

Maine Healthy Beaches 2015 Report to US EPA June 2016



I. Program Accomplishments

Maine Healthy Beaches (MHB) is managed by the Maine Department of Environmental Protection (DEP) and coordinated by the University of Maine Cooperative Extension (UMaine Extension). This team worked with 29 local management entities to conduct routine monitoring, assessment and public notification of water quality conditions for 60 beach management areas spanning Kittery to Mount Desert Island.

MHB accomplished the following in 2015:

- Processed 1968 enterococci samples at 143 routine and enhanced monitoring locations.
- Worked with local beach managers to implement precautionary rainfall advisories at 28 beaches impacted by non-point source pollution.
- Delivered 33 technical trainings for over 150 local staff and volunteers, 71 planning/problem-solving meetings (172 participants), and 14 presentations/interviews with diverse audiences (511 participants).
- In an effort to target human-sourced fecal contamination, 291 samples were analyzed for optical brightener levels at 43 enhanced monitoring locations.
- Planned and facilitated meetings with the MHB Technical Advisory Committee regarding the state's water quality standards and the program's beach action value in 2017.
- Convened and facilitated working group discussions regarding the cause and management of excessive accumulation of cast seaweed on beaches; published a blog via Maine Sea Grant used often by resource managers, media, etc.
- Supported enhanced monitoring and pollution remediation efforts for: Bar Harbor, Crescent Beach State Park, the Willard Beach storm drainage network, Goosefare Brook watershed, Spurwink River watershed, Crescent Beach State Park, Ogunquit River watershed, and Wells Harbor (Webhannet River).
- Collaborated with diverse researchers on the New England Sustainability Consortium (NEST) project focused on safe beaches and shellfish growing areas; received the *2015 George Mitchell Center Award for "Outstanding contribution by an external partner to sustainability research."*
- Served on several working groups focused on the health of coastal watersheds and acted as a model and advisor for towns/groups interested in monitoring freshwater recreation areas as well areas outside the scope of MHB.

II. Program Deliverables/Appendices

Appendix A *MHB 2015 Budget Summary*

Appendix B *MHB 2015 Beach Mgt. Area Classification/Tiered Monitoring Plan*

Appendix C *MHB 2015 Notification Activity*

Appendix D *Site-Specific Precautionary Rainfall Advisory Framework for York, Maine Beaches*

Appendix E *Summary Report of Enhanced Monitoring and Pollution Source Tracking Efforts in Goosefare Brook, Maine, 2012-2015*

Appendix F *Summary Maps: OOB actions to identify, eliminate and prevent sources of human-contamination, 2015*

Appendix G *Summary Report of Enhanced Monitoring and Pollution Source Tracking Efforts in the Willard Beach Watershed, Maine, 2012-2015*

Appendix H *Bar Harbor Cruise Ship Monitoring Report 2015*

III. Budget Information

Program Activities

There are more than 29 miles of public access beaches stretching along Maine's coast.

The US EPA sponsored, MHB 2015 budget (Appendix A) supported all monitoring, assessment and notification, education/outreach, enhanced monitoring and source-tracking efforts including:

- UMaine Extension staff salaries and a portion of a DEP staff salary. This team of personnel provided extensive support to 29 local management entities (towns, state parks, national park, and private beach associations) including program coordination, quality- assured protocols and structure, field/lab trainings, technical assistance, volunteer recruitment, education/outreach, etc.
- Partial support for a DEP data specialist that provided data management services, transferred MHB data to DEP's Environmental and Geographic Analysis Database (EGAD) system, managed the submission of MHB data into the US EPA databases (STORET and PRAWN), and fulfilled data requests as needed.
- Planning and problem-solving meetings with diverse partners including local beach managers, conservation commissions, MHB Technical Advisory Committee, researchers, etc.
- Field monitoring supplies, equipment, volunteer training packets, and quality-assurance including annual field, database, and observational trainings for nearly 200 citizen volunteers and local staff.
- Laboratory equipment, supplies, labor, sample transport (courier), training, and QA/QC support for four laboratories processing enterococci samples for 60 beach management areas spanning a large geographic area (approximately 200 mi.).
- Enhanced monitoring and pollution identification efforts as well as numerous planning and problem-solving meetings with diverse partners.
- Education and outreach efforts including delivering presentations to local, regional and national audiences, development and distribution of numerous publications, etc.
- A contract with Relyon Media to host the MHB database and public interface, as well as consultant services.
- Direct and indirect expenses including travel, telephone, computer services, postage, office support and supplies, photocopying, etc.

Volunteer Contribution

MHB participation is voluntary and towns/parks designate local beach managers and field monitors. Beach managers are typically town administrators, health nurses, fire chiefs, state park managers, etc. MHB tasks are an add-on to an already full schedule. The time devoted to these tasks varies and is difficult to quantify.

Towns and state parks utilize citizen volunteers or devote paid staff time to sample collection, transport, and data entry. Each of the local staff/volunteer monitors attended a 2 hr. pre-season field training and contributed an average of 3 hours weekly during the monitoring season. A conservative estimate of the total volunteer monitor contribution was approximately 8,000 hours (\$22/hour) for a total of \$176,000 in 2015.

IV. Performance Criteria

Beach Management Area Classification/Tiered Monitoring Plan

MHB is a voluntary program and monitoring coastal water quality for swimming and other water contact usage is the responsibility of local jurisdictions and is not mandated by state law. US EPA funding supports monitoring of moderate to high use beaches with adequate public access. Maine law allows public use of private beaches for “fishing, fowling and navigation” only.

