



August 2019

Pathogens Prevention Reduction and Control 5-6 (PC-00J88801)

FINAL REPORT

Overview

In September 2014, the Environmental Protection Agency awarded the second round of funding through a Lead Organization Cooperative Agreement {PC-0J88801 aka “Rounds 5-6”} to the Department of Health (DOH) in support of Puget Sound Estuary Ecosystem Restoration and Protection. This document and the supplemental materials provided serve as this agreement’s final report. Please note that the first round of funding (“Rounds 1-4”) of the Pathogens Prevention Reduction and Control Lead Organization work falls under a separate cooperative agreement {PC-00J32601} that ended in January 2017. The work of these two agreements fall under a six-year strategy which allowed DOH as a Lead Organization to work with the EPA, Puget Sound Partnership (PSP), Northwest Indian Fisheries Commission (NWIFC) and other Lead Organization agencies to develop and manage projects in alignment with the Puget Sound Action Agenda. Over six years and two cooperative agreements more than 160 projects were sub-awarded with over \$20 million invested.

This work has remained dedicated to the prevention and reduction of pathogen pollution in Puget Sound through the management of human and animal waste. Pathogens present a public health risk through consumption of shellfish and contact with polluted waters during recreational activities. Restoring shellfish growing areas, avoiding shellfish closures, and protecting people from disease served as the primary objectives of this Pathogens agreement. This document, and related appendices, serve as the final report for “Rounds 5-6” which ended August 31, 2019.

The Department of Health acknowledges and thanks the many people and organizations that contributed to this effort. Executing and delivering the work under this grant was possible through strong partnerships with organizations around Puget Sound.

In particular we wish to acknowledge both former and current staff within the Office of Environmental Health and Safety including: Maryanne Guichard, Jerrod Davis, Mary Knackstedt, Blake Nelson, Mark Toy, Stuart Glasoe, Megan Schell, Andrea Hood, Tracy Farrell, Kirsten Weinmeister, Emily Sanford, Nichole Simmons, Clara Hard, Todd Phillips, Rick Porso, Scott Berbells, Jerry Borchert, Laura Johnson, Marisa Nixon, Lawrence Sullivan, Jean Frost, Trevor Swanson, Dave Kangiser, Denise Lahmann, John



Eliasson, Jeremy Simmons, Lynn Schneider, Randy Freeby, Liz Maier, Debby Sargeant and Julianne Ruffner.

The directors and staff of each of the twelve local Environmental Health Jurisdictions as well as other county departments, tribes and non-profits who play a role in coordinating successful Pollution Identification and Correction (PIC) and On-site Sewage System local management programs.

Our Environmental Protection Agency Project Officers including: Michelle Wilcox, Chris Castner, Bill Zachmann, Catherine Gockel and Taylor Biaggi as well as the rest of the Puget Sound Team at Region 10.

The staff leads of the other six organizations with whom we coordinated and collaborated, especially staff from Department of Ecology: Tom Gries for his role in coordinating quality assurance for our sub-recipients, Ron Cummings for his role in review and approval of Ag BMP installations, and Amy Jankowiak for her role as the No Discharge Zone Project Lead.

Background and Approach

With the objective of reducing sources of pathogens and preventing associated diseases and illnesses, the Pathogens LO invested in the following programmatic areas:

- Inventory, inspect and fix failing on-site septic systems (OSS)
- Pollution Identification and Correction (PIC) programs
- Monitor and notify public of health threats via the Beach Environmental Assessment, Communication and Health (BEACH) program in partnership with the Department of Ecology
- Evaluate pollution risk on farms and implement livestock and manure best management practices (Ag BMPs) to protect water quality
- No Discharge Zone (NDZ) petition and increase the number of boating pump out stations
- Research and Data Management

Approximately two thirds of the Pathogens grant budget (around \$20 million) was invested in local programs and practices to improve management of OSS, livestock and manure, sewage from vessels, and other pollution sources. In addition to these investments, funds were utilized to build regional infrastructure in support of local pathogen management programs.

