In many cases pollution correction is not possible without the above forms of financial assistance.

Much work remains in the 2015-2017 PIC Focus Area as many pollution corrections are still needed. One non-permitted septic system in the Meadowbrook Slough area, discovered in December 2017, requires repair and permits have been filed with Clallam County. Various non-conforming sewage treatment systems in the Golden Sands Slough neighborhood require upgrade and these projects have been put on hold as cost share assistance from Clallam Conservation District disappeared when the Washington State Legislature failed to pass a capital budget in summer 2017.

Two Golden Sands Slough neighborhood conforming OSS upgrade projects slated for 2017 were put on hold due to the lack of a State Capital Budget. These two projects alone would 1) stop non-permitted transport of septage, 2) cease multiple instances of direct greywater discharge into the environment, 3) remove at least two in-ground sewage holding tanks of questionable integrity, 4) remove at least one above-ground sewage holding tank of questionable integrity, 5) provide a permanent solution in place of temporarily using a recreational vehicle’s onboard sewage holding tank.

Follow-Up/Next Steps

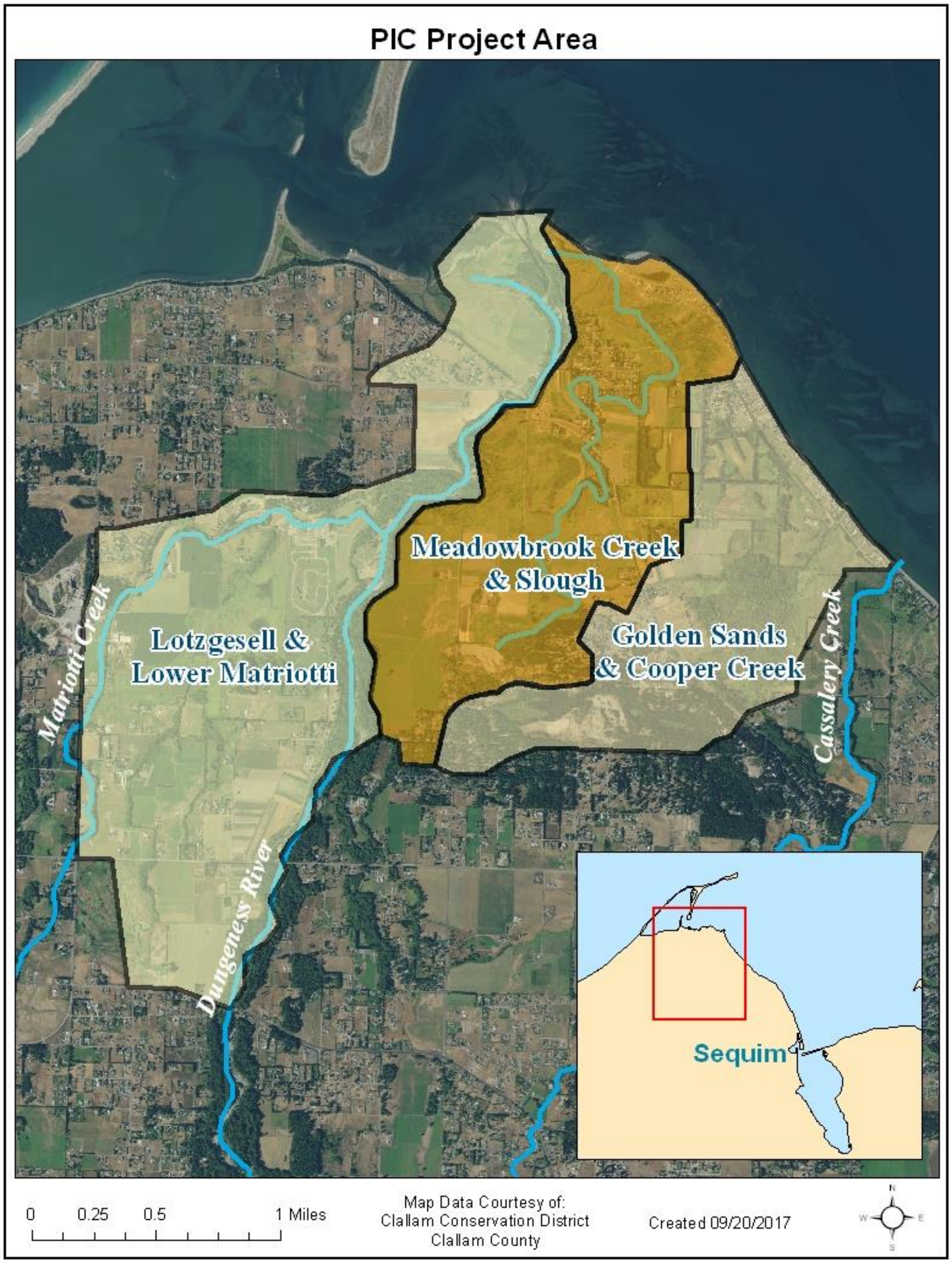
Moving forward, compliance efforts will need to continue in the 2015-2017 PIC Focus Area to bring about needed pollution corrections. Specific actions still needed include:

1) Clallam County Environmental Health will continue septic inspection compliance timelines begun in the 3-Crabs Beach area (21 notices of violation scheduled for certified mail in early 2018);
2) Clallam County Environmental Health will follow up with administrative penalties applied in four instances where property owners in the Meadowbrook Slough neighborhood neglected septic inspection compliance timelines;
3) One non-permitted, likely failing septic system in Meadowbrook Slough neighborhood requires repair—repair permit application filed with Clallam County;
4) Clallam County Environmental Health will pursue upgrades to conforming OSS in Golden Sands Slough neighborhood (upgrades generally contingent upon cost-share assistance from Clallam Conservation District and a Washington State capital budget);
5) Regular Baseline Trends Monitoring will continue on Clean Water District Streams to guide Clean Water Work Group decisions on where to focus future pollution correction efforts.

Further segmented water quality sampling is not planned for the 2015-2017 PIC Focus Area, though follow-up water quality sampling will likely occur as any eventual pollution correction efforts are completed.

A new, 2017-2019 PIC Focus Area, selected by the Clean Water Work Group, including large portions of Matriotti and Lotzgesell Creeks, is beginning an investigative phase under a new round of funding from Washington State Department of Health. Here, segmented water quality sampling will be used to root out sections of Matriotti and Lotzgesell Creeks in need of remediation due to bacterial pollution. A cursory review of the new focus area indicates greater prevalence of agricultural and animal-keeping practices within the watershed.

Figure 31. 2015-2017 and 2017-2019 PIC Focus Areas.



Expanded PIC Focus Area. Meadowbrook Slough, Meadowbrook Creek, and Golden Sands Slough make up primary waterways studied from 2015-2017. Matriotti and Lotzgesell Creeks slated for investigative water quality study from 2017-2019. Pollution correction measures will likely need to continue in the original 2015-2017 PIC Focus Area.

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Baseline Trends Monitoring Data

SITE = Trends Sampling Site
DATE = Date of Visit
NH3N = Ammonia as Nitrogen in µg/L
BARO. = Barometric Pressure in Hg
DO = Dissolved Oxygen in mg/L
DO %SAT. = Dissolved Oxygen %Local
FECAL = Fecal Coliforms in CFU/100 ml sample
FLOW = Discharge in Cubic Feet per Second
NO3N = Nitrate as Nitrogen in µg/L
NO2N = Nitrite as Nitrogen in µg/L
pH = pH
P = Phosphate as Phosphorous in µg/L
SALINITY = Salinity in PSU (ppt)
Si = Silicate as Silicon in µg/L /L
SpC = Specific Conductivity (at 25 deg. C)
STAGE = Stream or River Stage in Feet
TEMP. = Water Temperature in deg. C
TPN = Total Persulfate Nitrogen in µg/L /L
TPP = Total Persulfate Phosphorous in µg/L
TURBIDITY = Turbidity in FNU

SITE	DATE	NH3 N	BARO.	DO	DO %SAT.	FECAL	FLOW	NO3 N	NO2 N	pH	P	SALINITY	Si	SpC	STAGE	TEMP.	TPN	TPP	TURBIDITY
Agnew Creek/Ditch 0.3	11/24/2015		29.87	11.9		623				7.8		0.11		231	0.57	6.5			37
Agnew Creek/Ditch 0.3	1/26/2016					135						0.10		225	0.64	6.6			
Agnew Creek/Ditch 0.3	4/12/2016		29.90	12.4		28				8.7		0.11		235	0.25	11.8			5
Agnew Creek/Ditch 0.3	8/16/2016		29.96	9.6		87				8.0		0.10		176	0.42	17.3			4
Agnew Creek/Ditch 0.3	11/15/2016		29.65	11.4	101	101				8.1		0.12		247	0.25	9.7			5
Agnew Creek/Ditch 0.3	1/10/2017		29.55	13.4	99	47				8.0		0.13		269	0.22	2.3			14
Agnew Creek/Ditch 0.3	4/18/2017		29.79	12.8	116	44				8.6		0.10		183	-0.32	10.5			5
Agnew Creek/Ditch 0.3	8/15/2017		29.85	9.8	95	47				7.9		0.10		148	0.46	14.1			4
Agnew Creek/Ditch 0.3	11/14/2017		29.71	11.3	93	23				7.9		0.10		257	0.28	6.8			7
Bagley 0.7a	11/24/2015		29.89	12.6		346				7.6		0.04		94		5.5			66
Bagley 0.7a	1/26/2016					4						0.10		114	-12.36	5.9			
Bagley 0.7a	4/12/2016		29.94	11.1		14				7.9		0.09		189	-12.52	9.3			2
Bagley 0.7a	8/16/2016		29.96	9.9	99	62				7.9		0.10		246	-12.13	13.5			1
Bagley 0.7a	11/15/2016		29.67	11.0	96	3				8.0		0.10		209	-12.40	8.9			2
Bagley 0.7a	1/10/2017		29.55	13.6	99	16				7.8		0.10		210	-12.41	1.7			10
Bagley 0.7a	4/18/2017		29.83	11.1	98	2				8.0		0.10		147	-12.40	9.7			5
Bagley 0.7a	8/15/2017		29.86	10.3	96	12				8.0		0.10		250	-12.60	12.0			1
Bagley 0.7a	11/14/2017		29.70	12.1	100	40				7.7		0.10		119	-12.08	6.6			16
Bell 0.2	5/12/2015					182						0.20			0.94	12.1			
Bell 0.2	8/13/2015					4						0.20			0.96	14.8			
Bell 0.2	10/8/2015	7.4	30.11	9.8		136		2524.2	3.4	8.0	50.8	0.21	8534.3	444	1.00	12.4	3888.3	108.7	5

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SITE	DATE	NH3 N	BARO.	DO	DO %SAT.	FECAL	FLOW	NO3 N	NO2 N	pH	P	SALINITY	Si	SpC	STAGE	TEMP.	TPN	TPP	TURBIDITY
Bell 0.2	11/23/2015	25.0	29.86	11.2		14		4751.6	11.1	7.9	116.9	0.24	11589.1	505	1.10	6.6	6298.6	139.4	3
Bell 0.2	12/17/2015	24.2	29.70	11.6		18		2390.2	8.0	7.7	109.2	0.17	11077.5	361	1.52	6.0	4637.3	138.7	5
Bell 0.2	1/25/2016	25.5				132		2537.9	13.2		93.2	0.20	9408.5	377	1.30	5.8	4526.3	122.9	
Bell 0.2	2/17/2016	128.6	29.40	11.0		1000		1759.6	23.4	7.5	105.4	0.13	8416.1	372	1.54	8.2	3693.5	193.9	9
Bell 0.2	3/15/2016	82.5	30.20	11.8		102		1272.1	11.7	7.5	90.2	0.16	10468.7	343	1.52	6.6	3545.1	135.3	7
Bell 0.2	4/11/2016	10.2	30.13	11.2		23		3336.8	7.0	8.1	89.7	0.22	7801.4	460	1.00	10.3	4810.7	100.4	4
Bell 0.2	5/17/2016	12.7	30.30	10.4		40		3173.5	5.9	8.1	211.7	0.21	8124.7	440	0.92	10.9	3159.4	213.9	4
Bell 0.2	6/21/2016	14.7	30.30	9.8		70		3476.5	6.3	7.9	163.8	0.22	8889.6	454	0.46	12.4	4882.4	201.6	4
Bell 0.2	7/19/2016	36.4	30.10	8.9		888		3912.4	14.2	7.8	168.3	0.23	9169.8	466	0.76	14.1	5066.3	194.0	4
Bell 0.2	8/15/2016	9.9	30.09	9.4		54		3272.2	4.9	8.0	89.5	0.20	8564.0	435	0.88	14.0	4143.1	109.6	2
Bell 0.2	9/20/2016	11.5	30.17	10.3		20		3460.5	4.4	8.0	53.4	0.22	9116.2	457	1.00	11.4	4451.5	97.4	2
Bell 0.2	10/18/2016	10.4	29.98	10.1	91	2		2301.8	6.7	7.9	77.3	0.20	9305.0	481	1.06	10.4	4060.6	122.3	1
Bell 0.2	11/14/2016	19.8	30.04	10.1	90	2		2790.2	5.7	7.8	89.2	0.22	9212.3	464	1.06	10.3	4653.1	69.4	1
Bell 0.2	12/13/2016	17.6	30.33	12.1	94	36		3500.2	8.2	8.2	125.6	0.20	9049.9	488	1.04	5.4	5374.7	169.7	4
Bell 0.2	1/9/2017	19.4	29.60	12.0	94	6		1947.5	14.4	7.9	83.0	0.20	4341.6	492	1.04	4.6	4967.2	130.4	2
Bell 0.2	2/14/2017	26.0	30.01	12.6	96	10		4032.6	10.2	8.0	83.0	0.20	18025.0	452	1.14	4.0	4609.3	142.5	4
Bell 0.2	3/14/2017	9.1	29.68	11.1	95	6		1986.1	6.8	7.8	54.7	0.20	7287.4	398	1.39	7.9	2548.2	92.9	4
Bell 0.2	4/17/2017	8.3	29.81	11.0	97	4		2088.5	4.7	8.0	58.5	0.20	8410.7	404	1.24	9.7	4001.0	103.7	3
Bell 0.2	5/9/2017	10.2	30.08	11.2	98	18		3169.3	5.2	8.1	123.3	0.20	8674.8	458	0.98	9.7	4096.9	180.5	3
Bell 0.2	6/13/2017	13.4		9.9	91	42		3461.2	6.9	8.0	323.3	0.20	8521.6	493	0.78	11.9	5181.2	391.8	6
Bell 0.2	7/18/2017	19.2	30.03	9.3	88	56		4516.2	7.2	7.9	650.1	0.20	8779.3	502	0.68	13.1	7072.2	788.7	5
Bell 0.2	8/14/2017	7.6	30.02	9.7	92	52		3381.1	4.7	8.2	419.6	0.20	7747.8	437	1.04	13.1	5105.7	600.3	4
Bell 0.2	9/19/2017	8.9	29.73	10.4	95	48		3531.3	4.7	8.2	225.3	0.20	9237.9	473	1.00	10.9	5070.4	390.5	4
Bell 0.2	10/10/2017	6.7	29.87	10.8	95	23		3243.5	3.6	8.4	465.6	0.20	8917.4	475	1.04	9.8	4755.1	636.6	4
Bell 0.2	11/13/2017		29.60	10.3	89	81						0.20		430	1.28	8.8			7
Bell 0.2	12/12/2017		30.48	12.0	94	3						0.20		487	1.06	5.8			2
Cassalery 0.0	5/12/2015	14.7				4		1184.4	3.7		13.8	0.30	6202.1			12.5	1692.7	26.6	
Cassalery 0.0	6/11/2015	22.5				2	2.0	1315.9	3.6		17.1	0.40	480.7			12.9	1692.7	28.2	
Cassalery 0.0	7/7/2015	18.6				2	2.0	1191.4	3.1		13.7	0.50	6320.6			15.0	2057.2	28.5	
Cassalery 0.0	8/13/2015	11.5						1250.5	3.1		8.5		8609.6				1719.4	18.7	