Participating beaches must have a management entity capable of meeting objectives outlined in MHB protocols, the MHB Quality Assurance Project Plan (QAPP), and MHB Town/State Park Agreement. This includes a feasible plan for monitoring, assessment, and timely public notification of water quality conditions. New beaches will be recruited over time as resources and funding allow and/or circumstances change eligibility for program participation. In 2015, MHB successfully worked with 28 diverse local management entities to conduct routine monitoring for 60 beach management areas (Appendix B), 54 were classified as “Tier-1,” 6 were classified as “Tier-2” (reduced monitoring effort), and “Tier-3” beaches were not monitored (i.e. did not participate in the program).

Monitoring

MHB provided a unified structure and quality-assured tools to implement an adaptive monitoring regime, assess the risk of pollution at each beach management area, and notify the public of water quality conditions on Maine’s coastal beaches. The monitoring season lasted approximately three months, extending from Memorial Day through the week of Labor Day. In partnership with MHB staff, local management entities selected monitoring sites for each beach based on where people swim, at freshwater inputs (rivers, streams, storm drains), and near other high-risk features wildlife areas, etc. Samples were collected in 2-3 feet of water at 6-8 inches below the surface. For areas experiencing chronic bacterial pollution, additional monitoring sites were added in suspect areas to help determine contributing pollution sources and/or the worst-case scenario for water quality.

Parameters monitored included: enterococci bacteria, air and water temperature, salinity, tidal stage, rainfall, and additional weather/field conditions that may affect beach water quality. Based on US EPA Guidance Criteria and adopted by Maine, the safety threshold was 104 enterococci per 100 ml of sample water in 2015. Monitoring sites were resampled as soon as possible following an exceedance and the monitoring frequency increased until results were within acceptable limits. However, resampling was contingent on the time of results and availability of monitors and

laboratories; therefore resampling did not always occur the same day results were available.

Approximately 1968 samples were collected at 143 routine and enhanced monitoring locations spanning Kittery to MDI. Samples were transported to the laboratory (3 regional, 1 local) for analysis within 6 hours of collection. The majority of samples were processed by Nelson Analytical Laboratory and transported via a courier service. Samples were analyzed using the IDEXX Enterolert® Most Probable Number enumeration method. Beach sites were resampled as soon as possible following an exceedance. All samples and parameters were collected and analyzed according to US EPA-approved quality-assured protocols outlined in the MHB QAPP.

Assessment

Beyond routine beach monitoring, MHB evaluated the risk of pollution and potential/actual sources via a Risk Assessment Matrix, and in some cases, through GIS mapping and analysis, enhanced monitoring, and other pollution source-tracking efforts. MHB routinely assists local beach managers in completing or updating Risk Assessment Matrices, preliminary assessments of shoreline characteristics, activities (on and offshore) and water quality. MHB used this risk-based ranking system to inform the classification and monitoring regime for each beach management area, as well as to determine the need for an in-depth sanitary survey of the shoreline, freshwater inputs, and the surrounding watershed areas. In an effort to assess water quality and pollution sources in 2015, MHB supported enhanced monitoring and source-tracking efforts for: Bar Harbor, Crescent Beach State Park, the Willard Beach storm drainage network, Goosefare Brook watershed, Spurwink River watershed, Ogunquit River watershed, and Wells Harbor (Webhannet River).

Notification

Beach monitoring results were recorded in the MHB internal database that automatically updated the program website www.MaineHealthyBeaches.org. Once a decision was made to post the beach, the information was also publically accessible via the website and signage at major beach access points. When results exceeded the safety limit and/or a beach status change occurred, an automatic email alert was sent to local beach managers, MHB staff, and state agency partners. In some cases, towns provided supplemental information by providing educational signage (e.g. risk following rainfall, stagnant tide pools), content on local websites, Facebook pages, and hotlines. All beaches attributes, monitoring, and notification data was transferred to DEP's EGAD system for final submission into US EPA's STORET and PRAWN databases. MHB continued to make local beach information (site locations, monitoring and notification data, contact information, etc.) more easily accessible to the public via ArcGIS online.

MHB also worked to build local capacity to make well-informed beach management decisions as well as address pollution issues when they arose. Beach postings fall under local jurisdiction and are not mandated by state law. The program made recommendations to local beach managers based on the best and most current information available. In some cases, local managers waited for resample results before posting. Typically, this was for "low-risk" beaches and the decision was based on the results of neighboring sites, the magnitude of bacteria results, similarity of environmental conditions between sample collection day and results, historical water quality, risk of pollution, known pollution events, etc.

Additionally, 28 beaches issued precautionary rainfall advisories (based on local precipitation levels rather than elevated bacteria) in 2015. Several beaches were consistently posted following

heavy rainfall, while other beaches were posted under a precautionary advisory only once or twice during the season following flood conditions. Whether the beach was posted following elevated bacteria levels or heavy rainfall, in some cases beach managers kept the advisory in place until the next routine monitoring day indicated acceptable enterococci levels. The lag time in obtaining results, the availability of monitors, and the posting of precautionary rainfall advisories increased the number and duration of beach action days in 2015.