The PDF of a PowerPoint presentation linked in the Appendix section below provides an overview of each of these investment areas and provides a highlight of project from each of these. Each of the above program themes align with strategies and sub strategies (as documented on our FEATS reporting form in 18.C) from the Puget Sound Action Agenda as well as three of the [Puget Sound Vital Signs](#) (bacterial



standards met at Swimming Beaches, On-site Sewage System inspections and the acres of harvestable Shellfish Beds). The following Sub-strategies and Near Term Actions from the 2014 Action Agenda were advanced by these efforts: C5.1, C5.3, C7.4, C7.5, NTA C3.2.1, C7.1.2, C7.1.3, C9.3.1, C9.3.2, and C9.4.1.

Evaluation

Overall progress was measured in reference to the pathogen-related Puget Sound Vital Sign Indicators (acres of harvestable shellfish beds, inspection of on-site sewage systems in marine recovery areas and the condition of swimming beaches). Other key outputs include support of Pollution Identification and Correction Programs in the twelve Puget Sound counties, the number of priority swimming beaches monitored each year, and the development of a No Discharge Zone petition for Puget Sound. This last action that has been identified in the region's Comprehensive Conservation Management Plan since the early 1990s.

Please see our final FEATS report for additional detail on each of these measures as well the final status of each task.

Conclusions

We kept to our work plan programmatic investments and themes as outlined. The following highlights serve as a snapshot of the successful work supported through this program and associated agreements:

—There are over 155,000 acres in Puget Sound from which shellfish can be grown and harvested directly by commercial shellfish companies. Ongoing PIC programs and related activities funded in part by the NEP have empowered local health jurisdictions, state agencies, tribes, nonprofits, residents and other local governments to protect and improve water quality in these areas to allow for safe shellfish harvest. Incremental net gains are made each year, as some previously restricted shellfish harvest areas are returned to safe water quality conditions for harvest. From 2007 through August of 2019 a total of 12,500 acres were upgraded and 7,111 acres were downgraded for a net total of 5,389 acres of improvement. Over 1,000 acres will be added to the net total by the end of 2019.

— Drayton Harbor: 810 acres of Puget Sound shellfish beds in Drayton Harbor (near the U.S./Canada border) were re-opened in late 2016, enabling year-round commercial oyster harvest for the first time in 22 years. NEP funding for PIC program work added local capacity to find and fix improperly functioning septic systems, develop and deliver outreach programs, and support conservation district farm planning services to help farmers put in place management practices to reduce manure runoff. As of August 2019 DOH Shellfish Growing Area staff are evaluating additional acreage upgrades for a portion of the Prohibited area in Drayton Harbor in addition to the ~810 acres approved in 2016. Proposed changes include reclassifying 765 acres from Prohibited to Approved and 450 acres near the mouths of Dakota and California creeks from Prohibited to Unclassified in the fall of 2019. This story represents successful



water quality improvement results achieved through long-term community-wide pollution reduction efforts.

— Onsite Sewage System (OSS) Inspection/Correction Target: The Puget Sound Action Agenda’s 2020 OSS target requires that all systems in designated Marine Recovery Areas (MRAs) or other high risk areas be inventoried, inspected and repaired when needed at a rate of 95%. As of 2019, 51% of systems in MRAs and other high-risk areas are current with inspections. Between 2011 and 2019 the Total OSS Inventory increased by almost 34,000 systems while the percent “Without Documentation” declined from 14% to 7%. Over the same time period, the number of OSS “Current with Inspections” increased by 25,000 while the percentage went from 31% to 51%.

— OSS Programs: NEP funds have supported OSS programs operating in all 12 Puget Sound counties. Funds focused on the targets of the OSS and Shellfish Vital Signs and implementation of the local management programs. In addition to funding local OSS programs, NEP funds have played a role in the following: 1) directly funding OSS management programs, 2) exploring options to establish a sustainable regional funding source for the programs, and 3) establishing a regional loan program to assist homeowners with septic system repairs. The notably successful regional loan program was established after a recommendation from the Septic System Finance project won a [state award from IACC](#) and a [national award from EPA](#). The regional low-interest loan program is established in 11 of the 12 Puget Sound counties: Clallam, Island, Jefferson, King, Kitsap, Mason, Skagit, Snohomish, Tacoma-Pierce, Thurston, and Whatcom Counties. The loan program helps system owners pay for OSS repair costs based on recommendations from the Septic Finance Advisory Committee’s Financing Assessment, which was partially funded by NEP ([see related resources and reports here](#)). These loans are available in counties outside of Puget Sound and others are welcome to join in future cycles of the program.