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SITE	DATE	NH3 N	BARO.	DO	DO %SAT.	FECAL	FLOW	NO3 N	NO2 N	pH	P	SALINITY	Si	SpC	STAGE	TEMP.	TPN	TPP	TURBIDITY
Cassalery 0.0	1/25/2016																		
Cassalery 0.0	4/11/2016	52.1	30.15	9.9		310	6.1	1561.7	9.5	7.8	28.1	0.76	6192.9	1495		11.6	2397.5	46.1	6
Cassalery 0.0	5/17/2016	14.1	30.32	10.0		30	4.6	1969.4	5.2	8.0	14.4	0.20	6700.4	404		11.7	2561.2	70.6	6
Cassalery 0.0	6/21/2016	25.1	30.32	9.7		26		1744.9	4.1	7.9	16.9	0.22	6473.7	456		12.8	2307.4	28.2	2
Cassalery 0.0	7/19/2016	15.9	30.11	6.6		16		1608.5	3.5	7.9	13.8	0.51	6383.3	1019		14.9	2079.4	24.2	2
Cassalery 0.0	8/15/2016	9.7	30.11	9.3		92		1337.2	2.0	7.9	9.8	0.10	5896.7	263		14.5	1779.0	20.1	2
Cassalery 0.0	9/20/2016	16.3	30.17	9.9		34		1273.1	1.7	7.9	10.2	0.36	6204.3	722		11.9	1697.0	21.7	2
Cassalery 0.0	10/18/2016																		
Cassalery 0.0	11/14/2016																		
Cassalery 0.0	12/13/2016																		
Cassalery 0.0	1/9/2017																		
Cassalery 0.0	2/14/2017	171.0	30.02	11.7	92	14		980.7	7.4	7.7	18.4	1.50	12400.9	2840	-3.05	4.8	1539.4	75.6	11
Cassalery 0.0	3/14/2017	31.5	29.72	10.4	92	122		827.8	6.9	7.7	30.4	1.04	5874.1	2030		9.3	1744.9	100.4	7
Cassalery 0.0	4/17/2017	46.6	29.81	10.0	91	10		831.4	5.3	7.8	33.4	0.60	7253.4	1160	-2.77	10.7	2010.6	85.5	5
Cassalery 0.0	5/9/2017	18.2	30.09	10.6	94	2		941.8	3.0	8.1	17.8	0.20	7972.1	388	-2.56	10.3	1284.8	50.5	4
Cassalery 0.0	6/13/2017	17.3		9.8	92	30		889.9	3.4	8.0	16.7	0.20	6337.7	467		12.6	1117.1	55.9	4
Cassalery 0.0	7/18/2017	27.3	30.04	9.5	92	4		906.9	2.9	8.1	17.6		7546.0	938	4.10	14.1	1450.5	42.4	2
Cassalery 0.0	8/14/2017																		
Cassalery 0.0	9/19/2017	14.7	29.75	10.1	93	62		945.3	1.8	8.0	10.2	0.30	6364.4	558		11.2	1345.6	32.9	3
Cassalery 0.0	10/10/2017																		
Cassalery 0.0	11/13/2017																		
Cassalery 0.6	6/11/2015														0.55				
Cassalery 0.6	7/7/2015														0.58				
Cassalery 0.6	8/13/2015					20						0.10			0.44	13.7			
Cassalery 0.6	9/10/2015	9.5	30.10	9.3		194		1116.9	2.5	7.9	7.4	0.11	8700.0	240	0.58	13.2	1608.4	18.7	6
Cassalery 0.6	10/8/2015	5.5	30.08	9.5		122		1007.5	2.6	7.8	7.5	0.10	6696.3	240	0.63	12.1	1768.0	41.2	0
Cassalery 0.6	11/23/2015	16.7	29.86	9.8		12		1063.6	5.0	7.8	11.5	0.13	9268.4	269	0.66	6.5	1570.1	20.4	1
Cassalery 0.6	12/17/2015	25.3	29.70	10.2		522		1181.1	7.9	7.8	20.5	0.13	8799.7	275	0.80	6.8	2142.3	51.4	4
Cassalery 0.6	1/25/2016	26.9				122		1475.7	15.7		28.7	0.10	7145.1	273	0.74	7.0	2442.2	48.0	
Cassalery 0.6	2/17/2016	46.2	29.39	9.9		84		1624.2	19.3	7.4	40.0	0.14	6904.7	299	0.74	9.4	2737.1	82.3	6

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Cassalery 0.6	3/15/2016	10.5	30.20	11.1		100		1769.6	6.4	7.5	12.8	0.13	8125.8	278	0.74	7.7	2674.9	38.4	8
Cassalery 0.6	4/11/2016														0.62				
Cassalery 0.6	5/2/2016					60									0.66				
Cassalery 0.6	5/17/2016														0.68				
Cassalery 0.6	6/21/2016														0.68				
Cassalery 0.6	7/19/2016														0.70				
Cassalery 0.6	8/15/2016														0.70				
Cassalery 0.6	9/20/2016														0.64				
Cassalery 0.6	10/18/2016	7.0	29.98	9.6	86	2		1094.9	2.7	7.9	6.7	0.10	6581.7	247	0.68	10.4	1806.6	17.0	1
Cassalery 0.6	11/14/2016	8.1	30.06	9.0	81	16		1052.1	2.5	7.7	4.6	0.12	6843.9	245	0.72	10.6	2311.7	25.7	0
Cassalery 0.6	12/13/2016	27.6	30.33	11.4	88	6		1109.3	5.0	8.1	9.6	0.10	6600.9	250	0.58	4.9	1620.0	29.4	1
Cassalery 0.6	1/9/2017	75.2	29.59	11.2	88	2		1094.4	14.7	7.8	13.0	0.10	6457.3	250	0.66	4.8	1808.5	52.6	4
Cassalery 0.6	2/14/2017														0.58				
Cassalery 0.6	3/14/2017														0.56				
Cassalery 0.6	4/17/2017														0.48				
Cassalery 0.6	5/9/2017														0.48				
Cassalery 0.6	6/13/2017														0.50				
Cassalery 0.6	7/18/2017														0.44				
Cassalery 0.6	8/14/2017	12.3	30.02	9.4	89	84		915.8	2.6	8.0	8.1	0.10	6041.9	230	0.48	13.1	1338.4	45.4	2
Cassalery 0.6	9/19/2017														0.46				
Cassalery 0.6	10/10/2017	42.3	29.86	10.3	91	56		977.6	3.3	8.1	3.8	0.10	6228.7	228	0.44	9.9	1385.2	31.0	2
Cassalery 0.6	11/13/2017		29.58	9.5	83	2						0.10		235	0.54	8.7			2
Cassalery 0.6	12/12/2017		30.48	11.4	89	2						0.10		236	0.53	5.8			2
Chicken Coop 0.24	11/24/2015		29.88	12.4		10				7.7		0.08		173	-2.56	5.5			10
Chicken Coop 0.24	1/26/2016					2						0.10		111	-2.30	6.4			
Chicken Coop 0.24	4/12/2016		30.04	11.5		6				7.8		0.08		161	-4.20	8.6			2
Chicken Coop 0.24	8/16/2016		30.08	9.9	99	10				8.0		0.10		240	-4.81	13.6			1
Chicken Coop 0.24	11/15/2016		29.76	11.1	97	10				7.9		0.08		168	-3.22	9.3			2
Chicken Coop 0.24	1/10/2017		29.65	13.6	99	32				7.8		0.10		155	-3.14	2.0			11
Chicken Coop 0.24	4/18/2017		29.85	11.7	97	2				7.8		0.10		127	-3.12	7.2			7

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Chicken Coop 0.24	8/15/2017		29.94	10.5	96	26				8.1		0.10		232	-4.68	11.4			1
Chicken Coop 0.24	11/14/2017		29.86	11.8	97	6				8.0		0.10		177	-4.20	7.0			3
Cooper 0.1	5/12/2015	18.2				2		17.7	1.1		20.4	0.80	7983.1			17.1	271.6	39.7	
Cooper 0.1	6/11/2015	12.1				4		15.7	1.2		25.4	0.60	9570.3			16.8	288.1	51.7	
Cooper 0.1	7/7/2015	6.9				2		6.8	1.0		22.6	0.80	8401.4			16.6	255.0	45.4	
Cooper 0.1	8/13/2015	4.7				12		4.0	0.7		15.6	0.30	10886.4			18.8	206.3	34.7	
Cooper 0.1	9/10/2015	11.6	30.14	7.3		26		8.7	0.7	7.4	15.4	0.20	11088.8	391		15.8	243.3	34.6	7
Cooper 0.1	10/8/2015	11.6	30.12	6.1		114		21.0	1.3	7.2	16.0	0.20	8620.5	468		11.5	326.8	37.6	0
Cooper 0.1	11/23/2015	67.2	29.86	4.5		88		281.7	5.6	7.1	47.1	27.69	7837.1	43507		7.1	728.6	97.6	11
Cooper 0.1	12/17/2015	42.1	29.68	10.9		26		263.3	1.9	7.9	18.4	1.26	10807.4	2448		5.2	706.0	47.0	2
Cooper 0.1	1/25/2016	54.9				20		297.4	3.1		33.3	3.70	8460.8	6780		5.9	740.3	57.2	
Cooper 0.1	2/17/2016	15.6	29.38	6.5		6		223.5	1.6	7.1	32.9	2.57	5471.9	4750		9.1	606.0	52.6	2
Cooper 0.1	3/15/2016	14.2	30.20	7.8		2		113.1	1.5	6.9	22.0	5.63	7819.7	10033		7.5	499.8	37.4	3
Cooper 0.1	4/11/2016	28.5		7.0		6		47.1	1.8	7.3	30.5	1.35	6922.6	2590		12.3	385.6	45.5	3
Cooper 0.1	5/17/2016	24.1	30.31	8.3		2		36.9	1.4	7.6	20.8	0.56	7546.5	1111		15.0	242.5	44.1	3
Cooper 0.1	6/21/2016	7.8	30.33	7.7		2		6.6	0.7	7.4	13.4	0.55	7895.2	1105		14.7	238.0	30.5	2
Cooper 0.1	7/19/2016	9.1	30.11	8.1		22		9.2	0.7	7.4	17.1	0.26	8455.3	528		17.4	214.2	32.7	2
Cooper 0.1	8/15/2016	81.0	30.10	9.0		128		15.1	1.9	7.4	12.8	0.30	8564.3	665		18.3	263.4	30.0	3
Cooper 0.1	9/20/2016	11.7	30.16	7.6		22		22.2	0.5	7.3	9.5	0.20	8586.4	465		12.3	209.1	24.1	1
Cooper 0.1	10/18/2016	18.6	30.00	4.7	42	100		83.2	3.6	7.2	28.4	0.40	8484.4	710		10.1	662.4	63.9	2
Cooper 0.1	11/14/2016	70.6	30.06	7.4	78	2		240.7	7.8	7.5	39.1	27.40	2957.2	4278	-3.21	10.8	575.7	73.8	5
Cooper 0.1	12/13/2016	57.4	30.34	10.2	80	6		323.5	2.6	7.6	51.4	23.50	2829.2	34500	-3.19	5.0	853.3	70.0	5
Cooper 0.1	1/9/2017	45.2	29.60	8.5	64	6		426.5	4.0	7.6	17.8	1.79	8099.2	3436	-2.37	2.5	900.9	58.2	0
Cooper 0.1	2/14/2017	38.2	29.98	9.5	74	8		324.2	2.2	7.4	21.5	2.80	15631.0	5263	-3.67	4.1	581.7	62.6	5
Cooper 0.1	3/14/2017	30.1	29.72	7.1	63	20		230.9	2.2	7.3	21.9	7.30	7490.4	4210	-3.58	9.2	584.8	62.4	1
Cooper 0.1	4/17/2017	19.2	29.81	7.1	67	6		57.9	1.7	7.3	29.0	1.00	8001.7	1965	-3.67	12.4	495.1	74.5	2
Cooper 0.1	5/9/2017	18.8	30.07	7.8	75	18		27.6	1.4	7.4	25.7	0.40	8041.0	764	-4.01	13.6	442.4	83.0	5
Cooper 0.1	6/13/2017	13.0		9.3	95	6		10.2	1.2	7.7	22.8	0.40	7051.0	793	-4.00	16.4	333.1	65.7	2
Cooper 0.1	7/18/2017	14.7	30.04	8.8	93	4		4.1	1.0	7.5	20.3	0.30	9919.4	716	-4.12	18.4	247.9	61.9	1
Cooper 0.1	8/14/2017	36.6	30.02	7.8	83	28		16.4	1.4	7.3	15.9	4.40	7275.8	7914	-4.15	16.8	352.6	69.6	3

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Cooper 0.1	9/19/2017	60.1	29.76	7.1	70	26		25.0	1.8	7.1	19.0	6.10	7381.1	10732	-4.20	12.7	310.3	54.1	2
Cooper 0.1	10/10/2017	42.2	29.88	6.3	60	38		54.6	2.4	7.3	24.4	12.60	5558.4	21114	-3.61	9.4	310.7	63.2	4
Cooper 0.1	11/13/2017		29.53	6.2	65	40						29.70		46201	-2.70	8.8			11
Cooper 0.1	12/12/2017		30.48	7.5	74	2						30.60		47608	-2.94	7.2			3
Dean 0.17	11/24/2015		29.91	12.7		126				7.9		0.06		129		5.0			24
Dean 0.17	1/26/2016					58						0.10		113		5.8			
Dean 0.17	4/12/2016		30.05	11.7		2				8.0		0.09		196		8.7			3
Dean 0.17	8/16/2016						0.0												
Dean 0.17	11/15/2016		29.77	11.2	97	2				8.0		0.08		175	-11.13	8.9			4
Dean 0.17	1/10/2017		29.68	14.2	100	14				7.9		0.07		160	-11.09	0.8			14
Dean 0.17	4/18/2017		29.88	11.0	92	2				7.8		0.10		130	-10.27	12.7			
Dean 0.17	11/14/2017		29.85	12.0	98	64				8.0		0.10		189	-10.00	6.6			17
Dungeness 0.7	5/12/2015	3.2				2		35.3	0.5		3.0	0.10	3154.4			12.4	143.0		
Dungeness 0.7	6/11/2015	4.9				2		41.6	0.5		5.3	0.10	4017.7			13.7	259.8	15.0	
Dungeness 0.7	7/7/2015	8.8				4		60.8	0.9		4.8	0.10	3417.2			14.9	172.8	11.7	
Dungeness 0.7	8/13/2015	8.0				4		95.7	2.2		5.0	0.10	4628.7			17.6	167.7	9.7	
Dungeness 0.7	9/10/2015	59.4	30.10	9.6		12		174.1	3.6	7.9	10.5	0.09	4692.7	168		13.3	320.4	16.5	17
Dungeness 0.7	10/8/2015	62.1	30.10	10.3		114		165.7	13.1	7.9	16.0	0.10	3705.3	177		12.1	425.7	23.8	0
Dungeness 0.7	11/23/2015	2.7	29.84	12.4		2		96.0	0.4	8.0	9.2	0.06	4261.5	124		5.2	176.4	16.1	9
Dungeness 0.7	12/17/2015	0.2	29.65	12.4		14		92.1	0.3	7.9	5.2	0.06	4786.9	134		5.2	239.7	26.8	14
Dungeness 0.7	1/25/2016	2.8				2		79.7	1.0		11.6	0.10	3741.6	115		4.6	265.1	61.0	
Dungeness 0.7	2/17/2016	2.4	29.34	12.1		2		80.2	0.1	7.4	5.3	0.05	3352.5	113		6.4	262.5	21.2	16
Dungeness 0.7	3/15/2016	0.0	30.22	12.6		2		57.9	0.3	7.5	5.8	0.06	5128.4	131		5.4	197.1	14.7	14
Dungeness 0.7	4/11/2016	1.1	30.14	11.8		2		26.6	0.3	7.9	3.8	0.05	3034.7	116		8.5	96.7	7.2	4
Dungeness 0.7	5/17/2016	3.6	30.30	11.4		2		24.5	0.2	7.9	2.8	0.05	2622.8	100		10.1	105.9	15.4	5
Dungeness 0.7	6/21/2016	3.0	30.30	11.2		8		48.6	0.2	7.9	2.6	0.06	3027.2	122		10.6	189.3	12.8	3
Dungeness 0.7	7/19/2016	2.0	30.11	10.6		10		37.6	0.2	7.7	2.7	0.06	3056.7	123		13.9	106.0	6.5	1
Dungeness 0.7	8/15/2016	2.9	30.10	10.8		2		38.3	0.5	8.3	3.0	0.10	3239.3	140		15.9	91.3	5.8	1
Dungeness 0.7	9/20/2016	10.2	30.15	11.2		4		70.4	0.5	8.2	3.6	0.08	3358.9	159		12.8	193.5	10.7	0
Dungeness 0.7	10/18/2016	1.9	30.06	11.4	97	4		59.4	0.3	7.8	5.1	0.05	3036.1	108		8.9	156.3	20.8	9