In an effort to expedite information transfer, an extensive Communication Plan of local beach managers and field monitors was updated for re-sampling efforts and beach status notification in 2015. MHB staff brought new beach managers up to speed with the program and notification protocols as needed. Following each exceedance, MHB staff contacted local jurisdictions to ensure that MHB protocols were followed in a timely manner according to the MHB QAPP. On a daily basis, MHB staff quality- checked the database for accurate entry of field, laboratory and notification data. MHB also provided ongoing database technical support. Additionally, MHB responded to numerous data and information requests from NRDC, program participants, state agency partners, non-profits, researchers, students, etc. MHB routine and enhanced monitoring data was used by partners to inform ongoing efforts to address impaired water quality including funding proposals to support pollution source identification and elimination projects, biophysical and social science research, as well as watershed management, stormwater management, and comprehensive and water resource protection plans.

Education and Outreach

MHB delivered 14 presentations and interviews to local, regional, and national audiences (over 500 participants), and staff participated in newspaper, television, and radio interviews reaching diverse audiences in 2015. MHB also broadly distributed resources including training materials, program information, public reports, and other materials promoting best practices at the beach and throughout the watershed. Additionally, communities and organizations tackling bacterial pollution on beaches and shellfish growing areas continued to use the *Municipal Guide to Clean Water: Conducting Sanitary Surveys to Improve Coastal Water Quality* in 2015. Since 2010, it has been distributed to over 50 Maine communities, 8 state/federal agency partners, and 14 states (AL, CA, CT, FL, MA, MD, NH, NY, OH, RI, SC, VA, VT and WA). This resource was also available to download on the following websites: Maine Healthy Beaches, Maine Sea Grant, Great Lakes Working Research Group, Surfrider's Research Page and Blue Water Task Force Blog, and the Maine State Codes Enforcement Officers Resource page. The Northeast Sea Grant Consortium recognized it as an outstanding outreach achievement in 2013.

V. Flagship Beach Status

The two “flagship” beaches, Ferry Beach State Park and Wells Beach, continued to uphold all policies and guidelines set forth by MHB. In 2015, Ferry Beach had 1 exceedance (rate 7.7%) with 100% of those exceedances preceded by rainfall in the last 48hrs. Wells Beach (divided into 3 separate management areas) had zero exceedances for Casino Square, 4 exceedances (rate 8.9%; rainfall preceded 75%) for Wells Beach, and 0 exceedances for Wells Harbor.

VI. Data Summaries

- 1968 enterococci samples (including field/lab duplicates) were processed at 85 beach monitoring sites, and at 58 sites either located in close proximity to managed beaches or in upland areas to help pinpoint pollution sources.

- 100% of Tier 1 beaches were monitored.
- 8.6% of routine beach samples exceeded the safety threshold of 104 MPN/100mls of sample water.
- 248 beach action days (BADs) were reported including 117 actions at 37 beach management areas (Appendix C). Of the reported days, 103 were precautionary rainfall advisories based on local precipitation levels rather than recorded bacteria levels.
- 96.1% of total beach days (defined as beach season length x beach management areas) were free of beach advisories or closures.

Table 1¹. The percent of routine beach samples that exceeded the safety limit of 104 MPN enterococci per 100ml of sample water for each year spanning 2005-2015.

Year	# Samples	# Exceedances	% Exceedances
2005	1584	196	12.4%
2006	1339	124	9.3%
2007	1359	103	7.6%
2008	1276	79	6.2%
2009	1466	159	10.8%
2010	1486	166	11.2%
2011	1310	115	8.8%
2012	1472	156	10.6%
2013	1340	176	13.1%
2014	1190	96	8.1%
2015	1256	108	8.6%
Total	15078	1478	9.8%

The program-wide exceedance rate in 2015 was slightly greater than 2014 and less than 2013. Inter-annual variability of the percent exceedances may be due to multiple factors including but not limited to: precipitation levels, beach and watershed characteristics (e.g. impervious surfaces, pollution sources), sample collection day/time, the number of monitoring sites and beach management areas, etc. The average amount of rainfall observed (12.00 inches) during the 2015 monitoring season was less than 2014 (15.71 inches) and 2013 (17.20 inches). The slight increase in dry-weather exceedances in 2015 may be due in part to the increase in excessive seaweed accumulation observed on beaches. Moreover, the beaches with the greatest exceedance rates in 2015 were those with freshwater input that likely transport pollution from upland areas during all weather conditions, but especially when it rains.

In 2015, the following beach sites exhibited a greater than 20% exceedance rate and collectively accounted for 38.9% of the total exceedances recorded program-wide:

Table 2. The 8 beach sites for which greater than 20% percent of samples exceeded the safety limit of 104 MPN enterococci per 100ml of sample water for 2015.

Beach	# Samples	# Exceedances	% Exceedances
WILLARD BEACH	30	10	33.3%
LONG SANDS NORTH	13	4	30.8%

¹ This does not include special studies or duplicate data

GOOSE ROCKS	18	5	27.8%
GOOCHS BEACH	34	8	23.5%
GOOSE ROCKS	17	4	23.5%
LAITE BEACH	17	4	23.5%
PEMAQUID BEACH	13	3	23.1%
GOODIES BEACH	18	4	22.2%

Non-point source pollution likely contributed to fecal indicator bacteria (FIB) loading at these locations with 7 of the 8 sites impacted by freshwater inputs (rivers, streams, storm drains). Of the enterococci samples that exceeded the safety threshold at these 8 locations, 61.9 % occurred when antecedent (48 hrs.) precipitation was observed. In particular, exceedances observed at three beaches (Willard Beach-South Portland, Goose Rocks-Kennebunkport, Goodies-Rockport) were associated with antecedent (48 hrs.) precipitation 75% or more of the time (Table 2).