— Pollution Identification and Correction (PIC) Programs: NEP grants support PIC programs operating in all 12 Puget Sound counties. These programs carry out tasks essential to recovering and protecting shellfish harvest, swimming beaches, and water quality. Regional PIC workshops attended by staff from counties, conservation districts, tribes, state and federal agencies, and academia foster communication and opportunities to share best practices, technological advances, and shared challenges and solutions.

— Dairy Nutrient Management: DOH provided NEP funds to the Washington State Department of Agriculture (WSDA) Dairy Nutrient Management Program (DNMP) between 2014–2017. The funding increased capacity for agency staff to work with local partners to identify and correct fecal bacteria pollution from dairy facilities and improper application of dairy manure to agricultural lands in Whatcom, Skagit, and Snohomish counties. NEP funds enabled DNMP staff to increase collaboration with partners to sample and analyze water quality, conduct pollution source investigations, and provide technical assistance and education to dairy and berry producers. In Whatcom County, WSDA staff collected fecal coliform bacteria data at United States (US)-Canada border sites within the Nooksack



River watershed to help characterize bacteria levels in water flowing into the US. WSDA DNMP staff completed 32 dairy facility inspections (routine or investigative) and 23 follow up inspections. Follow up inspections resulted in 22 dairies successfully implementing recommended changes to protect water quality. DNMP staff provided regulatory technical assistance to 10 dairies through either a warning letter or notice of correction. WSDA DNMP inspectors referred 6 dairies to local conservation districts and 12 non-dairy properties to Department of Ecology for follow up. In the Portage Bay, Samish Bay and Lower Stillaguamish basins, DNMP staff visually assessed field conditions, nutrient applications, and storage capacity for 120 manure lagoons. In addition, DNMP staff contacted managers of 555 acres in berry production to recommend voluntary implementation of BMPs to protect water quality.

— Vessel Sewage Management: NEP funds supported the Department of Ecology in submitting a petition to establish a No Discharge Zone (NDZ) in Puget Sound. The Puget Sound No Discharge Zone became effective on May 10, 2018. The NDZ designation led to the elimination of harvest restrictions on 385 acres of shellfish beds in Puget Sound. The NDZ is about 2,300 square miles in size.

— Pathogen Research, Reporting and Monitoring: DOH invested in research to improve understanding of pathogen and marine biotoxin threats to prevent disease outbreaks. In 2016, under Cooperative Agreement PC-00J32601 (Pathogens “Rounds 1-4”), researchers deployed continuous temperature data loggers at more than 20 pathogen-monitoring sites in Puget Sound to understand relationships between temperature and disease occurrences (specifically, the bacterial pathogen, *Vibrio parahaemolyticus*). Data helped enable development of a proactive, risk based monitoring and notification program to prevent illness from *Vibrio parahaemolyticus* linked to the consumption of commercially harvested oysters. The 2016 work provided a water temperature network for tribes, the shellfish industry, and DOH to use in implementing the revised controls. DOH worked with the Northwest Association of Networked Ocean Observing Systems (NANOOS) to provide data collected from near real time loggers to the tribal, commercial, recreational and private shellfish harvesters through a web application. DOH staff continued to monitor and track ambient temperature and *Vibrio parahaemolyticus* levels in shellfish in 2017 using other funding sources and in 2018 under the Pathogens “Rounds 5-6” grant. In 2018, DOH deployed continuous temperature data loggers at 12 cellular data loggers and 17 intertidal monitoring sites in Puget Sound. Staff downloaded the available data from all of the sites and used this temperature data, in conjunction with oyster tissue monitoring data and illness information, to gain a better understanding of the environmental conditions at the time of oyster harvest associated with illnesses. The 2018 work provided a water temperature network for tribes, the shellfish industry, and DOH to use in implementing the revised controls. In addition, this data was available to recreational and private shellfish harvesters to allow them to make informed harvesting decisions.