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Dungeness 0.7	11/14/2016	3.0	30.07	11.6	98	4		26.9	0.0	7.1	2.8	0.05	2642.1	97		8.3	178.0	33.3	13
Dungeness 0.7	12/13/2016	4.3	30.34	13.5	100	2		63.5	0.3	8.2	3.6	0.10	3474.7	145		3.4	122.4	13.2	1
Dungeness 0.7	1/9/2017	5.3	29.60	14.2	103	2		65.4	0.4	7.8	3.2	0.10	3349.4	149		1.7	164.3	24.4	7
Dungeness 0.7	2/14/2017	5.4	29.92	13.2	100	2		107.6	0.3	8.0	5.2	0.10	7086.8	133		3.7	181.0	19.5	5
Dungeness 0.7	3/14/2017	3.0	29.75	12.2	99	412		81.8	0.0	7.9	4.3	0.10	3644.7	125		5.9	273.3	85.4	36
Dungeness 0.7	4/17/2017	3.3	29.79	11.7	100	4		40.7	0.2	7.9	3.3	0.00	4404.6	32		8.2	246.9	21.9	3
Dungeness 0.7	5/9/2017	3.5	30.04	11.7	101	2		35.8	0.3	8.2	2.9	0.10	3763.0	118		9.1	195.9	21.8	3
Dungeness 0.7	6/13/2017	2.6	30.10	11.3	100	4		13.6	0.1	8.1	2.7	0.00	2214.6	104		10.4	120.6	20.5	5
Dungeness 0.7	7/18/2017	3.8	30.03	11.2	107	2		14.1	0.3	8.2	2.3	0.10	3348.3	114		13.4	145.2	19.3	2
Dungeness 0.7	8/14/2017	0.0	30.02	11.0	105	2		29.5	0.3	8.4	2.6	0.10	2937.3	128		13.7	151.9	19.2	1
Dungeness 0.7	9/19/2017	12.0	29.76	10.9	102	4		75.1	0.5	8.2	4.9	0.10	3507.0	156		12.2	150.3	17.2	2
Dungeness 0.7	10/10/2017	20.8	29.89	11.2	99	4		86.8	0.7	8.2	2.4	0.10	3578.8	166		9.7	153.9	17.2	1
Dungeness 0.7	11/13/2017		29.50	11.9	99	14						0.10		107		6.7			41
Dungeness 0.7	12/12/2017		30.45	12.8	98	2						0.10		138		5.0			3
Dungeness 0.8	5/12/2015						235.0												
Dungeness 0.8	6/11/2015						200.0												
Dungeness 0.8	7/7/2015						89.1												
Dungeness 0.8	8/13/2015						64.2												
Dungeness 0.8	9/10/2015						80.6												
Dungeness 0.8	10/8/2015						80.5												
Dungeness 0.8	11/23/2015						557.0												
Dungeness 0.8	12/17/2015						656.0												
Dungeness 0.8	1/25/2016						793.0												
Dungeness 0.8	2/17/2016						883.0												
Dungeness 0.8	3/15/2016						644.0												
Dungeness 0.8	4/11/2016						584.0												
Dungeness 0.8	5/17/2016						604.0												
Dungeness 0.8	6/21/2016						420.0												
Dungeness 0.8	7/19/2016						336.0												
Dungeness 0.8	8/15/2016						191.0												

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Dungeness 0.8	9/20/2016						103.0												
Dungeness 0.8	10/18/2016						632.0												
Dungeness 0.8	11/14/2016						856.0												
Dungeness 0.8	12/13/2016						283.0												
Dungeness 0.8	1/9/2017						242.0												
Dungeness 0.8	2/14/2017						467.0												
Dungeness 0.8	3/14/2017						810.0												
Dungeness 0.8	4/17/2017						409.0												
Dungeness 0.8	5/9/2017						541.0												
Dungeness 0.8	6/13/2017						638.0												
Dungeness 0.8	7/18/2017						348.0												
Dungeness 0.8	8/14/2017						186.0												
Dungeness 0.8	9/19/2017						112.0												
Dungeness 0.8	10/10/2017						77.9												
Dungeness 0.8	11/13/2017						882.0												
Dungeness 0.8	12/12/2017						290.0												
Gierin 1.8	11/24/2015		29.93	10.9		48				7.9		0.19		385	-0.81	6.8			5
Gierin 1.8	1/26/2016					16						0.20		394	-1.03	6.4			
Gierin 1.8	4/12/2016		30.04	11.0		70				7.6		0.13		278	-0.90	9.3			12
Gierin 1.8	5/2/2016					118									-0.79				
Gierin 1.8	8/17/2016					33									-0.90				
Gierin 1.8	11/15/2016		29.78	10.1	89	2				7.9		0.18		382	-0.85	9.6			4
Gierin 1.8	1/10/2017		29.67	13.0	96	10				7.9		0.17		362	-1.00	2.4			11
Gierin 1.8	4/18/2017		29.89	11.1	95	12				8.1		0.20		414	-1.14	8.1			7
Gierin 1.8	8/15/2017		29.96	10.3	97	46				8.0		0.10		169	-0.78	12.6			6
Gierin 1.8	11/14/2017		29.85	10.7	89	14				7.9		0.20		366	-0.84	7.4			2
Golden Sands Slough 0.0	5/12/2015	76.3				112		2.1	1.5		80.1	7.60	4551.7		-0.86	22.7	1145.6	176.6	
Golden Sands Slough 0.0	6/11/2015	19.9				24		1.1	0.7		24.0	13.70	2179.2		-0.84	21.1	281.2	63.9	
Golden Sands Slough 0.0	7/7/2015	23.2				64		0.2	0.8		55.4	22.30	2585.4		-0.75	18.5	1410.8	146.2	
Golden Sands Slough 0.0	8/13/2015	32.2				45		0.8	4.8		15.1	22.80	4286.5		-0.62	22.0	585.9	72.6	

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Golden Sands Slough 0.0	9/10/2015	538.2	30.13	4.5		100		2.0	2.0	7.8	110.1	10.11	10908.4	235	-0.75	22.3	1676.7	297.5	15
Golden Sands Slough 0.0	10/8/2015	95.5	30.11	10.5		402		0.2	1.8	7.7	111.6	16.00	6820.5	26048	-0.75	15.1	1088.3	278.7	10
Golden Sands Slough 0.0	11/23/2015	131.0	29.86	4.6		112		526.5	8.6	7.1	134.5	27.29	3941.3	42850	-0.43	7.6	1347.4	168.5	7
Golden Sands Slough 0.0	12/17/2015	116.5	29.68	6.9		196		240.1	5.7	7.3	106.3	10.75	6765.0	18100	0.39	5.8	1405.3	166.8	7
Golden Sands Slough 0.0	1/25/2016	47.1				130		174.0	3.9		89.4	2.20	9193.2	4125		6.0	1437.9	163.8	
Golden Sands Slough 0.0	2/17/2016	20.6	29.36	5.2		98		220.4	6.4	6.9	117.4	1.53	8461.5	2939		8.5	1536.3	189.0	5
Golden Sands Slough 0.0	3/15/2016	13.6	30.22	8.1		4		128.5	2.3	7.1	40.3	18.90	3842.1	31000		9.3	600.4	69.8	4
Golden Sands Slough 0.0	4/11/2016	18.6	30.15	8.6		14		3.9	1.4	7.7	75.1	11.00	5095.6	18600	-0.10	14.7	1023.4	156.5	8
Golden Sands Slough 0.0	5/17/2016	79.0	30.30	10.9		16		5.1	3.5	8.3	236.6	10.74	4278.7	18101	-0.95	20.0	871.1	329.5	4
Golden Sands Slough 0.0	6/21/2016	41.7	30.30	8.5		626		0.0	0.9	8.3	164.1	12.62	4909.0	20995	-0.75	17.8	1135.0	203.7	5
Golden Sands Slough 0.0	7/19/2016	45.7	30.11	7.3		81		3.5	1.4	8.0	44.0	26.62	4403.4	41480	-0.70	21.6	516.2	77.4	4
Golden Sands Slough 0.0	8/15/2016	35.7	30.10	11.9		80		3.6	4.0	8.2	56.0	23.00	4690.6	36876	-0.82	23.0	611.7	94.8	5
Golden Sands Slough 0.0	9/20/2016	159.3	30.16	11.4		68		8.7	8.4	8.0	141.0	19.16	6068.3	30770		15.4	667.0	230.3	5
Golden Sands Slough 0.0	10/18/2016	327.7	30.00	6.3	64	42		78.0	16.4	7.4	231.3	11.00	6352.7	18573		12.8	1701.3	414.8	7
Golden Sands Slough 0.0	11/14/2016	1274.0	30.06	3.9	43	147		7.6	3.5	7.1	591.5	29.30	11474.1	4533	-0.08	11.2	4033.2	730.2	3
Golden Sands Slough 0.0	12/13/2016	275.7	30.34	4.9	37	25		43.1	6.5	7.6	119.8	2.70	10600.3	3700	0.15	3.3	1956.4	194.2	3
Golden Sands Slough 0.0	1/9/2017	118.9	29.59	8.2	80	5		67.6	5.4	7.3	60.1	30.60	9745.5	47874	-0.24	5.4	1664.8	157.0	0
Golden Sands Slough 0.0	2/14/2017	94.3	29.97	8.2	72	3		137.1	2.7	7.3	23.8	15.40	12051.8	25410	-0.18	5.7	586.6	91.0	4
Golden Sands Slough 0.0	3/14/2017	54.5	29.74	7.4	70	28		69.6	3.1	7.3	61.3	9.60	6246.1	16155	-0.31	10.0	840.8	123.8	3
Golden Sands Slough 0.0	4/17/2017	55.9	29.79	7.6	88	22		26.7	1.1	7.4	39.9	22.60	3062.6	35758	0.00	16.0	578.1	98.2	2
Golden Sands Slough 0.0	5/9/2017	54.0	30.06	12.9	149	18		0.0	0.8	8.5	36.0	10.70	1230.0	17959	-0.59	19.6	716.8	111.4	3
Golden Sands Slough 0.0	6/13/2017	25.4		12.6	157	20		0.4	0.7	8.8	59.2	15.30	6045.7	25091	-1.12	22.3	1135.7	206.9	6
Golden Sands Slough 0.0	7/18/2017	31.5	30.04	14.7	204	37		0.0	0.6	8.5	32.2	24.00	4579.2	37798	-1.12	25.2	856.4	141.1	6
Golden Sands Slough 0.0	8/14/2017	94.8	30.03	10.2	116	57		2.8	2.7	8.0	29.5	3.60	4031.2	6529	-1.05	21.0	663.6	126.7	5
Golden Sands Slough 0.0	9/19/2017	108.1	29.76	10.4	122	13		3.1	1.5	7.8	39.7	24.40	5109.1	38344	-0.75	15.6	475.7	110.1	6
Golden Sands Slough 0.0	10/10/2017	338.3	29.89	0.1	1	14		2.4	2.5	7.1	244.0	17.20	6758.7	27486	-0.35	10.0	2158.4	459.0	13
Golden Sands Slough 0.0	11/13/2017		29.53	0.2	2	460						27.90		43689	-0.30	8.7			7
Golden Sands Slough 0.0	12/12/2017		30.48	7.7	78	2						30.60		47502	-0.60	7.9			2
Hurd 0.2	11/24/2015		29.94	9.0		36				7.3		0.08		170		9.5			1
Hurd 0.2	1/26/2016					2						0.10		175	-2.30	9.0			

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Hurd 0.2	4/12/2016		29.99	9.7		2				7.2		0.08		173	-2.25	9.4			0
Hurd 0.2	8/16/2016		30.05	9.2		40				7.4		0.10		170	-2.30	11.2			0
Hurd 0.2	11/15/2016		29.75	8.7	78	2				7.6		0.08		163	-2.46	10.2			2
Hurd 0.2	1/10/2017		29.64	9.8	83	14				7.4		0.10		168	-2.36	8.0			20
Hurd 0.2	4/18/2017		29.86	10.2	90	4				7.6		0.10		164	-2.41	9.7			1
Hurd 0.2	8/15/2017		29.93	9.3	84	2				7.3		0.10		167	-2.43	10.6			1
Hurd 0.2	11/14/2017		29.82	9.0	79	10				7.4		0.10		165	-2.27	9.5			1
Jimmycomelately 0.15	5/12/2015					2						0.10			0.76	9.9			
Jimmycomelately 0.15	8/13/2015					2						0.00			0.61	14.3			
Jimmycomelately 0.15	10/8/2015	608.8	30.12	8.2		6		515.4	73.2	7.6	136.6	0.15	9379.8	305	0.69	11.1	2249.7	186.8	5
Jimmycomelately 0.15	11/23/2015	0.8	29.88	12.7		30		626.6	1.8	7.6	22.2	0.07	11152.8	150	0.78	3.9	1306.6	37.8	5
Jimmycomelately 0.15	12/17/2015	0.2	29.68	12.3		4		286.9	2.1	7.1	9.6	0.05	11614.6	105	1.36	5.6	649.3	37.2	11
Jimmycomelately 0.15	1/25/2016	3.0				2		234.4	2.3		17.0	0.00	9087.8	103	1.22	4.7	693.8	35.0	
Jimmycomelately 0.15	2/17/2016	2.8	29.42	11.7		2		181.7	1.1	7.3	12.9	0.06	8964.7	125	0.98	7.1	465.8	28.4	5
Jimmycomelately 0.15	3/15/2016	0.0	30.18	12.5		2		164.9	1.8	7.2	11.9	0.05	11658.9	96		5.4	539.7	36.2	17
Jimmycomelately 0.15	4/11/2016	8.2	30.13	11.0		2		77.2	1.1	7.7	20.1	0.08	9419.5	177		8.8	279.5	22.0	2
Jimmycomelately 0.15	5/17/2016	4.5	30.30	10.7		4		98.8	0.4	7.8	19.3	0.10	9925.4	202	0.76	10.0	202.0	27.2	1
Jimmycomelately 0.15	6/21/2016	4.5	30.20	10.6		26		107.0	0.6	7.7	16.4	0.08	8869.0	158	0.88	11.1	289.6	21.0	1
Jimmycomelately 0.15	7/19/2016	5.5	30.11	9.7		46		68.7	0.5	7.9	19.1	0.11	9302.6	222	0.67	13.5	221.2	24.4	1
Jimmycomelately 0.15	8/15/2016	4.9	30.09	9.4		10		134.6	0.9	7.8	22.5	0.10	9672.8	254	0.60	14.0	263.2	22.5	0
Jimmycomelately 0.15	9/20/2016	164.6	30.17	9.0		8		194.9	12.8	7.4	68.8	0.13	9390.0	269	0.68	11.0	551.0	89.2	4
Jimmycomelately 0.15	10/18/2016	13.3	29.97	10.9	95	2		681.2	2.5	7.4	20.6	0.06	8628.9	132	1.14	9.3	1251.2	42.4	6
Jimmycomelately 0.15	11/14/2016	13.8	30.06	10.8	94	4		214.3	0.9	7.7	19.7	0.10	9722.2	171	0.85	9.8	463.1	42.7	1
Jimmycomelately 0.15	12/13/2016	4.3	30.33	13.3	97	2		305.4	0.3	8.0	15.5	0.10	9036.2	162	0.86	2.7	507.1	37.5	3
Jimmycomelately 0.15	1/9/2017	5.4	29.60	13.5	97	62		463.4	0.9	7.3	18.1	0.10	8459.0	152	1.04	1.3	805.0	62.6	7
Jimmycomelately 0.15	2/14/2017	5.4	30.04	13.5	98	4		469.4	1.0	7.9	14.1	0.10	17504.7	129	1.08	2.4	713.6	46.4	6
Jimmycomelately 0.15	3/14/2017	4.9	29.68	12.2	98	4		348.5	2.0	7.4	11.0	0.05	7715.1	97	1.70	5.7	665.6	60.9	16
Jimmycomelately 0.15	4/17/2017	3.8	29.81	11.7	96	2		238.9	1.4	7.8	10.3	0.10	10367.8	118	1.38	7.0	702.2	52.1	7
Jimmycomelately 0.15	5/9/2017	3.5	30.10	11.8	97	48		187.5	1.0	8.0	12.1	0.10	11019.7	133	1.10	7.4	421.4	39.7	3
Jimmycomelately 0.15	6/13/2017	4.1	30.11	10.7	95	20		136.9	0.7	7.8	17.4	0.10	9169.8	181	0.86	10.6	359.5	50.4	1