Based on the US EPA PRAWN calculation of a beach action day (any part of 24 hours is counted as an entire action day), the number of beach action days in 2015 (248) was greater than the number of days reported in 2014 (229) and less than those reported in 2013 (275). There were zero beach closures in 2015. Additionally, the number of BMAs with action days was greater in 2015 (37) compared to 2014 (34). The increase in action days is likely due precautionary rainfall advisories (PRAs), which accounted for 103 beach action days and 42% of the total recorded action days, and just over half of the total number of advisories (PRA=59, Contamination=58). For example, PRAs accounted for over 71% of the BADs at Colony Beach (Kennebunkport). In general, contamination advisories (145 total days) were longer than PRAs (103 total days).

Six beach management areas (Goose Rocks, Willard, Goodies, Goochs, Long Sands North, and East End) collectively accounted for 41.1% of the reported beach action days in 2015 and in all cases, BADs were composed of both PRA and contamination advisory days (Table 3).

Table 3. The 6 BMAs representing those accounting for 5% or more of the total % BADs for the 2015 season (emphasis placed on contamination advisories when summarizing data).

Beach	# BADs	# PRAs	% PRAs	# Contamination	% Contamination
GOOSE ROCKS	27	9	33.3%	18	66.7%
WILLARD BEACH	18	6	33.3%	12	66.7%
GOODIES BEACH	16	6	37.5%	10	62.5%
GOOCHS BEACH	14	1	7.1%	13	92.9%
LONG SANDS NORTH	14	3	21.4%	11	78.6%
EAST END BEACH	13	2	15.4%	11	84.6%

In addition to PRAs, other likely contributing factors to the increase in action days were excessive seaweed accumulation, lag times of resamples, duration of actions days, etc. For example, the historically clean site on Pemaquid beach was likely impacted by regrowth and persistence of Enterococci in cast seaweed and sand (see Section VII). Depending on the timing of results and the availability of monitors/ laboratories, resampling did not always occur the same day results were available. The length of beach advisories also varied. For example, the average duration for an advisory at Laite Beach (Camden) was 4 days whereas the average length of an advisory program-

wide was 2.12 days in 2015. Beach managers sometimes kept an advisory in place until the next routine monitoring day indicated acceptable enterococci levels. In some cases, there were “running” advisories where PRAs blended with contamination advisories and vice versa. Additionally, US EPA considers any part of one day an action day, and this blanket status can inflate BADs by counting days where beaches were open for most of the day.

VII. Collaborative efforts focused on sharing resources and solving problems

Fecal contamination degrades ecosystems and threatens public health and coastal economies largely based on tourism. The majority of Maine’s beaches are impacted by freshwater inputs (rivers, streams, storm drains) that transport pollutants from upland areas. Sources are typically difficult to find, often requiring intensive investigations beyond the immediate shoreline. Once sources are verified, solutions are often complex and expensive. Overall, there’s a need for constant monitoring, maintenance, and expansion of sewer infrastructure. Most of Maine’s population is located within coastal watersheds and over-development and a changing climate compound the issues.

Since 2003, MHB has provided extensive support to communities experiencing bacterial pollution issues. Some examples include: circulation studies, microbial source tracking, sanitary surveys, GIS mapping/analysis, stakeholder workshops, outreach campaigns, pollution source tracking toolbox, etc. The toolbox approach utilizes parameters like pharmaceuticals and optical brighteners to target human-sourced contamination. This work has led to important local actions to identify, remove, and prevent pollution sources. Some examples include: enhanced monitoring, property surveys, sewer/stormwater investigations, installation of boat pump outs, infrastructure upgrades, watershed management plans, protective ordinances, outreach campaigns, etc.

Excessive seaweed accumulation

In 2014 and 2015, communities were challenged by the aesthetics, impact on water quality/safety and how best to manage seaweed cast on beaches. In response, MHB developed a [blog](#) based on the expertise of researchers and agency partners, that was used widely by beach managers, media, etc. to better understand the likely causes, impacts, and protective rules. For example, the sight and smell of composting seaweed generally outraged the public, inundating municipalities with complaints and requests to remove it. There were also dry-weather exceedances in historically clean areas. For examples, Biddeford Pool-Oceanside had 3 consecutive exceedances. In 2014, it took FIB levels on York’s beaches a few weeks to wane. It poses other safety hazards such as inhibiting visibility for lifeguards. However, there are prescriptive rules that indicate seaweed can be moved but not removed from beaches designated as part of a coastal sand dune system (i.e. southern Maine beaches). Some areas acquired special permits to manage the seaweed, and York increased its budget to improve their beach cleaning capacity in 2016.