— BEACH program: The BEACH coordinator worked with four counties in 2015 to monitor 20 high risk beaches and notify the public of unsafe conditions: Clallam, Island, Kitsap, and Pierce. The BEACH coordinator worked with six counties in 2016 to monitor 34 high risk beaches and notify the public of



unsafe conditions: Clallam, Island, Jefferson, Kitsap, Pierce, and Whatcom counties. The BEACH coordinator worked with three counties in 2017 to monitor 19 high risk beaches and notify the public of unsafe conditions: Clallam, Kitsap, and Whatcom.

— Transboundary work: This project funded laboratory analysis of bacteria from Canadian surface water samples collected in a portion of the Nooksack River watershed that originates in British Columbia (BC), Canada. Working under an approved QAPP, a Canadian organization collected once monthly ambient water samples at fixed location sites from January 2016 through December 2018. Over a three-year period, funds paid a qualified Canadian laboratory to analyze the water samples for bacteria (total coliforms, *E. coli*, fecal coliform) and report the results to DOH. Results were incorporated into an online map. The project supported compilation of baseline data characterizing bacteria levels in waters flowing into Whatcom County, Whatcom County's portion of the Nooksack watershed and potentially contributing bacteria pollution to the downstream Portage Bay shellfish beds.

— Enhancing Shellfish-Related Norovirus Illness Prevention and Response: In cooperation with Washington Sea Grant, DOH hosted a one-year Marc Hershman Fellow from 2017-2018 to assist the Shellfish Program in better understanding norovirus in shellfish and provide policy guidance. This fellowship program places fellows with a host agency for a one-year project working on ocean and coastal science and policy management issues. In 2017, over 100 norovirus illnesses were linked to the consumption of oysters harvested in Washington State. The fellowship focused on enhancing shellfish-related norovirus illness prevention and response in a collaborative interagency project based primarily in Mason County. The Fellow updated the DOH web-based fact sheet on 'Norovirus in Shellfish', created shellfish illness investigation tools, interviewed shellfish managers from other states about their response to norovirus cases and compiled the response information into an accessible document. The Fellow also created a literature review and library of shellfish and norovirus related materials, including information on detection, persistence and transmission. She also created a Standard Operating Procedure (SOP) and field checklist for shellfish inspectors conducting post-harvest contamination or mishandling investigations. She built and executed a survey documenting socioeconomic impacts of the 2014 and 2017 Hammersley Inlet norovirus outbreaks on Hammersley Inlet shellfish farmers, and wrote a summary report of what was learned. She also produced summary documents for a British Columbia Norovirus Working Group, and assisted in follow-up for ongoing illness investigations. Various components of this research were presented at state, national, and international conferences.

— Ultraviolet Disinfection Study: In the summer of 2017, DOH conducted a study to determine how ultraviolet disinfection (UVD) units in Western Washington perform. We examined 97 UVD units in Thurston and Pierce counties for indicators of proper installation, maintenance, and electrical and physical status. We also collected effluent samples from 22 UVD units in Thurston County. Effluent samples were tested for microbial and physical sewage quality by measuring fecal coliform concentrations, temperature, pH, dissolved oxygen, conductivity, turbidity, and UV transmittance. We



also reviewed recent service reports for the studied OSSs. The data was analyzed to determine how many issues with UVD units we could expect to see and possible reasons why the UV bulb malfunctions.

The results of this study indicate that UVD units in the field can effectively reduce fecal coliform concentrations when installed and maintained correctly. However, a high proportion of UVD units were malfunctioning and unable to provide disinfection. Based on these results, we recommend that DOH and local health jurisdictions ensure more frequent maintenance through an intensive local management plan. Certified maintenance providers should also make sure that they perform service inspections as frequently as required. Service inspections should include thorough maintenance of protective sleeves, replacement of UV bulbs, and inspection of electrical components based on manufacturer's recommendations. OSS designs should specify a freefall port to collect samples. Manufacturers should improve unit designs to minimize biofilm buildup and electrical malfunction. These interventions will help increase field effectiveness of UVD units by preventing further malfunctions and improving reliability of sewage treatment.