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Jimmycomelately 0.15	7/18/2017	10.3	30.05	10.0	93	4		115.6	0.8	7.9	20.1	0.10	11287.9	244	0.72	12.0	236.1	47.9	0
Jimmycomelately 0.15	8/14/2017	4.9	30.03	9.7	92	2		116.2	0.9	8.0	21.9	0.10	9032.9	265	0.70	13.1	348.5	63.2	1
Jimmycomelately 0.15	9/19/2017	39.3	29.73	10.0	90	12		138.8	1.4	7.8	34.9	0.10	7447.1	273	0.66	10.5	309.1	63.4	2
Jimmycomelately 0.15	10/10/2017	43.7	29.87	10.4	89	4		131.0	3.0	8.0	28.5	0.10	9157.3	283	0.66	8.6	297.7	57.4	1
Jimmycomelately 0.15	11/13/2017		29.61	11.8	98	86						0.00		104	1.86	6.8			52
Jimmycomelately 0.15	12/12/2017		30.48	13.2	96	2						0.10		158	0.84	3.0			2
Johnson 0.0	5/12/2015					18						0.10			0.68	10.8			
Johnson 0.0	8/13/2015					26						0.10			0.47	15.1			
Johnson 0.0	10/8/2015	10.9	30.11	10.4		64		59.7	1.2	8.1	61.7	0.14	8587.7	290	0.49	11.8	247.2	70.1	5
Johnson 0.0	11/23/2015	0.0	29.86	12.9		52		348.9	1.9	8.0	54.0	0.11	12496.6	227	0.80	4.1	1215.6	83.0	11
Johnson 0.0	12/17/2015	0.8	29.69	12.6		18		208.7	4.1	7.7	39.6	0.08	11739.3	170	0.88	5.2	865.9	87.1	19
Johnson 0.0	1/25/2016	4.5				14		177.0	3.3		46.2	0.10	9928.0	179	0.76	4.5	757.2	76.2	
Johnson 0.0	2/17/2016	4.8	29.42	11.9		8		208.4	3.3	7.6	51.2	0.10	9375.3	205	0.90	7.4	1178.4	90.5	14
Johnson 0.0	3/15/2016	0.0	30.20	12.7		16		165.2	3.0	7.5	43.6	0.08	11610.4	168	1.04	5.3	1209.4	81.1	26
Johnson 0.0	4/11/2016	5.1		11.4		8		143.5	1.5	8.2	49.4	0.13	8826.1	280	0.48	9.3	468.8	55.0	2
Johnson 0.0	5/17/2016	8.0	30.30	11.3		8		85.9	0.6	8.0	26.0	0.08	5006.4	163	0.52	9.7	177.9	36.5	2
Johnson 0.0	6/21/2016	7.6	30.30	10.6		472		286.2	1.1	8.1	55.7	0.14	9409.3	288	0.38	12.0	535.8	71.8	2
Johnson 0.0	7/19/2016	3.1	30.10	10.1		30		117.7	0.6	8.1	39.6	0.09	6046.6	198	0.42	14.3	340.5	46.7	1
Johnson 0.0	8/15/2016	5.5	30.09	10.0		14		133.0	1.0	8.1	46.2	0.10	6912.4	220	0.35	14.2	319.0	48.9	1
Johnson 0.0	9/20/2016	12.5	30.17	10.7		6		229.7	1.1	8.0	66.1	0.16	9798.6	327	0.30	10.9	466.2	79.6	0
Johnson 0.0	10/18/2016	14.6	29.98	10.9	95	2		845.7	2.7	7.9	62.5	0.10	10743.8	290	0.40	9.4	1370.3	55.7	1
Johnson 0.0	11/14/2016	20.6	30.05	10.7	94	4		248.4	1.5	7.9	55.3	0.15	10897.5	310	0.40	9.7	1200.1	81.1	0
Johnson 0.0	12/13/2016	8.0	30.33	13.7	99	2		452.5	0.6	8.3	55.4	0.20	10118.2	311	0.38	2.3	1013.3	75.9	1
Johnson 0.0	1/9/2017	7.6	29.60	13.8	98	4		406.5	0.8	7.8	56.2	0.20	9053.7	390	0.46	1.0	856.0	108.4	4
Johnson 0.0	2/14/2017	9.0	30.03	13.8	100	2	0.6	599.8	2.5	8.1	41.1	0.10	17984.7	212		2.2	1266.0	93.5	15
Johnson 0.0	3/14/2017	7.0	29.69	12.2	99	4		350.8	3.1	7.6	30.8	0.10	8824.9	159	0.90	5.9	987.8	107.8	28
Johnson 0.0	4/17/2017	5.0	29.80	11.7	99	2		227.9	2.1	7.9	30.9	0.10	9684.1	190	0.80	7.7	433.1	90.8	14
Johnson 0.0	5/9/2017	7.1	30.09	11.7	99	2		147.3	1.0	8.1	32.7	0.10	7971.1	222	0.48	8.5	448.6	60.5	4
Johnson 0.0	6/13/2017	6.5	30.11	10.8	97	26		301.9	1.5	8.1	51.2	0.10	9777.3	270	0.38	11.0	665.8	97.3	2
Johnson 0.0	7/18/2017	8.9	30.03	10.4	97	38		258.1	1.2	8.4	53.1	0.10	10387.9	261	0.30	12.4	546.9	99.4	1

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Johnson 0.0	8/14/2017	0.0	30.02	10.4	98	16		58.2	0.6	8.2	28.4	0.10	4662.9	167	0.46	12.7	208.4	58.6	16
Johnson 0.0	9/19/2017	7.5	29.73	10.8	97	4		302.6	1.3	8.3	60.2	0.20	9238.6	319	0.26	10.4	470.0	89.4	1
Johnson 0.0	10/10/2017	1.6	29.86	11.3	97	2		245.2	1.4	8.3	64.8	0.20	10463.2	346	0.27	8.4	380.2	96.1	1
Johnson 0.0	11/13/2017		29.61	11.6	97	72						0.10		258	0.62	7.1			8
Johnson 0.0	12/12/2017		30.48	13.3	98	2						0.10		246	0.45	3.7			3
Lotzgesell 0.1	5/12/2015	25.6				58		1184.3	8.9		12.5	0.10	7402.3		-1.53	18.5	2097.4	46.8	
Lotzgesell 0.1	6/11/2015	36.7				28		1629.7	14.9		15.9	0.10	9760.8		-1.38	17.8	2097.4	48.0	
Lotzgesell 0.1	7/7/2015	29.7				64		1458.1	23.5		11.5	0.10	8192.1		-1.70	13.6	2459.8	50.2	
Lotzgesell 0.1	8/13/2015	47.8				98		1489.4	28.1		17.7	0.10	10529.7		-1.65	20.1	2583.9	54.3	
Lotzgesell 0.1	9/10/2015	16.5	30.10	8.4		52		1724.9	4.7	7.7	8.0	0.12	10945.3	283	-1.33	12.8	2672.2	40.2	12
Lotzgesell 0.1	10/8/2015	32.6	30.07	7.9		184		1158.3	22.6	7.5	29.1	0.10	8484.8	290	-1.22	12.6	2151.0	78.1	13
Lotzgesell 0.1	11/23/2015	30.1	29.80	9.0		6		1383.5	9.2	7.5	14.1	0.14	10582.0	287	-0.94	7.2	2429.2	31.3	4
Lotzgesell 0.1	12/17/2015	28.7	29.62	9.5		58		1306.9	7.8	8.1	13.9	0.14	9875.5	284	-0.60	7.0	2344.5	37.2	5
Lotzgesell 0.1	1/25/2016	27.1				34		1692.3	8.0		13.3	0.10	8095.5	277	-0.85	7.5	2745.4	48.3	
Lotzgesell 0.1	2/17/2016	29.1	29.30	9.6		34		1881.0	4.9	7.1	19.5	0.14	8269.6	292	-0.50	9.5	3489.0	49.6	10
Lotzgesell 0.1	3/15/2016	22.5	30.18	10.6		6		1939.9	4.1	7.2	10.4	0.14	10340.2	292	-0.99	8.5	3392.6	34.1	6
Lotzgesell 0.1	4/11/2016		30.11	10.3		44		2000.3	14.8	7.7		0.14	7894.4	283	-1.17	11.5	3349.0	24.2	9
Lotzgesell 0.1	5/17/2016	15.4	30.26	9.8		64		2371.0	6.7	7.7	10.8	0.14	8185.6	283	-1.30	11.7	2869.6	58.1	9
Lotzgesell 0.1	6/21/2016	15.1	30.30	9.0		62		2161.6	5.0	7.6	12.1	0.13	8280.6	281	-1.20	12.2	3247.9	31.9	9
Lotzgesell 0.1	7/19/2016	18.5	30.08	8.7		104		2236.1	6.1	7.6	9.9	0.14	8569.6	285	-1.18	13.4	3083.9	30.7	9
Lotzgesell 0.1	8/15/2016	17.4	30.06	8.9		38		2059.4	5.5	7.7	11.4	0.10	8323.1	284	-1.59	13.7	2480.1	28.5	9
Lotzgesell 0.1	9/20/2016	15.6	30.12	9.2		36		2142.6	3.9	7.7	10.8	0.14	8680.0	285	-1.33	11.9	2587.2	33.4	9
Lotzgesell 0.1	10/18/2016	27.3	30.00	7.9	71	14		1425.6	18.5	7.4	25.1	0.14	8752.4	293	-1.10	10.7	2472.4	53.0	3
Lotzgesell 0.1	11/14/2016	12.3	30.03	7.9	71	28		1314.9	7.0	7.4	12.2	0.14	8859.0	288	-1.02	10.9	2970.9	44.3	4
Lotzgesell 0.1	12/13/2016	33.6	30.31	9.9	78	6		1400.7	8.2	7.7	10.5	0.10	8226.2	283	-1.06	5.6	2062.6	39.0	4
Lotzgesell 0.1	1/9/2017	201.4	29.60	10.2	81	42		1487.9	20.3	7.4	10.5	0.10	8024.2	285	-1.24	5.4	2855.9	63.2	7
Lotzgesell 0.1	2/14/2017	14.8	29.88	10.7	88	40		1612.2	2.6	7.6	11.1	0.10	15909.7	280	-1.05	6.9	2394.0	61.0	14
Lotzgesell 0.1	3/14/2017	27.3	29.74	10.3	92	28		1472.1	4.0	7.6	13.0	0.10	7671.3	286	-0.88	9.9	2319.9	59.9	5
Lotzgesell 0.1	4/17/2017	12.3	29.76	10.8	100	28		1480.5	2.9	7.9	9.3	0.10	8339.3	280	-1.16	11.8	3103.4	49.9	5
Lotzgesell 0.1	5/9/2017	13.7	30.01	10.2	94	8		1650.2	3.1	7.7	10.2	0.10	9485.1	275	-1.28	11.8	2101.3	45.2	6

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SITE	DATE	NH3 N	BARO.	DO	DO %SAT.	FECAL	FLOW	NO3 N	NO2 N	pH	P	SALINITY	Si	SpC	STAGE	TEMP.	TPN	TPP	TURBIDITY
Lotzgesell 0.1	6/13/2017	27.3	30.09	9.7	90	70		1667.3	4.0	7.9	11.7	0.10	7945.8	271	-1.49	12.3	2169.6	70.9	11
Lotzgesell 0.1	7/18/2017	16.3	30.01	9.4	89	32		1883.7	4.0	7.7	10.5	0.10	9843.5	275	-1.33	13.1	3094.1	52.6	9
Lotzgesell 0.1	8/14/2017	4.9	29.98	9.3	88	28		1884.3	3.8	7.8	8.5	0.10	8405.9	282	-1.35	12.8	2181.3	59.2	12
Lotzgesell 0.1	9/19/2017	13.6	29.71	9.6	89	68		1854.1	3.5	7.7	9.0	0.10	8643.7	280	-1.35	11.5	2250.1	47.6	11
Lotzgesell 0.1	10/10/2017	12.6	29.85	9.9	89	4		1595.3	3.0	7.9	7.6	0.10	8614.0	277	-1.47	10.4	2058.8	49.9	10
Lotzgesell 0.1	11/13/2017		29.45	8.0	70	30						0.10		291	-1.05	9.0			5
Lotzgesell 0.1	12/12/2017		30.41	9.5	77	2						0.10		276	-1.18	6.8			7
Matriotti 0.3a	5/12/2015	40.2				179		941.7	9.1		18.9	0.05	7244.7		-8.50	16.4	1989.6	48.8	
Matriotti 0.3a	6/11/2015	59.7				46		1506.0	13.5		25.6	0.10	9042.0		-8.58	16.9	1989.6	52.4	
Matriotti 0.3a	7/7/2015	31.8				35		1350.8	21.6		19.1	0.10	8152.9		-8.70	13.9	2360.9	49.4	
Matriotti 0.3a	8/13/2015	291.6				389		1346.8	33.6		41.3	0.10	10618.6		-8.73	19.4	2740.3	76.1	
Matriotti 0.3a	9/10/2015	18.6	30.10	8.6		113		1554.0	5.9	7.8	13.5	0.12	11143.0	301	-8.55	13.3	2517.7	43.1	9
Matriotti 0.3a	10/8/2015	53.4	30.07	8.3		219		1208.0	18.3	7.6	32.7	0.20	8725.0	309	-8.64	12.6	2157.6	88.8	8
Matriotti 0.3a	11/23/2015	36.4	29.80	9.7		18		1402.3	8.4	7.6	22.1	0.15	11161.9	310	-8.22	6.9	2499.5	42.9	4
Matriotti 0.3a	12/17/2015	19.7	29.62	10.7		105		1064.5	5.5	7.8	29.7	0.13	10330.1	263	-7.80	6.1	2205.3	63.2	9
Matriotti 0.3a	1/25/2016	23.9				75		1204.4	6.3		39.5	0.10	8657.7	269	-8.00	6.9	2574.2	76.5	
Matriotti 0.3a	2/17/2016	25.1	29.29	10.4		187		1202.9	6.4	7.2	41.2	0.13	8478.7	266	-7.60	8.6	2676.3	106.7	15
Matriotti 0.3a	3/15/2016	21.7	30.19	11.3		54		1195.0	4.2	7.3	26.0	0.13	10615.9	279	-7.97	7.6	1650.9	63.3	12
Matriotti 0.3a	4/11/2016	74.9	30.11	10.4		185		1949.3	5.7	7.9	25.3	0.15	8315.4	315	-8.44	11.7	2724.3	36.1	8
Matriotti 0.3a	5/2/2016					31									-8.46				
Matriotti 0.3a	5/17/2016	35.0	30.25	10.1		91		2072.5	5.5	7.9	24.0	0.14	8020.3	291	-8.39	12.0	2104.2	43.0	8
Matriotti 0.3a	6/21/2016	190.8	30.30	9.4		325		1930.1	6.0	7.7	31.7	0.14	8480.8	293	-8.10	12.5	3334.3	56.2	6
Matriotti 0.3a	7/19/2016	130.6	30.08	9.2		320		1903.8	5.6	7.7	25.6	0.14	8293.9	287	-8.67	14.5	2849.4	44.2	5
Matriotti 0.3a	8/15/2016	207.6	30.06	9.1		361		1604.0	5.9	7.9	35.4	0.10	8030.2	284	-8.68	14.9	2585.9	56.9	6
Matriotti 0.3a	9/20/2016	62.9	30.12	9.6		39		2040.6	4.0	7.8	20.4	0.15	8913.0	302	-8.60	12.3	2870.1	42.0	7
Matriotti 0.3a	10/18/2016	59.2	30.00	8.5	77	38		1400.9	16.6	7.5	29.1	0.15	9183.7	305	-8.44	10.8	2451.1	55.7	3
Matriotti 0.3a	11/14/2016	133.7	30.03	8.4	76	52		1239.2	7.2	7.5	16.7	0.15	9129.4	306	-8.34	10.9	3077.9	51.9	4
Matriotti 0.3a	12/13/2016	42.6	30.31	11.0	86	19		1395.8	7.2	7.8	15.4	0.20	8799.7	313	-6.43	5.1	2053.9	46.1	4
Matriotti 0.3a	1/9/2017	180.4	29.58	11.0	87	28		1490.5	17.3	7.5	15.9	0.20	8564.2	314	-8.43	4.9	2398.1	72.9	8
Matriotti 0.3a	2/14/2017	25.5	29.87	12.0	94	53		1329.3	3.5	7.8	21.2	0.10	16208.2	279	-8.13	4.9	2089.0	69.5	10