The research community and US EPA recognize that FIBs like Enterococci can regrow and persist in sand, seaweed and sediments. These “naturalized” contributions have not been linked to human illness and further research is needed. In 2015, Dr. Steve Jones from the University of New Hampshire studied Enterococci levels in cast seaweed mounds on York’s beaches, underscoring the complexity of these systems and the impact of warmed, cast seaweed on FIB levels. According to researchers, drifting seaweed is typically not associated with elevated FIB levels, and it’s the process of being warmed and cast on the beach that allows the population to proliferate. FIB loading

from seaweed, sand, and marsh muddles the ability to avoid false positive postings. More research and is needed to help understand the magnitude and duration of any health risks posed by seaweed that's been "seeded" with fecal material from birds, pets, stormwater, etc. and allowed to proliferate in a favorable environment. With no easy and inexpensive method to assess the FIB source, MHB will continue to consider seaweed as a potential health risk until further research and guidance develops.

Working groups and applied research partnerships

In response to changing federal/state policies, MHB planned and facilitated two large meetings with the MHB Technical Advisory Committee and subsequent sub-committee meetings. DEP staff and MHB shared current water quality standards and recent US EPA guidelines/criteria relating to the state's water quality standards (schedule 1) and the program's beach action value (BAV) in 2017 (schedule 2). Diverse experts (e.g. public health, microbiology, resource managers, etc.) considered the state of the science in epidemiology and microbiology, as well as other factors like the high frequency of false positive postings, economic impact, feasibility and retaining program participants, etc. The factors were weighed cumulating in a vote with results being consensus minus one to continue using the current 104 MPN limit in some capacity in 2017. A subcommittee formed focused on the BAV and is continuing its work considering 10 years of MHB data and other factors in forming a BAV justification in 2016. MHB will continue to seek this expertise in establishing important policies and addressing challenges.

In response to the challenges regarding excessive seaweed accumulation, MHB convened a working group of experts that informed the seaweed [blog](#) as well as an informed MHB's response to inquiries from beach managers, the public, press, etc. MHB also convened and facilitated meetings regarding Representative Lydia Blume's (coastal York Maine) bill "An Act to Improve Cast Seaweed Management for Health, Ecology and Tourism." MHB brought in the expertise of consultants, geologists, microbiologists and resource managers to discuss the bill. Once it is accepted, the content will be considered in more depth, but the representative's interest is in allowing coastal communities the ability to better and more quickly respond to episodic events.

Additionally, UMaine staff continued being an active member of the Marine Extension Team (MET), a collaboration of Maine Sea Grant and UMaine Cooperative Extension, providing educational and applied research programs in coastal community development, ecosystem health, fisheries, aquaculture, and tourism. Staff also served on the Goosefare Brook Watershed Management Plan Steering Committee and Stream Monitoring and Assessment Committee, Casco Bay Working Group, Ogunquit River Watershed Restoration Committee, Maine Beaches Conference Steering Committee, Coastal Watersheds Working Group, etc.

Applied research partnerships have also been instrumental in improving decision-making, addressing pollution issues, relaying information to diverse audiences, and supporting student advancement in Maine and beyond. In 2015, MHB continued collaboration with microbiologists, biophysical and social science researchers on the New England Sustainability Consortium (NEST) project focused on safe beaches and shellfish beds. MHB support included multiple interviews and meetings, with students and faculty, presenting at the Maine Sustainability and Water Conference, etc. As part of MHB's ongoing efforts to augment decision making and remediation efforts, MHB will continue to seek opportunities for innovation through collaboration in 2016.

Enhanced monitoring

MHB has supported enhanced monitoring of multiple parameters (toolbox approach) targeting human sourced fecal contamination. Typically, as the number of parameters that exceed a threshold (or detectable) limit increases, so does the confidence that human sources are impacting water quality. The focus areas have changed over time with the primary targets being freshwater inputs to the shoreline. Due to limited resources and staff, the number of toolbox parameters monitored was reduced in 2015 compared to previous years. However, MHB data and support (historical and current) has raised awareness regarding water quality issues and has helped make addressing them a priority.

Beyond routine beach monitoring, 462 samples were analyzed for Enterococci (ENT) at 58 additional monitoring locations in 2015. Samples were collected upland in freshwater inputs to the beach on designated dates throughout the season or were collected on a routine basis in “high-risk” areas such as the mouths of rivers and streams, storm drains, stagnant tide pools, etc. MHB also supported assessment of intermittent, suspected sources such as seepages and runoff typically associated with heavy rainfall. Additionally, MHB analyzed 291 samples for optical brightener (OB) levels at 43 enhanced monitoring locations in 2015. Optical brighteners are commonly used in commercial/retail products and are typically flushed down the drain. Therefore, when optical brightener concentrations are coupled with elevated fecal bacteria levels, it can be indicative of human-sourced fecal contamination.

Kittery

MHB has supported enhanced monitoring, assessment of bacteria levels in sand and seaweed, and other local initiatives to improve water quality. Kittery’s commitment to clean water extends beyond coastal beaches. It is a designated “MS4” community and has successfully partnered with local groups and has hired consultants to help address the health of Kittery’s water resources. This commitment is demonstrated through Kittery’s hiring and retaining a Shoreland and Environmental Resource Officer, developing and implementing a stormwater management plan, surveying properties for malfunctioning septic systems, conducting investigations of sewer and stormwater infrastructure, etc. Over the past few years, this work has led to the removal of dozens of grey and black water discharges negatively impacting water quality.

In 2015, Kittery continued its commitment to public health and clean water by posting precautionary rainfall advisories to inform the public of the potential risk associated with heavy rainfall. The town was also awarded \$59,050 from ME DEP to implement Phase IV of its Watershed Management Plan and completed a septic system database for priority properties needing further investigation. Kittery continued enhanced monitoring and pollution source tracking efforts including smoke testing sewer lines, improvements to sewer and stormwater infrastructure, stormwater educational outreach events, etc. As part of the York County MS4 Stormwater Working Group, Kittery contracted with consultants to ensure MS4 priorities were met.