- Assessing Viral Risk in Selected Embayments (Male specific Coliphage): In response to a large norovirus outbreak involving shellfish harvested from Hammersley Inlet in early 2017, the Washington State Department of Health (the Department) conducted a short microbial study using sentinel oyster cages in December 2017-January 2018. The study noted elevated levels of the viral indicator MSC in the general area where shellfish implicated in the norovirus outbreak were harvested. In response to these findings, the Department applied for grant funds from EPA to conduct a follow up study in the winter of 2018-2019. Sampling in Budd Inlet was conducted as well to evaluate the potential for reclassifying portions of this area in response to interest in shellfish harvest from the Squaxin Island Tribe. Results of the 2018-2019 study showed similar patterns to 2017-2018 sampling in Hammersley Inlet, but in lower concentrations. The lower results overall may be due to lower rainfall accumulation, with much of the precipitation in the critical period (February) falling as snow rather than rain. MSC concentrations in Budd Inlet were generally higher than in Hammersley Inlet, with unexpectedly high results in the Butler Cove area. Whether the increase in seasonal MSC counts in Hammersley Inlet was due to viral loading from point discharges (like the Shelton WWTP) or from nonpoint sources (like onsite septic systems) experiencing seasonally high water tables could not be determined.

— Whatcom Clean Water Program Coordinator: In 2013, DOH hired the Whatcom Clean Water Program (WCWP) Coordinator position to coordinate efforts and support long-term water quality improvement work among 13 local, state, federal, and tribal and local agencies working in the lower Nooksack basin to support shellfish harvest recovery goals in Whatcom County. Supported by NEP funds, the WCWP Coordinator leads advisory meetings and helps steer overall program strategy, facilitates relationships across partner agencies to define and maintain role clarity, tracks action items and progress, produces reports, and evaluates results to inform program adaptation. The Coordinator convenes quarterly Core



Team meetings, contributes to agendas for and participates in PIC programs in Skagit, Whatcom, Pierce, Mason and King Counties. She has been instrumental in coordinating manager team and PIC field staff meetings, and supports sub-committees for outreach and data review. The Coordinator participates in regional and north sound PIC program meetings and coordinates with multiple partners and helps guide DOH investments in Whatcom County. The Coordinator worked with program partners to update the work plan and develop meeting agendas, produce a reporting template and quarterly reports, and post on their website. The coordinator conducted Whatcom Clean Water Core group meetings with representatives from more than a dozen partner agencies to communicate progress and discuss program strategies, maintained a WCWP website and produced quarterly reports on PIC monitoring and correction action work. Reporting is key to help grant managers and PIC Coordinators understand whether PIC work is being well coordinated with routinely shared program methods, successes, and challenges. Findings are shared in presentations to multiple partners in order to help determine whether they are making progress and to identify barriers to making progress.

In addition, the Coordinator participates in recurring PIC Manager Team Meetings, Field Staff Team meetings, Local Integrating Organization (LIO) forums including the Salish Sea Ecosystem Conference, the annual Washington State Environmental Health Association Conference, Whatcom County Council meetings, and transboundary (U.S./Canada) WRIA 1 Planning Unit, and shellfish protection district advisory committee meetings. The Coordinator provides technical review to various grant funded projects in Whatcom County for various grant deliverables and provides a field perspective to DOH headquarters staff. As Whatcom County has strengthened its role in leading a local PIC program field tasks with local and state agency staff, the WCWP Coordinator has coordinated shared information with community groups about the WCWP, participated in outreach events, helped Ecology develop a presentation about livestock pollution for the Portage Bay Shellfish Protection District and arranged for WSDA and Ecology staff to present at other events. She and Ecology staff followed up with the County Council to discuss how the county could address water issues as part of its 2015-2016 budget, including addressing the overall partnership structure that includes federal agencies and two Native American tribes. Whatcom County Executives proposed \$300,000 to contribute a significant amount of funding for a local PIC Program. DOH met with Whatcom County and local Tribes to discuss a PIC proposal and asked for commitment from the County to carry out the program. The County unanimously approved a resolution supporting the Whatcom County PIC program toward continuing its PIC program work and enjoys consistent support from its local leadership. In 2015, the Coordinator worked with the Governor's Office staff, Whatcom County Public Works and the Whatcom Conservation District to conduct a one-day LEAN meeting to better align state agency and County led PIC work. In 2016, the WCWP Coordinator worked with the Governor's office and DOH staff and supervisors to refine WCWP structure. The effort reviewed work and barriers to increase effectiveness. This led to and resulted in a revised WCWP charter and effort to identify measurable goals.