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Matriotti 0.3a	3/14/2017	22.9	29.75	11.2	99	155		941.9	4.4	7.7	20.5	0.10	7465.2	274	-7.96	9.0	2010.2	106.3	7
Matriotti 0.3a	4/17/2017	39.9	29.76	11.4	105	196		876.3	3.4	8.0	22.2	0.10	8019.0	282	-8.30	11.3	2043.8	66.8	4
Matriotti 0.3a	5/9/2017	42.9	30.01	10.5	97	49		1253.3	4.7	7.9	25.1	0.10	9023.1	282	-8.56	11.9	1851.8	62.2	5
Matriotti 0.3a	6/13/2017	185.5	30.08	9.8	92	119		1507.6	5.9	7.9	23.4	0.10	7818.3	274	-8.62	12.6	2450.5	108.5	10
Matriotti 0.3a	7/18/2017	290.5	30.03	9.5	92	396		1497.3	4.5	7.9	40.8	0.10	9289.8	262	-8.67	13.8	3334.9	77.5	6
Matriotti 0.3a	8/14/2017	252.8	29.98	9.5	90	507		1456.2	3.7	7.9	30.0	0.10	7385.9	270	-8.57	13.3	2008.6	85.7	6
Matriotti 0.3a	9/19/2017	34.0	29.69	9.7	88	77		1764.4	4.0	7.7	17.4	0.10	8903.3	296	-8.52	10.6	2290.0	82.5	8
Matriotti 0.3a	10/10/2017	30.3	29.81	10.0	88	42		1686.9	3.2	8.0	11.1	0.10	8799.4	296	-8.60	9.7	2138.7	58.5	12
Matriotti 0.3a	11/13/2017		29.55	8.3	72	102				7.4		0.20		305	-8.30	8.5			8
Matriotti 0.3a	12/12/2017		30.43	10.3	80	10						0.10		300	-8.35	5.5			12
McDonald 01.6	11/24/2015		29.86	12.8		396	6.0			7.8		0.05		109		4.8			35
McDonald 01.6	1/26/2016					26	37.0					0.00		96		4.9			
McDonald 01.6	4/12/2016		29.93	11.8		2	11.8			8.1		0.07		139		8.6			1
McDonald 01.6	8/16/2016		29.98	10.0		12				8.1		0.10		202		14.8			0
McDonald 01.6	11/15/2016		29.68	11.5	99	8				8.0		0.07		149		8.5			1
McDonald 01.6	1/10/2017		29.60	14.2	100	4				7.9		0.07		155		0.7			5
McDonald 01.6	4/18/2017		29.80	11.8	99	2				8.0		0.10		117		7.5			4
McDonald 01.6	8/15/2017		29.85	10.6	99	2	11.0			8.2		0.10		178		12.5			1
McDonald 01.6	11/14/2017		29.73	12.4	100	8				7.6		0.00		87		5.7			15
McDonald 03.1	8/16/2016						0.9												
McDonald 03.1	11/15/2016						14.1												
McDonald 03.1	1/10/2017						14.2												
McDonald 03.1	4/18/2017						31.5												
McDonald 03.1	11/14/2017						50.4												
Meadowbrook 0.1	5/12/2015	5.0				2		2.1	0.5		19.1	0.10	6069.7		2.23	15.5	196.8	34.7	
Meadowbrook 0.1	6/11/2015	7.5				2		4.3	0.6		27.6	0.40	8156.8		2.22	15.2	196.8	34.7	
Meadowbrook 0.1	7/7/2015	13.0				10		5.6	0.6		24.7	0.50	6729.2		2.23	16.2	260.8	52.5	
Meadowbrook 0.1	8/13/2015	2.4				2		4.3	0.7		16.3	0.10	8700.8		2.15	19.7	203.1	37.7	
Meadowbrook 0.1	9/10/2015	11.8	30.13	5.8		2		9.6	0.6	7.3	15.9	0.11	9463.5	256	2.25	15.1	209.3	31.3	7
Meadowbrook 0.1	10/8/2015	12.4	30.11	5.1		90		10.8	0.9	7.3	23.1	0.10	7569.6	283		11.7	329.1	45.5	0

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Meadowbrook 0.1	11/23/2015	92.0	29.84	6.4		35		226.5	5.0	7.6	73.7	27.34	2953.4	42860	3.35	8.7	757.5	106.5	13
Meadowbrook 0.1	12/17/2015	63.7	29.65	9.2		56		266.9	5.3	7.7	72.6	21.48	4038.9	34600	3.70	6.1	813.9	117.2	17
Meadowbrook 0.1	1/25/2016	17.1				2		187.4	3.2		47.8	0.40	8477.3	748	2.79	6.1	667.3	76.3	
Meadowbrook 0.1	2/17/2016	23.0	29.36	6.2		10		164.2	1.8	6.9	52.8	12.00	7625.0	15000	3.49	8.9	697.1	82.3	3
Meadowbrook 0.1	3/15/2016	14.0	30.22	8.2		4		66.7	1.1	7.1	33.4	0.67	9225.5	1329	2.82	7.3	535.2	69.6	2
Meadowbrook 0.1	4/11/2016	8.2	30.14	7.6		2		8.7	0.7	7.3	32.7	0.18	6449.5	381	2.62	12.4	270.4	42.7	1
Meadowbrook 0.1	5/17/2016	4.6	30.30	7.9		13		2.1	0.5	7.4	20.9	0.11	6343.3	240	2.58	14.5	235.6	44.7	1
Meadowbrook 0.1	6/21/2016	5.8	30.30	5.1		10		6.6	0.4	7.2	19.2	0.11	6740.7	228	2.50	13.9	260.1	41.3	2
Meadowbrook 0.1	7/19/2016	1.0	30.12	4.3		20		5.0	1.3	7.2	35.9	0.27	6842.5	560	2.65	17.2	401.5	79.5	6
Meadowbrook 0.1	8/15/2016	2.7	30.10	7.6		8		3.7	0.7	7.6	71.3	0.20	7236.2	399	2.58	17.4	251.8	111.5	2
Meadowbrook 0.1	9/20/2016	15.9	30.15	7.1		8		7.4	0.5	7.5	46.6	0.20	7249.4	410	2.50	12.8	235.8	65.9	4
Meadowbrook 0.1	11/14/2016														3.04				
Meadowbrook 0.2	12/13/2016	11.9	30.34	8.0	60	4		225.7	2.3	8.1	15.5	0.10	7733.4	244		4.2	455.2	38.0	1
Meadowbrook 0.2	1/9/2017	132.2	29.60	9.6	81	2		208.4	4.3	7.0	45.2	18.70	3536.0	30810	-10.46	3.0	617.0	84.3	7
Meadowbrook 0.2	2/14/2017	14.4	29.50	9.5	73	32		215.4	2.1	7.7	23.8	0.20	14492.1	409	-10.84	4.2	481.3	58.0	4
Meadowbrook 0.2	3/14/2017	7.4	29.75	8.3	73	3		101.3	1.0	7.6	28.5	0.20	7014.0	317	-11.37	9.4	473.2	64.3	1
Meadowbrook 0.2	4/17/2017	6.0	29.80	8.4	79	12		13.8	0.7	7.7	21.8	0.14	7641.9	297	-11.27	12.5	489.2	62.4	2
Meadowbrook 0.2	5/9/2017	3.5	30.06	8.2	77	2		5.1	0.5	7.8	18.8	0.11	7351.8	234	-11.32	13.1	298.3	52.5	1
Meadowbrook 0.2	6/13/2017	2.6		8.2	82	2		3.0	0.4	8.1	17.0	0.10	6360.1	219	-11.28	15.5	289.5	56.3	1
Meadowbrook 0.2	7/18/2017	14.1	30.04	7.2	76	4		7.8	1.0	7.7	21.6	0.90	8073.0	1816	-12.22	18.0	282.0	71.7	2
Meadowbrook 0.2	8/14/2017	2.7	30.03	6.6	78	20		5.8	0.4	7.8	20.5	27.00	6767.4	42709	-12.29	15.0	274.9	71.4	2
Meadowbrook 0.2	9/19/2017	16.2	29.75	8.0	78	4		8.0	0.5	7.4	25.6	1.80	7081.2	3324	-12.40	13.1	221.7	74.2	2
Meadowbrook 0.2	10/10/2017	9.6	29.90	7.9	70	12		5.3	0.5	7.6	29.8	0.50	7218.3	1007	-12.40	9.8	171.3	65.0	2
Meadowbrook 0.2	11/13/2017		29.54	6.8	73	14						31.50		48666	-10.60	8.8			14
Meadowbrook 0.2	12/12/2017		30.46	8.2	68	2						7.20		12539	-11.70	5.8			4
Meadowbrook 0.6	11/14/2016	5.6	30.07	4.3	38	4		108.1	1.4	7.8	20.2	0.12	8349.1	253		5.5	457.8	49.6	
Meadowbrook 1.8	10/18/2016	10.5	30.01	6.3	55	10		175.7	1.3	7.6	17.6	0.12	7943.5	252		9.6	588.3	37.3	1
Meadowbrook Slough 0.23	5/12/2015	19.3				14		50.7	1.0		15.4	0.50	4292.7		-2.53	9.3	165.7	24.4	
Meadowbrook Slough 0.23	6/11/2015	56.6				4		54.6	1.1		22.6	0.10	5003.7		-2.25	12.1	236.3	30.3	
Meadowbrook Slough 0.23	7/7/2015	57.6				2		57.1	0.7		24.7	12.00	3754.2		-2.54	14.7	304.1	46.6	

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SITE	DATE	NH3 N	BARO.	DO	DO %SAT.	FECAL	FLOW	NO3 N	NO2 N	pH	P	SALINITY	Si	SpC	STAGE	TEMP.	TPN	TPP	TURBIDITY
Meadowbrook Slough 0.23	8/13/2015	15.1				2		98.5	1.6		22.5	0.10	5920.2		-2.65	15.6	191.6	32.6	
Meadowbrook Slough 0.23	9/10/2015	26.5	30.14	4.4		72		107.7	0.9	7.3	19.8	0.09	5950.8	177	-2.64	14.7	294.4	28.6	6
Meadowbrook Slough 0.23	10/8/2015	31.0	30.13	4.2		590		194.7	2.1	7.3	26.2	0.09	3836.0	187	-2.60	13.2	522.2	39.5	1
Meadowbrook Slough 0.23	11/23/2015	51.9	29.87	2.7		84		225.4	3.0	7.1	26.2	2.17	6015.1	4055	-2.23	9.8	366.5	33.5	2
Meadowbrook Slough 0.23	12/17/2015	100.9	29.69	8.3		126		176.4	3.6	7.3	65.1	20.60	5517.0	32900	-0.80	6.2	634.1	103.7	18
Meadowbrook Slough 0.23	1/25/2016	73.2				55		105.4	1.3		43.1	0.50	4976.3	1071	-1.96	6.1	332.8	63.0	
Meadowbrook Slough 0.23	2/17/2016	51.3	29.39	4.9		12		135.3	1.8	6.8	52.6	0.93	4861.7	1823	-1.18	7.1	417.7	68.8	3
Meadowbrook Slough 0.23	3/15/2016	34.6	30.20	5.5		4		59.8	1.3	6.9	29.1	6.32	4789.1	11112	-1.87	7.3	307.6	39.3	2
Meadowbrook Slough 0.23	4/11/2016	10.2	30.15	5.0		2		72.2	1.3	7.1	15.9	5.17	4224.8	9205	-2.12	8.5	181.9	17.0	1
Meadowbrook Slough 0.23	5/17/2016	17.5	30.32	6.9		32		48.7	0.7	7.6	19.1	0.07	4267.7	141	-2.20	9.7	128.1	35.0	1
Meadowbrook Slough 0.23	6/21/2016	19.0	30.33	5.8		75		36.0	0.6	7.7	19.5	0.06	4370.5	135	-1.25	10.6	160.7	31.5	4
Meadowbrook Slough 0.23	7/19/2016	18.8	30.11	4.7		2		50.8	0.6	7.4	19.2	0.07	4488.4	138	-2.12	11.8	145.5	27.5	1
Meadowbrook Slough 0.23	8/15/2016	18.1	30.10	5.0		108		44.1	0.8	7.4	23.6	0.10	4462.3	142	-2.22	13.6	129.3	53.3	1
Meadowbrook Slough 0.23	9/20/2016	21.0	30.17	5.3		36		73.0	0.6	7.5	20.2	0.08	4590.2	161	-2.30	13.0	221.4	31.8	1
Meadowbrook Slough 0.23	10/18/2016	34.5	30.01	1.1	11	12		68.5	1.5	7.0	21.8	11.20	3910.3	18890	-1.90	11.5	206.2	33.2	2
Meadowbrook Slough 0.23	11/14/2016	36.7	30.07	2.9	27	12		34.5	2.1	6.9	21.4	10.52	3698.8	1784	-0.73	10.5	193.5	41.8	5
Meadowbrook Slough 0.23	12/13/2016	27.7	30.35	5.2	46	6		66.5	1.5	7.4	16.3	8.70	4141.9	15004	-1.64	8.0	214.6	37.4	20
Meadowbrook Slough 0.23	1/9/2017	24.7	29.60	6.0	52	8		122.8	2.1	6.9	19.6	13.60	4081.2	22824	-1.18	5.2	233.8	38.8	7
Meadowbrook Slough 0.23	2/14/2017	24.7	30.00	6.8	55	2		112.9	0.9	7.6	20.4	0.60	8049.0	1227	-1.30	5.9	203.2	35.4	4
Meadowbrook Slough 0.23	3/14/2017	23.3	29.72	6.9	56	24		106.3	0.7	7.6	19.2	0.10	4039.8	170	-1.59	5.9	281.6	36.6	1
Meadowbrook Slough 0.23	4/17/2017	9.2	29.81	7.2	60	294		44.5	0.7	7.7	18.4	0.10	4847.6	162	-1.73	7.4	276.1	42.2	1
Meadowbrook Slough 0.23	5/9/2017	17.2	30.06	7.2	61	6		40.6	0.6	7.5	18.6	0.10	5098.3	155	-1.79	8.2	213.6	43.5	1
Meadowbrook Slough 0.23	6/13/2017	32.7	30.10	6.5	57	572		26.8	0.5	8.1	19.4	0.10	4101.9	122	-1.74	9.7	197.5	44.3	1
Meadowbrook Slough 0.23	7/18/2017	40.8	30.04	5.9	56	64		33.8	0.7	7.3	15.7	3.20	4967.4	5770	-2.75	12.4	157.6	44.4	2
Meadowbrook Slough 0.23	8/14/2017	17.9	30.02	2.7	26	30		47.4	0.4	7.2	17.4	4.40	4123.5	7885	-2.80	13.0	228.3	52.1	2
Meadowbrook Slough 0.23	9/19/2017	39.3	29.76	6.0	57	94		81.9	0.8	7.3	23.0	0.50	4282.6	1074	-2.87	13.3	195.2	52.7	2
Meadowbrook Slough 0.23	10/10/2017	20.4	29.88	5.9	55	130		83.0	0.8	7.6	18.2	0.20	4460.0	343	-2.83	11.7	179.8	44.0	1
Meadowbrook Slough 0.23	11/13/2017		29.58	5.8	55	62						13.50		22530	-0.95	8.7			10
Meadowbrook Slough 0.23	12/12/2017		30.49	5.5	52	10						22.40		35877	-2.00	7.5			6
No Name 0.03	11/24/2015		29.91	12.3		20				7.8		0.09		195	-2.42	6.0			6