In 2016, Kittery plans to reintroduce a septic pump-out ordinance that will require pump out of priority properties every 3 years and will expand its septic system database to include the remaining systems in the Urbanized Area. The town will also conduct enhanced monitoring and source tracking efforts, infrastructure improvements, and stormwater outreach. Kittery will continue to implement Phase IV 319 grant and will install best management practices in 3 areas including a biofiltration system and wetland detention basin.

York

In an effort to improve water quality on York's beaches, MHB has supported multi-year enhanced monitoring studies, microbial source tracking, GIS watershed risk analysis, Stakeholder Workshops and more to supplement York's actions to address impaired water quality. Like Kittery, York is a designated "MS4" community, has hired and retained a Shoreland and Environmental Resource Officer, partnered with local groups, and more to augment the town's efforts to address the health of its water resources. In 2014 and 2015, York hired a consultant to augment the existing coastal beaches dataset, studies and methodologies. This work resulted in a site-specific, weather-based model for York's beaches that resulted in the town posting precautionary rainfall advisories in 2015 (Appendix D). It also led to a microbial source tracking study to assess FIB levels in cast seaweed on the beach. In response, the local beach manager developed a new beach management and cleaning plan that will implement the latest technology in beach cleaning systems that exposes the sand to UV radiation facilitating bacteria die-off. The Board of Selectmen approved the plan in 2015 with a budget increase and implementation scheduled for the 2016 beach season.

Additionally, enhanced monitoring and pollution source tracking studies successfully identified and remediated a broken sewer line in 2015. The town also mapped septic systems, installed stormwater catch basin filters and developed a 319-compliant Watershed Management Plan that was approved by ME DEP. The town also continued improvements to sewer and stormwater infrastructure, conducted stormwater outreach, and also contracted with consultants as part of the York County MS4 Stormwater Working Group to ensure MS4 priorities were met. In 2016, York plans to reintroduce a septic ordinance that would require septic inspections at the time of property transfers, will implement Phase 1- 319 grant funds, and will map septic systems impacting Long Sands and Short Sands Beaches. The town also plans to contract with Steve Jones to continue microbial source tracking studies, and the sewer district will upgrade two pump stations and will conduct an inflow and infiltration study focusing on areas impacting Long Sands Beach and Short Sands beaches. York plans to continue improvements to sewer and stormwater infrastructure including storm drains and outfalls along Long Sands Beach.

Ogunquit River Watershed (Ogunquit, Wells)

MHB has supported multi-year enhanced monitoring and pollution source identification efforts including monitoring of multiple parameters, in-depth data analysis, a circulation study, sanitary surveys, GIS Watershed Risk Analysis, Stakeholder Workshops and more to support improving water quality in the Ogunquit River. Ogunquit's commitment to water quality expands beyond the coastal zone to include protective ordinances in upland areas. MHB continued to serve on the Ogunquit River Watershed Restoration Committee in 2015.

In addition to hiring a Deputy Beach Manager to help with local efforts, Ogunquit continued to implement phase 1 of its 319- Watershed Management Plan (award 92K) in 2015. The town was also awarded funding (\$72,120) to implement Phase II of the plan as well as funding through Coastal Community Planning Grant (\$28,599) for addressing Bacteria Contamination in the Ogunquit River Watershed. As a part of its ongoing commitment to water quality, the town created a septic system database that also includes the town of Wells, and installed 3 infiltration trenches to drain the parking areas. The town planted erosion control and vegetative buffers near parking lots and along stream banks, and encouraged landowners to allow currently mowed areas along the stream bank to grow back and to minimize future mowing. They also continued enhanced monitoring and pollution source tracking efforts including smoke and dye testing sewer lines, and conducted education/outreach activities focused on the quality and preservation of water resources including pesticide awareness and a pet waste and water quality campaign.

Wells

Beyond routine beach monitoring, MHB has supported the analysis of samples collected intermittently to assess bacteria levels in sand, seaweed and stormwater impacting Wells beaches. In 2015, MHB supported enhanced monitoring in the Webhanett River impacting water quality on Wells Harbor Beach. As part of this effort, 28 samples were collected at 2 locations. Enterococci values ranged from <10 MPN to 209 MPN/100mls with seasonal geometric mean values of 16 MPN (site W-12) and 18 MPN (W-13). MHB plans to continue supporting the town's efforts to assess water quality in the river in 2016.

Kennebunk/ Kennebunkport

MHB supported multi-year enhanced monitoring and pollution source identification efforts including monitoring of multiple parameters, in-depth data analysis, a circulation study, sanitary surveys, GIS Watershed Risk Analysis, Stakeholder Workshops and more to support improving water quality in the adjacent rivers that impact neighboring beaches in Kennebunk and Kennebunkport. In 2015, both towns implemented precautionary rainfall advisories, and the frequency of routine testing on Kennebunk's beaches increased to twice per week or more depending on the number of resamples. Kennebunkport's health nurse conducted education/outreach about the MHB program, including promoting best practices at the beach and larger watershed areas. The town also provided timely notification of water quality conditions on the community website and via the public health office's outgoing message.