Other activities include work related to transboundary (U.S./Canada) issues to ensure a more efficient structure to carry out tasks to reach water quality monitoring. Related to cross-border water quality, the WCWP coordinator participates in a Shared Waters forum focused on Boundary Bay and co-chairs with Canadian counterparts the British Columbia-Washington Transboundary Technical Collaboration Group (TCG) to reduce fecal bacteria pollution in the international tributaries of the Nooksack River. Prior to the TCG formation in August 2018, the Coordinator has participated in various transboundary workgroups and projects, including the BC/-WA Nooksack River Transboundary Water Quality Task Group which contributed to a list of recommendations to the Environmental Cooperation Council.

— ZAPS: Funding supported Whatcom Conservation District (WCD) staff to help install and maintain near-real time water quality monitoring equipment in the Nooksack River watershed in Whatcom County. The project was to deploy and evaluate the use of ZAPS LiquiD™ monitors to help characterize trends in bacterial levels and other parameters. WCD installed four stationary units and one unit in a mobile trailer (five total units) and collected over 200 grab samples to compare to ZAPS unit readings. A mobile unit was deployed to three locations.

— Policy Work: Along with several other state agencies, DOH participates in the Shellfish Coordination Group convened by the Governor's Shellfish Policy Advisor. The Shellfish Coordination Group participants identify barriers to and solutions for achieving successful water quality improvement and shellfish restoration work, particularly in geographic areas with high agricultural land use.

Course corrections including challenges and solutions, are addressed in our biannual FEATS reports for the duration of the agreement. These funds contributed to infrastructure of many local programs aimed at the uniform objective of improving and maintaining water quality sufficient to ensure public health.

Note: This work largely continues and builds on efforts of Pathogens 1-4 (PC-00J326-01) (funding the same programmatic categories) for which a final report for was completed in spring 2017. In addition, the Puget Sound Institute is in the process of completing an analysis of the two agreements similar to the work done for the Marine and Nearshore Lead Organization. This analysis/synthesis report is expected to be finalized in fall/winter 2019.

Recommendations and next steps

As we look towards the future of National Estuary Program investments, there are many opportunities to build upon the infrastructure and programs supported via the Pathogens Prevention, Reduction and Control Lead Organization and to apply lessons learned. In particular, as the region moved to a new funding and planning model the Department of Health was selected via a competitive process as the lead for the Shellfish Strategic Initiative. This new agreement (PC- 01J18001) is active from 2016-2023 and will implement priority near term actions from both the 2016-2018 Puget Sound Action Agenda and the 2018-2022 Action Agenda. There is a large policy and planning component to this highly



collaborative effort, which enables more comprehensive planning around the Shellfish Beds Vital Sign and more. The new planning model brings together an advisory team for structured decision-making (including around funding recommendations) and encourages a high degree of coordination amongst our partners and sister agencies.

Appendices

- [Presentation to the Ecosystem Coordination Board](#) (August 2017)
- [Final Advanced Post Award Monitoring Review](#) (September 2017)

For more information:

<https://www.doh.wa.gov/CommunityandEnvironment/Shellfish/EPAGrants>



This project is part of the **Puget Sound National Estuary Program**.

The National Estuary Program is a place-based program to protect and restore the water quality and ecological integrity of estuaries of national significance.

“This project has been funded wholly or in part by the United States Environmental Protection Agency under assistance agreement PC-00J88801 to the Washington State Department of Health. The contents of this document do not necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.”