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SITE	DATE	NH3 N	BARO.	DO	DO %SAT.	FECAL	FLOW	NO3 N	NO2 N	pH	P	SALINITY	Si	SpC	STAGE	TEMP.	TPN	TPP	TURBIDITY
No Name 0.03	1/26/2016					4						0.00		103	-2.34	6.7			
No Name 0.03	4/12/2016		30.06	11.4		2				7.6		0.08		170	-2.44	9.1			4
No Name 0.03	8/16/2016		30.10	9.1		2				7.9		0.10		273		15.8			12
No Name 0.03	11/15/2016		29.78	10.9	98	22				7.8		0.10		206	-2.41	10.1			3
No Name 0.03	1/10/2017		29.68	13.6	99	24				7.7		0.08		178	-2.40	2.0			9
No Name 0.03	4/18/2017		29.87	11.5	97	2				7.8		0.10		109	-2.32	7.9			11
No Name 0.03	8/15/2017		29.96	9.2	91	2				7.8		0.10		256	-2.50	15.0			13
No Name 0.03	11/14/2017		29.87	11.6	98	1				8.0		0.10		264	-2.46	7.8			28
Sequim Bay State Park Creek 0.0	5/12/2015					2						0.40			-5.92	10.0			
Sequim Bay State Park Creek 0.0	8/13/2015					2						0.50			-6.00	15.1			
Sequim Bay State Park Creek 0.0	10/8/2015	78.2	30.12	8.2		2	0.0	264.4	2.0	7.6	58.2	0.44	8337.6	892	-5.98	11.3	752.1	71.1	4
Sequim Bay State Park Creek 0.0	11/23/2015	0.0	29.87	12.5		2		1663.8	2.2	7.9	61.7	0.13	11402.0	281	-5.79	5.1	2956.4	85.2	6
Sequim Bay State Park Creek 0.0	12/17/2015	1.6	29.68	12.5		12		903.8	5.9	7.5	75.3	0.08	11364.6	176	-4.00	5.6	2166.2	134.0	19
Sequim Bay State Park Creek 0.0	1/25/2016	5.7				8		362.8	4.1		68.3	0.10	9387.6	210	-5.70	5.2	1301.5	116.1	
Sequim Bay State Park Creek 0.0	2/17/2016	6.1	29.41	11.9		14		330.0	4.0	7.5	70.8	0.10	9032.3	201	-4.91	7.5	1219.5	108.5	17
Sequim Bay State Park Creek 0.0	3/15/2016	6.5	30.19	12.6		10		507.0	4.1	7.5	74.7	0.08	11698.6	163	-5.42	5.6	1828.1	132.8	27
Sequim Bay State Park Creek 0.0	4/11/2016	6.9	30.14	11.1		2		70.1	1.2	7.9	60.5	0.18	9019.4	369	-5.78	9.2	541.2	63.3	2
Sequim Bay State Park Creek 0.0	5/17/2016	6.4	30.30	10.5		1		178.3	0.4	7.9	61.4	0.23	9100.7	476	-6.81	10.2	509.3	70.9	1
Sequim Bay State Park Creek 0.0	6/21/2016	4.0	30.30	10.1		10		99.1	0.4	7.8	63.6	0.24	8533.1	486	-5.80	11.7	498.3	71.0	1
Sequim Bay State Park Creek 0.0	7/19/2016	3.8	30.11	8.1		8		221.7	0.2	7.6	65.0	0.34	8832.1	688	-5.85	13.6	624.7	70.6	1
Sequim Bay State Park Creek 0.0	8/15/2016	5.1	30.10	8.3		2		351.9	0.5	7.5	64.2	0.50	8844.1	939	-5.87	13.9	673.1	63.3	0
Sequim Bay State Park Creek 0.0	10/18/2016																		
Sequim Bay State Park Creek 0.0	12/13/2016																		
Sequim Bay State Park Creek 0.0	1/9/2017																		
Sequim Bay State Park Creek 0.0	2/14/2017	6.9	30.03	13.5	99	6		525.1	2.2	8.0	48.3	0.10	17504.7	240	-5.70	2.7	1135.2	96.3	11
Sequim Bay State Park Creek 0.0	4/17/2017																		
Sequim Bay State Park Creek 0.0	5/9/2017																		

SITE	DATE	NH3 N	BARO.	DO	DO %SAT.	FECAL	FLOW	NO3 N	NO2 N	pH	P	SALINITY	Si	SpC	STAGE	TEMP.	TPN	TPP	TURBIDITY
Sequim Bay State Park Creek 0.0	6/13/2017	5.2	30.11	10.6	97	64		163.1	1.0	8.0	62.0	0.20	8929.5	405	-5.82	11.6	651.4	110.3	4
Sequim Bay State Park Creek 0.0	7/18/2017	61.5	30.05	1.1	13	4		168.7	2.5	7.0	50.8	26.30	8921.9	41005	-5.91	13.7	624.8	84.7	4
Sequim Bay State Park Creek 0.0	8/14/2017	68.5	30.02	1.5	17	8		149.2	4.4	7.4	49.8	22.50	6574.2	35644	-5.93	13.9	602.5	92.0	2
Sequim Bay State Park Creek 0.0	9/19/2017	43.5	29.74	3.2	34	248		106.1	4.0	7.3	45.7	26.30	4654.7	41151	-5.90	11.0	499.0	79.3	2
Sequim Bay State Park Creek 0.0	10/10/2017																		
Sequim Bay State Park Creek 0.0	11/13/2017		29.62	11.5	98	24						0.20		329	-5.68	7.7			11
Sequim Bay State Park Creek 0.0	12/12/2017		30.50	13.1	98	2						0.10		296	-5.75	4.1			2
Siebert 1.0	11/24/2015		29.91	12.9		82				7.7		0.05		103		4.6			44
Siebert 1.0	1/26/2016					14						0.00		90	-17.30	5.2			
Siebert 1.0	4/12/2016		29.92	11.6		2				8.0		0.08		165	-17.95	9.3			1
Siebert 1.0	8/16/2016		29.98	10.1		2				8.1		0.10		218	-17.70	8.3			
Siebert 1.0	11/15/2016		29.69	11.5	99	2				8.1		0.07		148	-17.30	8.6			0
Siebert 1.0	1/10/2017		29.58	14.4	100	1				7.9		0.07		150	-17.40	0.4			4
Siebert 1.0	4/18/2017		29.84	11.7	98	2				8.4		0.10		123	-17.35	4.8			
Siebert 1.0	8/15/2017		29.87	10.4	102	6				8.3		0.10		213	-17.64	14.0			1
Siebert 1.0	11/14/2017		29.75	12.3	100	18				7.7		0.00		77	-16.85	6.3			22

Segmented Sampling Data

Column Headings
SITE = Segmented Sampling Site
EVENT = Reason for Sample (Plume Response or Regular Segmented Sampling)
TYPE = Type of Sample (Primary or Field Replicate)
DATE = Date of Visit
TIME = Time Sample Collected
TEMP. = Water Temperature in deg. C
SAL. = Salinity in ppt
SAL. QUAL. = Salinity Qualifier
FOWL = Evidence of Waterfowl Present?
FECAL = Fecal Coliforms in CFU/100 ml
FECAL QUAL. = Fecal Coliform Qualifier
COMP. = Composite Value (Primary and Lab Duplicate Averaged)?
TOT. COL. = Total Coliforms
COL. QUAL. = Total Coliforms Qualifier
E. COLI = Total E. Coli
E. COLI QUAL. = Total E. Coli Qualifier

Data Qualifiers
TNTC = Too numerous to count
N = Analyte likely present, unreadable
G = Real value likely greater than count
U = Under/less than (analyte not observed/below detection limit)
J = Estimate/analyte present but difficult to read

SITE	EVENT	TYPE	DATE	TIME	TEMP.	SAL.	SAL. QUAL.	FOWL	FECAL	FECAL QUAL.	COMP.	TOT. COL.	COL. QUAL.	E. COLI	E. COLI QUAL.
130 Sea Lawn	plume	primary	10/1/2015	12:00					3276	G		24192	G	2924	
210 Sea Lawn	plume	primary	6/29/2015	11:10					1064	G		24192	G	211	
GS1	plume	primary	8/29/2016	13:30					3	U	Y				
GS1	segmented	primary	11/4/2015	10:45	9.6	28			356	TNTC					
GS1	segmented	primary	4/27/2016	9:31	12.4	8.1			52						
GS1	segmented	primary	8/16/2016	9:46	18.2	24			94						
GS1	segmented	primary	10/26/2016	10:15	12.3	6.3			94						
GS1	segmented	primary	12/27/2016	13:45					184						

SITE	EVENT	TYPE	DATE	TIME	TEMP.	SAL.	SAL. QUAL.	FOWL	FECAL	FECAL QUAL.	COMP.	TOT. COL.	COL. QUAL.	E. COLI	E. COLI QUAL.
GS1	segmented	primary	1/26/2017	11:34	8.1	30			6						
GS1	segmented	primary	9/5/2017		20	22			432						
GS1	segmented	primary	10/13/2017	10:00	10.4	25.62	J		8						
GS10	plume	primary	9/1/2015	10:20					2960						
GS10	segmented	primary	11/4/2015	12:45	11.1	0.8				N					
GS10	segmented	primary	4/27/2016	11:15	16.8	10.1			168						
GS10	segmented	primary	8/16/2016	11:16	19.8	19.6			448						
GS10	segmented	primary	10/26/2016	11:30					202	G					
GS10	segmented	primary	12/27/2016	11:20	6.8	27			38						
GS10	segmented	primary	1/26/2017	10:56	6.5	14			9		Y				
GS10	segmented	primary	9/5/2017		22.2	19.7			352						
GS10	segmented	primary	10/13/2017		12.9	13.78	J		161	J	Y				
GS11	plume	primary	8/29/2016	13:10					115		Y				
GS11	segmented	primary	11/4/2015	12:58	11.2	0.9			1592	TNTC					
GS11	segmented	primary	4/27/2016	11:36	17.4	9.2			116						
GS11	segmented	primary	8/16/2016	11:36	22.3	20			234						
GS11	segmented	primary	10/26/2016	11:45					408	G					
GS11	segmented	primary	12/27/2016	11:10	7	25.9			48		Y				
GS11	segmented	primary	1/26/2017	10:50	7.1	19.7			6						
GS11	segmented	primary	9/5/2017		22.5	19.6			456						
GS11	segmented	primary	10/13/2017		13.9	14.02	J		210						
GS12	plume	primary	10/1/2015	11:20					1780	G		24192	G	1003	
GS12	segmented	primary	11/4/2015	1:10	10.9	1			1868	TNTC					
GS12	segmented	primary	4/27/2016	11:48	16.8	8.7			170						
GS12	segmented	replicate	4/27/2016	11:49	16.8	8.7			157		Y				
GS12	segmented	primary	8/16/2016	12:07	22	20			63						

SITE	EVENT	TYPE	DATE	TIME	TEMP.	SAL.	SAL. QUAL.	FOWL	FECAL	FECAL QUAL.	COMP.	TOT. COL.	COL. QUAL.	E. COLI	E. COLI QUAL.
GS12	segmented	primary	10/26/2016	11:48					348	G					
GS12	segmented	primary	12/27/2016	11:05	6.9	25.5			18						
GS12	segmented	primary	1/26/2017	10:46	6.6	14.5			6						
GS12	segmented	primary	9/5/2017		20.7	18.9			214						
GS12	segmented	primary	10/13/2017		12.5	13.79	J		206						
GS13	plume	primary	9/21/2017	11:40					284		Y				
GS13	segmented	primary	11/4/2015	1:20	10.7	1			1996	TNTC					
GS13	segmented	primary	4/27/2016	12:00	17.2	8.6			172						
GS13	segmented	primary	8/16/2016	12:10	22.3	20			606						
GS13	segmented	primary	10/26/2016	11:57					660	G					
GS13	segmented	primary	12/27/2016	10:50	6.7	27.9			58						
GS13	segmented	primary	1/26/2017	10:36	5.9	14			68						
GS13	segmented	primary	9/5/2017		21	18.9			644						
GS13	segmented	primary	10/13/2017		13.9	13.99	J		84						
GS14	plume	primary	6/29/2015	11:40					959	G	Y	24192	G	519	
GS14	plume	primary	10/1/2015	11:45					1964	G	Y	24192	G	728	
GS14	plume	primary	8/29/2016	13:00					26		Y				
GS14	plume	primary	9/21/2017	11:30					42						
GS14	segmented	primary	11/4/2015	1:30	12.2	0.6			1328	TNTC					
GS14	segmented	primary	4/27/2016	12:05	17.8	12.4			186		Y				
GS14	segmented	primary	8/16/2016	12:15	24.2	19.6			80						
GS14	segmented	primary	10/26/2016	12:00					218						
GS14	segmented	primary	12/27/2016	11:35	7.1	26			90		Y				
GS14	segmented	primary	1/26/2017	11:06	7.3	18			48						
GS14	segmented	primary	9/5/2017		23.3	19.8			330						
GS14	segmented	primary	10/13/2017		14.8	13.59	J		206						