Goosefare Brook Watershed (Saco and Old Orchard Beach)

The Goosefare Brook (GFB) forms the border between the towns of Saco to the south and Old Orchard Beach (OOB) to the north and both are designated "MS4" communities. MHB has supported enhanced monitoring and pollution source tracking efforts, held Stakeholder Workshops, and more to address impaired water quality in GFB. Initially, MHB efforts focused on the entire watershed but since 2012, MHB has focused primarily on OOB's New Salt Rd. Tributary (NSRT). Combining the results of multiple source tracking approaches has generated "hot-spots" or priority areas needing further investigation. As a result, Saco and OOB have conducted property surveys to identify malfunctioning septic systems, as well as investigations of sewer and stormwater infrastructure. This has led to removal of numerous grey and black water discharges throughout the watershed as well as upgrades and expansion of sewer and stormwater infrastructure.

As part of an ongoing effort, MHB continued to serve on the Goosefare Brook Watershed Management Plan Steering and Stream Monitoring and Assessment Committees, provide GIS support as well as monitor priority areas in 2015 (Appendix E). This included 171 paired ENT and OB samples at 19 sites stratified throughout the NSRT watershed, 16 routine sites and 3 FYI. ENT values ranged from <10 to 7,701 MPN/100mls with a combined geometric mean of 160 MPN for all sites. Twelve out of the 16 routinely monitored sites exceeded the ENT EPA geometric mean safety threshold of 35 MPN/100ml. OB values ranged from 18 to 156µg/l with a combined mean of 80 µg/l for all sites in the NSRT with just 1 routine site exceeding the mean OB threshold of 100 µg/l. For 2015, the monitoring season was expanded to include mid-May through late-October to document baseline ENT and OB readings before and after the majority of seasonal residents arrive to Ocean Park. In addition, two new monitoring locations were established to further bracket upland of known bacteria hot spots in the GFB-05 series, assessing the contribution of the portion of the tributary that runs through the marsh those elevated concentrations. The 2015 season reinforced the

mouth of the GFB and marsh as suspect areas needing further investigation as positive deviations for ENT and OBs at several identified hot spots suggest the potential for human-sourced fecal contamination.

Saco and OOB also continued collaboration on their Watershed Management Plan (WMP). As part of the ongoing efforts to improve the health of the entire drainage area, a group of diverse partners worked together to collect a suite of parameters (e.g. FIB, OBs, dissolved oxygen, fauna, conductivity, etc.) in 2015. This work also included a stream corridor assessment survey, fish presence/abundance study, toxics assessment, stormwater retrofitting, restoration planning, and public education/outreach.

Both towns also investigated the integrity of and made improvement to sewer/stormwater infrastructure (Appendix F). For example, Saco's 2014 comprehensive flow analysis was used to prioritize sewer investigations conducted within the Bear Brook watershed. The town televised 2500 ft. of sewer lines and dye tested 5 properties with approximately 15 minor malfunctions detected and repaired. One significant malfunction was the connection of a residential sewer lateral into the storm drain that was reconnected into the sanitary sewer system. Approximately 1,700 ft of interceptor sewer main along Bear Brook was also replaced. Additionally, OOB Public Works worked with MHB to choose priority areas for investigations using the MHB generated database detailing dye testing and sewer camera work. Subsequent efforts included dye, camera, and smoke testing to ensure the integrity of 36,000 feet of sewer lines as well as dye and smoke testing 68 properties with 5 malfunctions detected and removed. The town also made upgrades and improvements made to 7,000 feet of sewer/stormwater lines. Additionally, both towns continued to post supplemental signage at the mouth of the Goosefare brook in 2015, alerting the public of the potential risk of water contact at this location.

In 2016, OOB Public Works plans to work with MHB to document sewer and stormwater camera work to streamline and prioritize future efforts. Both towns will also continue enhanced monitoring and pollution source tracking efforts as well as improvements to sewer/stormwater infrastructure. MHB will partner with the watershed committee and Dr. Steve Jones to conduct microbial source tracking in priority areas in the NSRT. The watershed plan will include potential stormwater retrofit projects that will be prioritized for upcoming years. The towns plan to continue their collaboration to restore the Goosefare Brook by applying for a 319-grant to perform prioritized retrofit projects in 2017. Saco also plans to amend the Zoning Ordinance with regards to stormwater management, which will increase requirements for water quality treatment for new and redevelopment projects.

Spurwink River Watershed (Scarborough, Cape Elizabeth, South Portland)

MHB has supported enhanced monitoring, sanitary survey work and brought together diverse partners to share data and remediation strategies to address water quality in the Spurwink River that empties onto Higgins Beach. As a result, the town remediated a malfunctioning septic system in 2013 and has retained a Beach Monitoring Coordinator dedicated to coordinating beach monitoring efforts and educational outreach initiatives since 2014. In 2015, Scarborough renewed bacteria source tracking work initiated by MHB in the Spurwink River Watershed (2010-2013) to improve the overall water quality at Higgins Beach. As part of this effort, 18 paired ENT and OB samples were collected during July and August at 12 sites within the watershed. The overall ENT geometric mean value for all sites was 117 MPN/100 mls sample water with single sample values ranging from 20-933 MPN/100 ml. Optical brightener concentrations ranged from 31-213µg/l with an overall mean for all sites of 113µg/l. Higgins Beach often experiences impaired water quality during and following heavy rainfall due in part to the proximity of the beach to the Spurwink

River. As a result, the Higgins Beach Association continued to post precautionary rainfall advisories in 2015.