SITE	EVENT	TYPE	DATE	TIME	TEMP.	SAL.	SAL. QUAL.	FOWL	FECAL	FECAL QUAL.	COMP.	TOT. COL.	COL. QUAL.	E. COLI	E. COLI QUAL.
GS14b	plume	primary	6/29/2015	11:30					557		Y	24192	G	997	
GS14b	plume	primary	10/1/2015	11:35					1388	G		24192	G	550	
GS15	segmented	primary	10/26/2016	12:10					612						
GS15	segmented	primary	12/27/2016	13:48					6						
GS15	segmented	primary	1/26/2017	11:10	5.4	6.5			8		Y				
GS15	segmented	primary	9/5/2017		17.8	0.3			425		Y				
GS15	segmented	primary	10/13/2017		9.3	0.27	J		14		Y				
GS2	segmented	primary	11/4/2015	10:51	10.1	2.7			2648	TNTC					
GS2	segmented	replicate	11/4/2015	10:51	10.1	2.7			2466	TNTC	Y				
GS2	segmented	primary	4/27/2016	9:41	14.2	9		Y	72						
GS2	segmented	primary	8/16/2016	10:00	18.8	24			92						
GS2	segmented	primary	10/26/2016	10:25					1000	TNTC					
GS2	segmented	primary	12/27/2016	9:35	5.1	25.3			396						
GS2	segmented	primary	1/26/2017	9:35	7.3	26.5			10						
GS2	segmented	primary	9/5/2017		20.3	21.4		Y	161		Y				
GS2	segmented	primary	10/13/2017		10.5	14.94	J	Y	38						
GS3	segmented	primary	11/4/2015	10:55	10.1	2.3			1768	TNTC					
GS3	segmented	primary	4/27/2016	9:54	14.8	7.3			72						
GS3	segmented	primary	8/16/2016	10:03	18.2	10			110						
GS3	segmented	primary	10/26/2016	10:30					134						
GS3	segmented	primary	12/27/2016	9:40	5.4	28.76			182						
GS3	segmented	primary	1/26/2017	9:45	6.9	23			46						
GS3	segmented	primary	9/5/2017		20.8	21.6			168						
GS3	segmented	primary	10/13/2017		13.2	16.2	J		64						
GS4	segmented	primary	11/4/2015	11:15	10.3	2.4			3388	TNTC					
GS4	segmented	primary	4/27/2016	10:04	14.3	10.7		Y	44						

SITE	EVENT	TYPE	DATE	TIME	TEMP.	SAL.	SAL. QUAL.	FOWL	FECAL	FECAL QUAL.	COMP.	TOT. COL.	COL. QUAL.	E. COLI	E. COLI QUAL.
GS4	segmented	primary	8/16/2016	10:15	19.2	24.8			38						
GS4	segmented	primary	10/26/2016	10:40					198						
GS4	segmented	primary	12/27/2016	10:15	5.6	29.2			192						
GS4	segmented	primary	1/26/2017	9:55	6.1	17			2						
GS4	segmented	primary	9/5/2017		20.3	21.6			54						
GS4	segmented	primary	10/13/2017		12.5	15.55	J		18						
GS5	segmented	primary	11/4/2015	11:44	10.7	2.4			1936	TNTC					
GS5	segmented	primary	4/27/2016	10:12	15	16			72						
GS5	segmented	primary	8/16/2016	10:23	21.5	25.7			16						
GS5	segmented	primary	10/26/2016	10:45					140						
GS5	segmented	primary	12/27/2016	10:00	6	29.15			36						
GS5	segmented	primary	1/26/2017	10:09	6.4	20			2						
GS5	segmented	primary	9/5/2017		21.6	21.7			32						
GS5	segmented	primary	10/13/2017		14.4	16.77	J		30						
GS6	segmented	primary	11/4/2015	12:08	10.8	2.1			2000	TNTC					
GS7	plume	primary	8/29/2016	13:20					178		Y				
GS7	plume	primary	9/21/2017	11:30					22						
GS7	segmented	primary	11/4/2015	12:18	10	2.2			1768	TNTC					
GS7	segmented	primary	4/27/2016	10:27	15.2	16.5		Y	64						
GS7	segmented	primary	8/16/2016	10:30	19.4	21			306						
GS7	segmented	primary	10/26/2016	10:54					390	G					
GS7	segmented	primary	12/27/2016	10:30	5.5	29.1			64						
GS7	segmented	primary	1/26/2017	10:20	7.3	28			20						
GS7	segmented	primary	9/5/2017		20.1	20.3			506						
GS7	segmented	primary	10/13/2017		14.1	17.59	J		46						
GS8	plume	primary	6/29/2015	11:20					2760	TNTC		24192	G	293	

SITE	EVENT	TYPE	DATE	TIME	TEMP.	SAL.	SAL. QUAL.	FOWL	FECAL	FECAL QUAL.	COMP.	TOT. COL.	COL. QUAL.	E. COLI	E. COLI QUAL.
GS8	segmented	primary	11/4/2015	12:25	10.2	1			4080	TNTC					
GS8	segmented	primary	4/27/2016	10:34	15.7	7.8			121		Y				
GS8	segmented	primary	8/16/2016	10:45	19.4	19.5			540						
GS8	segmented	primary	10/26/2016	11:00					610	G					
GS8	segmented	primary	12/27/2016	10:40	6.2	28.7			60						
GS8	segmented	primary	1/26/2017	10:30	6.5	16			30						
GS8	segmented	primary	9/5/2017		20.5	19.5			506						
GS8	segmented	primary	10/13/2017		14.2	15.35	J		136						
GS9	plume	primary	6/29/2015	11:00					1114	G		24192	G	593	
GS9	plume	primary	10/1/2015	11:05					1432	G		24192	G	408	
GS9	segmented	primary	11/4/2015	12:35	10.4	1.1			1972	TNTC					
GS9	segmented	primary	4/27/2016	10:40	15.6	9.5			270						
GS9	segmented	primary	8/16/2016	11:00	20	19.1			268						
GS9	segmented	primary	10/26/2016	11:07					440	G					
GS9	segmented	primary	12/27/2016	11:00	6.7	27.9			68						
GS9	segmented	primary	1/26/2017	10:45	7.2	16.5			12						
GS9	segmented	primary	9/5/2017		20.9	19.3			426						
GS9	segmented	primary	10/13/2017		12.7	13.92	J		120						
Legacy 2	plume	primary	8/29/2016	13:12					53						
MC1	segmented	primary	10/6/2015	12:15	12.3	0.4			140						
MC1	segmented	primary	5/2/2016	11:22	16.2	0.2			14						
MC1	segmented	primary	10/25/2016	11:22	11.1	2.4			36						
MC1	segmented	primary	4/4/2017	12:18	8	0.2			3		Y				
MC1a	segmented	primary	6/26/2017	13:20					50						
MC1a	segmented	primary	7/5/2017	12:07					4						
MC2	segmented	primary	10/6/2015	12:35	10.9	0.1			66						

SITE	EVENT	TYPE	DATE	TIME	TEMP.	SAL.	SAL. QUAL.	FOWL	FECAL	FECAL QUAL.	COMP.	TOT. COL.	COL. QUAL.	E. COLI	E. COLI QUAL.
MC2	segmented	primary	5/2/2016	11:10	13.3	0.2			22						
MC2	segmented	replicate	5/2/2016	11:11	13.3	0.2			6						
MC2	segmented	primary	8/16/2016	14:50	19.7	0.2			4		Y				
MC2	segmented	primary	10/25/2016	11:10	10.2	2.8			26						
MC2A	segmented	primary	4/4/2017	11:46	9.2	0.1			6						
MC3	segmented	primary	10/6/2015	12:50	10.1	0.1			46						
MC3	segmented	primary	5/2/2016	10:50	11.4	0.1			20						
MC3	segmented	primary	8/16/2016	14:45	14.5	0.1			8						
MC3	segmented	primary	10/25/2016	11:00	10.2	0.2			22						
MC3	segmented	primary	4/4/2017	11:36	8.8	0.1			2						
MC4	segmented	primary	10/6/2015	14:25	10.2	0.1			152		Y				
MC4	segmented	primary	5/2/2016	10:30	10.7	0.1			8						
MC4	segmented	primary	8/16/2016	12:45	14	0.1			38						
MC4	segmented	primary	10/25/2016	10:45	10.4	0.1			26						
MC4	segmented	primary	4/4/2017	13:25	9.5	0.1			2		Y				
MS1	segmented	primary	10/6/2015	13:15	13.3	0.1			728	G					
MS1	segmented	primary	11/24/2015	9:40	6.8	0.1			126						
MS1	segmented	primary	5/2/2016	12:00	9.6	0.1			32						
MS1	segmented	primary	8/16/2016	13:33	17.5	0.1			24						
MS1	segmented	replicate	8/16/2016	13:33	17.5	0.1			35		Y				
MS1	segmented	primary	10/25/2016	12:30	12.1	7.2			64						
MS1	segmented	primary	4/4/2017	13:00	6.7	0.1			10						
MS1	segmented	primary	4/5/2017	12:45	7.2	0.1			6						
MS1	segmented	primary	4/6/2017	10:33	6.5	0.1			10						
MS1	segmented	primary	6/14/2017	12:40					118						
MS1	segmented	primary	6/26/2017	12:22					286						

Clallam County Environmental Health Services
C17104/PC-00J88801/PC-00J32601

SITE	EVENT	TYPE	DATE	TIME	TEMP.	SAL.	SAL. QUAL.	FOWL	FECAL	FECAL QUAL.	COMP.	TOT. COL.	COL. QUAL.	E. COLI	E. COLI QUAL.
MS1	segmented	primary	7/5/2017	11:30					102						
MS1a	segmented	primary	11/24/2015	9:35	7.1	0.3			146						
MS1a	segmented	primary	5/2/2016	11:46	13.5	0.1			6						
MS1a	segmented	primary	8/16/2016	13:29	17.5	0.1			2						
MS1a	segmented	primary	10/25/2016	12:35	12.3	3.2			16						
MS1a	segmented	replicate	10/25/2016	12:36	12.3	3.2			18		Y				
MS1a	segmented	primary	4/4/2017	12:04	8.8	0.2			2	U					
MS1a	segmented	primary	4/5/2017	12:51	8	0.1			2	U					
MS1a	segmented	primary	4/6/2017	10:36	7.5	0.1			6						
MS1a	segmented	primary	6/14/2017	12:30					80						
MS1a	segmented	primary	6/26/2017	12:20					246						
MS1a	segmented	primary	7/5/2017	11:20					28						
MS2	segmented	primary	10/6/2015	13:29	13.4	0			228						
MS2	segmented	primary	11/24/2015	9:55	6.4	0.1			196						
MS2	segmented	primary	5/2/2016	12:07	9.5	0.1			16						
MS2	segmented	primary	10/25/2016	12:18	12.1	0.1			18						
MS2	segmented	primary	4/4/2017	12:50	7.3	0.1			124						
MS2	segmented	primary	4/5/2017	12:35	7	0.1			1010	G	Y				
MS2	segmented	primary	4/6/2017	10:26	6.4	0.1			148		Y				
MS2	segmented	primary	6/14/2017	12:50					436						
MS2	segmented	primary	6/26/2017	12:30					102		Y				
MS2	segmented	primary	7/5/2017	11:40					4						
MS2a	segmented	primary	11/24/2015	9:48	7.1	2.3			160						
MS2a	segmented	replicate	11/24/2015	9:48	7.1	2.3			160		Y				
MS2a	segmented	primary	5/2/2016	12:01	11	0.1			10						
MS2a	segmented	primary	8/16/2016	13:42	14.9	0.1			108						

SITE	EVENT	TYPE	DATE	TIME	TEMP.	SAL.	SAL. QUAL.	FOWL	FECAL	FECAL QUAL.	COMP.	TOT. COL.	COL. QUAL.	E. COLI	E. COLI QUAL.
MS2a	segmented	primary	10/25/2016	12:27	12.1	0.1			30		Y				
MS2a	segmented	primary	4/4/2017	13:01	6.8	0.1			20						
MS2a	segmented	primary	4/5/2017	12:55	7.3	0.1			74						
MS2a	segmented	primary	4/6/2017	10:40	6.5	0.1			12						
MS2a	segmented	primary	6/14/2017	12:35					325		Y				
MS2a	segmented	primary	6/26/2017	12:25					468						
MS2a	segmented	primary	7/5/2017	11:35					128						
MS3	segmented	primary	10/6/2015	13:40	13.7	0.1			266						
MS3	segmented	primary	11/24/2015	10:00	6.1	0.1			186						
MS3	segmented	primary	5/2/2016	12:25	9.9	0.1			2	U					
MS3	segmented	primary	8/16/2016	13:50	13.8	0.1			288						
MS3	segmented	primary	10/25/2016	12:15	12.1	0.1			94						
MS3	segmented	primary	4/4/2017	12:40	6.9	0.1			4						
MS3	segmented	primary	4/5/2017	12:29	7.8	0.1			24						
MS3	segmented	primary	4/6/2017	10:20	7.4	0.1			2						
MS3	segmented	primary	6/14/2017	13:00					236						
MS3	segmented	primary	6/26/2017	12:36					168						
MS3	segmented	primary	7/5/2017	11:45					12						
MS4	segmented	primary	10/6/2015	13:55	13.1	0.1			118						
MS4	segmented	primary	11/24/2015	10:05	8.7	0.1			2	U					
MS4	segmented	primary	5/2/2016	12:31	8.7	0.1			2	U					
MS4	segmented	primary	8/16/2016	14:00	14.2	0.1			292						
MS4	segmented	primary	10/25/2016	11:56	12.3	0.1			6						
MS4	segmented	primary	4/4/2017	12:34	6.7	0.1			2						
MS4	segmented	primary	4/5/2017	12:20	7.8	0.1			6						
MS4	segmented	primary	4/6/2017	10:13	6.7	0.1			2	U					

SITE	EVENT	TYPE	DATE	TIME	TEMP.	SAL.	SAL. QUAL.	FOWL	FECAL	FECAL QUAL.	COMP.	TOT. COL.	COL. QUAL.	E. COLI	E. COLI QUAL.
MS4	segmented	primary	6/14/2017	13:05					360						
MS4	segmented	primary	6/26/2017	12:41					834						
MS4	segmented	primary	7/5/2017	11:50					2						
MS5	segmented	primary	10/6/2015	14:10	13.2	0.1			508	G					
MS5	segmented	primary	11/24/2015	10:07	8.2	0.1			2						
MS5	segmented	primary	5/2/2016	12:35	10.7	0.1			6						
MS5	segmented	primary	8/16/2016	13:53	14.8	0.1			966						
MS5	segmented	primary	10/25/2016	11:57	11.3	0.1			12						
MS5	segmented	primary	4/4/2017	12:36	6.9	0.1			6						
MS5	segmented	primary	4/5/2017	12:23	7.6	0.1			22						
MS5	segmented	primary	4/6/2017	10:15	6.5	0.1			2						
MS5	segmented	primary	6/14/2017	13:06					8						
MS5	segmented	primary	6/26/2017	12:42					2						
MS5	segmented	primary	7/5/2017	11:52					2	U					
MS6	segmented	primary	11/24/2015	10:15	5.7	0.1			10						
MS6	segmented	primary	5/2/2016	13:06	11.7	0.1			2	U					
MS6	segmented	primary	8/16/2016	13:00	16.7	0.1			2	U					
MS6	segmented	primary	10/25/2016	12:40	11.6	0.1			2	U					
MS6	segmented	primary	4/4/2017	13:16	7.7	0.1			2	U					
MS6	segmented	primary	6/14/2017	13:50					2						
MS6	segmented	primary	6/26/2017	13:40					12						
MS6	segmented	primary	7/5/2017	12:21					2	U					
MC1b	segmented	primary	11/3/2017	11:20	6.8	2.9			112						
MC2A	segmented	primary	11/3/2017	11:02	6.3	1		Y	18						
MC3	segmented	primary	11/3/2017	10:52	6.7	0.1			62						
MC4	segmented	primary	11/3/2017	10:38	7.2	0.1			60						

Ozark UNDERGROUND LABORATORY 1572 Aley Lane • Protem, MO 65733 • (417) 785-4289 • fax (417) 785-4290 • contact@ozarkundergroundlab.com

Certificate of Analysis

Date of certificate: September 4, 2015

Client: Clallam County Environmental Health
223 E. 4th St., Suite 14
Port Angeles, WA 98362

Project name: Golden Sands Slough - 2015

Contact person: Andy Perham (a.perham@co.clallam.wa.us)

Samples collected by: ABP

Date samples shipped: August 26, 2015

Date samples rec'd at OUL: August 28, 2015

Date analyzed by OUL: September 3, 2015

Included with certificate of analysis:
Table of results, copy of sample collection data sheets, discrepancy sheet and analysis graphs

Results for charcoal samplers analyzed for the presence of fluorescein, eosine and rhodamine WT (RWT) dyes.

Peak wavelengths are reported in nanometers (nm); dye concentrations are reported in parts per billion (ppb).

OUL Number	Station Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein		Eosine		RWT	
					Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
Y9566	**1**	**11 GS**	**8/4/15 1120**	**8/11/15 1325**	**516.2**	**0.302**	**ND**		**ND**	
Y9572	1	11 GS	8/11/15 1325	8/19/15 1020	516.2 *	0.370	ND		ND	
Y9578	1	11 GS	8/19/15 1020	8/25/15 1120	515.8	0.304	ND		ND	
Y9567	**2**	**21 GSa**	**8/4/15 1130**	**8/11/15 1330**	**ND**		**ND**		**ND**	
Y9573	2	21 GSa	8/11/15 1330	8/19/15 1030	515.2 *	0.225	ND		ND	
Y9579	2	21 GSa	8/19/15 1030	8/25/15 1130	ND		ND		ND	
Y9568	**3**	**21 GSb**	**8/4/15 1140**	**8/11/15 1335**	**ND**		**ND**		**ND**	
Y9574	3	21 GSb	8/11/15 1335	8/19/15 1035	514.6	1.61	ND		ND	
Y9581	3	21 GSb	8/19/15 1035	8/25/15 1135	ND		ND		ND	
Y9569	**4**	**131 GSa**	**8/4/15 1145**	**8/11/15 1245**	**515.2**	**4.18**	**540.2**	**1.19**	**ND**	
Y9575	4	131 GSa	8/11/15 1245	8/19/15 1100	514.8	0.600	ND		ND	
Y9582	4	131 GSa	8/19/15 1100	8/25/15 1150	ND		ND		ND	
Y9570	**5**	**131 GSb**	**8/4/15 1150**	**8/11/15 1300**	**516.2**	**0.654**	**ND**		**ND**	

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OUL Number	Station Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein		Eosine		RWT	
					Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
Y9576	5	131 GSb	8/11/15 1300	8/19/15 1110	515.0 *	0.241	ND		ND	
Y9583	5	131 GSb	8/19/15 1110	8/25/15 1155	ND		ND		ND	
Y9571	**6**	**131 GSc**	**8/4/15 1155**	**8/11/15 1315**	**515.4**	**0.460**	**ND**		**ND**	
Y9577	6	131 GSc	8/11/15 1315	8/19/15 1120	514.6	0.321	ND		ND	
Y9584	6	131 GSc	8/19/15 1120	8/25/15 1210	ND		ND		ND	
Y9580	Laboratory control charcoal blank									

Note: Dye concentrations are based upon standards used at the OUL. The standard concentrations are based upon the as sold weight of the dye that the OUL uses. If the client is not using OUL dyes, the client should provide the OUL with a sample of the dye to compare to the OUL dyes.

Footnotes: ND = No dye detected

* = A fluorescence peak is present that does not meet all the criteria for a positive dye result. However, it has been calculated as though it was the tracer dye.

Thomas J. Aley, PHG and RG

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Certificate of Analysis

Date of certificate: September 18, 2015
Client: Clallam County Environmental Health
223 E. 4th St., Suite 14
Port Angeles, WA 98362
Project name: Golden Sands Slough - 2015
Contact person: Andy Perham (a.perham@co.clallam.wa.us)

Samples collected by: Andy Perham
Date samples shipped: September 14, 2015
Date samples rec'd at OUL: September 16, 2015
Date analyzed by OUL: September 17, 2015
Included with certificate of analysis:
Table of results, copy of sample collection data sheet and analysis graphs

Results for charcoal samplers analyzed for the presence of fluorescein, eosine and rhodamine WT (RWT) dyes.
Peak wavelengths are reported in nanometers (nm); dye concentrations are reported in parts per billion (ppb).

OUL Number	Station Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein		Eosine		RWT	
					Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
Y9944	**7**	**81 GS**	**8/19/15 1210**	**8/25/15 1215**	**ND**		**ND**		**ND**	
Y9947	7	81 GS	8/25/15 1215	9/1/15 1030	ND		ND		ND	
Y9950	7	81 GS	9/1/15 1030	9/9/15 1115	516.4 *	0.322	ND		ND	
Y9945	**8**	**20 Sea Lawn**	**8/19/15 1220**	**8/25/15 1230**	**ND**		**ND**		**ND**	
Y9948	8	20 Sea Lawn	8/25/15 1230	9/1/15 1050	ND		ND		ND	
Y9951	8	20 Sea Lawn	9/1/15 1050	9/9/15 1125	ND		ND		ND	
Y9946	**9**	**40 Sea Lawn**	**8/19/15 1230**	**8/25/15 1225**	**ND**		**ND**		**ND**	
Y9949	9	40 Sea Lawn	8/25/15 1245	9/1/15 1110	515.6 *	0.271	ND		ND	
Y9952	9	40 Sea Lawn	9/1/15 1110	9/9/15 1140	ND		ND		ND	

Note: Dye concentrations are based upon standards used at the OUL. The standard concentrations are based upon the as sold weight of the dye that the OUL uses. If the client is not using OUL dyes, the client should provide the OUL with a sample of the dye to compare to the OUL dyes.

Footnotes: ND = No dye detected

* = A fluorescence peak is present that does not meet all the criteria for a positive dye result. However, it has been calculated as though it was the tracer dye.

Thomas J. Aley, PHG and RG

Thomas Aley

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Certificate of Analysis

Date of certificate: October 8, 2015
Client: Clallam County Environmental Health
223 E. 4th St., Suite 14
Port Angeles, WA 98362
Project name: Golden Sands Slough
Contact person: Andy Perham (a.perham@co.clallam.wa.us)

Samples collected by: Andy Perham
Date samples shipped: September 30, 2015
Date samples rec'd at OUL: October 2, 2015
Date analyzed by OUL: October 7, 2015
Included with certificate of analysis:
Table of results, copy of sample collection data sheet and analysis graphs

Results for charcoal samplers analyzed for the presence of fluorescein, eosine and rhodamine WT (RWT) dyes.
Peak wavelengths are reported in nanometers (nm); dye concentrations are reported in parts per billion (ppb).

OUL Number	Station Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein		Eosine		RWT	
					Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
B0430	10	61 GSa	9/9/15 1030	9/15/15 1045	ND		ND		ND	
B0431	11	61 GSb	9/9/15 1040	9/15/15 1055	ND		ND		ND	
B0432	12	70 Sea Lawn	9/9/15 1155	9/15/15 1115	ND		ND		ND	
B0433	10	61 GSa	9/15/15 1045	9/22/15 1030	ND		ND		ND	
B0434	11	61 GSb	9/15/15 1055	9/22/15 1035	ND		ND		ND	
B0435	12	70 Sea Lawn	9/15/15 1115	9/22/15 1015	ND		ND		ND	
B0436	10	61 GSa	9/22/15 1030	9/29/15 1335	ND		ND		ND	
B0437	11	61 GSb	9/22/15 1035	9/29/15 1340	ND		ND		ND	
B0438	12	70 Sea Lawn	9/22/15 1015	9/29/15 1325	ND		ND		ND	

Note: Dye concentrations are based upon standards used at the OUL. The standard concentrations are based upon the as sold weight of the dye that the OUL uses. If the client is not using OUL dyes, the client should provide the OUL with a sample of the dye to compare to the OUL dyes.

Footnotes: ND = No dye detected

Thomas J. Aley, PHG and RG

Thomas Aley

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Ozark UNDERGROUND LABORATORY 1572 Aley Lane • Protem, MO 65733 • (417) 785-4289 • fax (417) 785-4290 • contact@ozarkundergroundlab.com

Certificate of Analysis

Date of certificate: August 21, 2017
Client: Clallam County Environmental Health
111 E. 3rd Street
Port Angeles, WA 98362
Project name: PIC Pilot
Contact person: Andy Perham (aperham@co.clallam.wa.us)
Jacob Melly (jmelly@co.clallam.wa.us)

Samples collected by: Jacob Melly
Date samples shipped: August 9, 2017
Date samples rec'd at OUL: August 10, 2017
Date analyzed by OUL: August 15 & 16, 2017
Included with certificate of analysis:
Table of results, copy of sample collection data sheets, discrepancy sheet and analysis graphs

Results for charcoal samplers analyzed for the presence of fluorescein, eosine and rhodamine WT (RWT) dyes.

Peak wavelengths are reported in nanometers (nm); dye concentrations are reported in parts per billion (ppb).

OUL Number	Station Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein		Eosine		RWT	
					Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
C4447	P1	Packet 1	7/12/17 NT	7/19/17 1050	ND		ND		ND	
C4448	P2	Packet 2	7/12/17 NT	7/19/17 1110	ND		ND		ND	
C4449	P3	Packet 3	7/12/17 NT	7/19/17 1115	ND		ND		ND	
C4450	P4	Packet 4	7/12/17 NT	7/19/17 1130	ND		ND		ND	
C4451	P6	Packet 6	7/12/17 NT	7/19/17 1150	ND		ND		ND	
C4452	P7	Packet 7	7/12/17 NT	7/19/17 1200	ND		ND		ND	
C4453	P8	Packet 8	7/12/17 NT	7/19/17 1215	516.0 *	0.228	ND		ND	
C4454	P9	Packet 9	7/12/17 NT	7/19/17 1430	519.8 *	1.64	ND		ND	
C4455	P1	Packet 1	7/19/17 1050	7/26/17 1045	ND		ND		ND	
C4456	P2	Packet 2	7/19/17 1110	7/26/17 1055	514.2 *	0.187	ND		ND	
C4457	P3	Packet 3	7/19/17 1115	7/26/17 1100	ND		ND		ND	
C4458	P4	Packet 4	7/19/17 1130	7/26/17 1120	ND		539.6 *	0.125	ND	
C4459	P6	Packet 6	7/19/17 1150	7/26/17 1135	ND		ND		ND	

OUL Number	Station Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein		Eosine		RWT	
					Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
C4460	Laboratory control charcoal blank									
C4461	P7	Packet 7	7/19/17 1200	7/26/17 1145	514.4	0.267	ND		ND	
C4462	P8	Packet 8	7/19/17 1215	7/26/17 1200	514.2 *	0.182	ND		ND	
C4463	P9	Packet 9	7/19/17 1430	7/26/17 1246	ND		ND		ND	
C4464	P1	Packet 1	7/26/17 1045	8/2/17 0950	ND		ND		ND	
C4465	P2	Packet 2	7/26/17 1055	8/2/17 1000	ND		ND		ND	
C4466	P3	Packet 3	7/26/17 1100	8/2/17 1005	ND		ND		ND	
C4467	P4	Packet 4	7/26/17 1120	8/2/17 1025	ND		ND		ND	
C4468	P6	Packet 6	7/26/17 1135	8/2/17 1030	ND		ND		ND	
C4469	P7	Packet 7	7/26/17 1145	8/2/17 1040	ND		ND		ND	
C4470	P8	Packet 8	7/26/17 1200	8/2/17 1050	ND		ND		ND	
C4471	P9	Packet 9	7/26/17 1246	8/2/17 1115	ND		ND		ND	
C4472	P1	Packet 1	8/2/17 0950	8/9/17 1030	ND		ND		ND	
C4473	P2	Packet 2	8/2/17 1000	8/9/17 1045	ND		ND		ND	
C4474	P3	Packet 3	8/2/17 1005	8/9/17 1055	ND		ND		567.6	2.25
C4475	P4	Packet 4	8/2/17 1025	8/9/17 1110	ND		ND		ND	
C4476	P6	Packet 6	8/2/17 1030	8/9/17 1120	ND		ND		568.0	69.1
C4477	P7	Packet 7	8/2/17 1040	8/9/17 1130	ND		ND		567.8	121
C4478	P8	Packet 8	8/2/17 1050	8/9/17 1135	ND		ND		ND	
C4479	P9	Packet 9	8/2/17 1115	8/9/17 1200	ND		ND		ND	
C4480	Laboratory control charcoal blank									

Note: Dye concentrations are based upon standards used at the OUL. The standard concentrations are based upon the as sold weight of the dye that the OUL uses. If the client is not using OUL dyes, the client should provide the OUL with a sample of the dye to compare to the OUL dyes.

Footnotes: ND = No dye detected NT = No time given

* = A fluorescence peak is present that does not meet all the criteria for a positive dye result. However, it has been calculated as though it were the tracer dye.

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Certificate of Analysis

Date of certificate: October 11, 2017
Client: Clallam County Environmental Health
111 E. 3rd Street
Port Angeles, WA 98362
Project name: PIC Project
Contact person: Andy Perham (aperham@co.clallam.wa.us)
Jacob Melly (jmelly@co.clallam.wa.us)

Samples collected by: JTM,AP, LA
Date samples shipped: October 3, 2017
Date samples rec'd at OUL: October 4, 2017
Date analyzed by OUL: October 9, 2017
Included with certificate of analysis:
Table of results, copy of sample collection data sheets, discrepancy sheet and analysis graphs

Results for charcoal samplers analyzed for the presence of fluorescein, eosine and rhodamine WT (RWT) dyes.
Peak wavelengths are reported in nanometers (nm); dye concentrations are reported in parts per billion (ppb).

OUL Number	Station Number	Date/Time Placed	Date/Time Collected	Fluorescein		Eosine		RWT	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
C5835	P2	9/6/17 1208	9/12/17 1108	ND		ND		ND	
C5836	P3	9/6/17 1215	9/12/17 1115	ND		ND		ND	
C5837	P4	9/6/17 1225	9/12/17 1137	ND		ND		ND	
C5838	P5	9/6/17 1335	9/12/17 1234	ND		ND		ND	
C5839	P6	9/6/17 1240	9/12/17 1155	ND		ND		ND	
C5840	Laboratory control charcoal blank								
C5841	P8	9/6/17 1245	9/12/17 1210	ND		ND		ND	
C5842	P2	9/12/17 1108	9/19/17 0915	ND		ND		ND	
C5843	P3	9/12/17 1118	9/19/17 0925	ND		ND		ND	
C5844	P4	9/12/17 1138	9/19/17 0955	ND		ND		ND	
C5845	P5	9/12/17 1235	9/19/17 1035	ND		ND		ND	
C5846	P6	9/12/17 1158	9/19/17 1005	518.4 *	0.449	ND		ND	

OUL Number	Station Number	Date/Time Placed	Date/Time Collected	Fluorescein		Eosine		RWT	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
C5847	P8	9/12/17 1210	9/19/17 1015	ND		ND		ND	
C5848	P2	9/19/17 0915	9/26/17 0940	ND		ND		ND	
C5849	P3	9/19/17 0925	9/26/17 0950	ND		ND		ND	
C5850	P4	9/19/17 0955	9/26/17 1005	ND		ND		ND	
C5851	P5	9/19/17 1035	9/26/17 1040	ND		ND		ND	
C5852	P6	9/19/17 1005	9/26/17 1010	ND		ND		ND	
C5853	P8	9/19/17 1015	9/26/17 1025	ND		ND		ND	
C5854	P2	9/26/17 0940	10/3/17 1110	ND		ND		ND	
C5855	P3	9/26/17 0950	10/3/17 1120	ND		ND		ND	
C5856	P4	9/26/17 1005	10/3/17 1135	ND		ND		ND	
C5857	P5	9/26/17 1040	10/3/17 1210	ND		ND		ND	
C5858	P6	9/26/17 1010	10/3/17 1140	ND		ND		ND	
C5859	P8	9/26/17 1025	10/3/17 1155	ND		ND		ND	
C5860	Laboratory control charcoal blank								

Note: Dye concentrations are based upon standards used at the OUL. The standard concentrations are based upon the as sold weight of the dye that the OUL uses. If the client is not using OUL dyes, the client should provide the OUL with a sample of the dye to compare to the OUL dyes.

Footnotes: ND = No dye detected

* = A fluorescence peak is present that does not meet all the criteria for a positive dye result. However, it has been calculated as though it were the tracer dye.

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