Willard Beach, South Portland

In an effort to address Willard Beach water quality, MHB supported multi-year enhanced monitoring, a shoreline/watershed survey, stakeholder meetings, etc. Of particular concern are the 6 stormwater drainage pipes discharging directly to the beach, draining stormwater from ~ 1 km² of residential and commercially developed areas. In 2015, the City consistently posted rainfall advisories in support of public health due to the potential for pollution and the primary users being young children. MHB continued to support enhanced monitoring (Appendix G) in 2015, and as a part of this effort, 55 ENT and 54 OB samples were analyzed at 12 sites located within the stormwater system including one site on Willard Beach also routinely monitored through the MHB program. Since enhanced monitoring began, 138 ENT and 137 OB samples have been analyzed at 14 sites (13 subsurface sites as well as the MHB site on Willard Beach). Combined ENT mean results for each site² ranged from 23-527 MPN/100ml and OB results from 14-107µg/l. All monitoring locations except DM0507 exceeded the US EPA-recommended ENT geometric mean safety threshold of 35 MPN/mL for marine waters while one site (CB1599) exhibited an OB mean concentration above 100µg/l. ²Overall, OB mean values were relatively low for the majority of sites monitored suggesting non-human sources (wildlife, pets) are likely the principal contributors to stormwater bacterial pollution. However, human sources cannot be ruled out as optical brightener concentrations varied between monitoring sites, with at least three sites consistently exceeding the 100 µg/l threshold.

In 2015, the City expanded their pollution source tracking toolbox to include preliminary monitoring of surfactants and chlorine. Results revealed no concentrations above EPA established thresholds. A more robust data set is needed to better understand the source(s) of bacteria impacting water quality on Willard Beach. Additionally, the City implemented a pet waste and water quality campaign, maintained and cleaned catch basins and sewer lines, and replaced a leaky sewer manhole in 2015. In 2016, MHB will continue supporting enhanced monitoring efforts within the storm drain system as well as South Portland's efforts to promote responsible pet ownership. The City also plans to partner with Dr. Steve Jones to conduct microbial source tracking of priority sites within the stormwater system in 2016.

Crescent Beach State Park

In response to an elevated FIB levels on Crescent Beach, two sites were added in the neighboring marsh area to assess the quality of the discharge. As a part of this effort, 19 ENT samples were analyzed at 2 sites with results ranging from <10 to 1019 MPN/100mls from marsh-east (geometric mean 218 MPN/100ml) and results ranging from 41 to 225 from marsh-west (geometric mean 84 MPN/100ml). As a result, the park investigated the integrity of nearby wastewater infrastructure and repaired a leaky valve. Although the marsh sites were frequently elevated, the beach sites were only impacted 3 times, indicating the marsh discharge may only impact beach water quality after heavy rainfall.

Popham Beach State Park

MHB has supported ongoing efforts to assess water quality in the Morse river mouth as well as water quality assessment and special signage relating to stagnant tide pools forming on the beach

² Only sites with 5 samples or greater included in ENT geomean and OB mean data summary comparisons. Sites monitored over multiple seasons were combined to obtain overall geomean ENT and mean OB values.

on a weekly basis during the monitoring season. In 2015, MHB supported 12 additional samples collected from tide pools and results ranged from <10 MPN to 10 MPN.

Rockport

MHB has supported Rockport in its efforts to address pollution issues on Goodies Beach, throughout the adjacent Harbor, associated tributaries, and the Pascal Ave. storm drainage network. In 2015, Rockport continued to consistently post precautionary rainfall advisories in support of public health at a conservative threshold of 0.25 inches, especially since primarily small children use the beach. The town also initiated a GIS-based watershed management project and continued enhanced monitoring and pollution source tracking. Efforts include enhanced monitoring of multiple parameters, and based on 2014 pharmaceutical survey results, Rockport inspected 4 home-to-sewer connections with no issues found. Rockport was also awarded a Coastal Community Planning Grant (\$11,236) for A Watershed Approach to Managing Land use Impacts to Coastal Waters in 2016. The town will continue enhanced monitoring and pollution source tracking efforts, and will develop a feasibility study of on-site treatment of storm runoff affecting Goodie's Beach. The town also plans to inspect 10 homes (home-to-sewer connections based on PPCP results) and conduct education/outreach efforts including BMPs for watershed residents.

Camden

MHB has supported local efforts to improve water quality on Laite Beach, in the adjacent harbor, associated tributaries and storm drainage network. This work has included enhanced monitoring, Boater's Education Campaign, bringing in outside expertise and funding, etc. In 2015, Camden conducted enhanced monitoring of multiple parameters and pollution source tracking efforts including 167 in-home inspections of basement sewer/sump pump/floor and perimeter drain connections. This also included smoke and dye tested the Bayview Pump Station sewer system and televising 2.1 miles of sewer pipe and 0.55 miles of storm drains. As a result, one illicit sewer connection to the storm drainage system was eliminated and a section of sewer pipe on that was directly up gradient from a major stormwater drainage area was replaced, as well as 700 linear ft. of 15 inch ADS storm drain and 4 catch basins.

In 2016, Camden plans to conduct door to door surveys in the Bayview Pump Station sewer system area, and smoke and dye test the Rawson Ave. pump station area. There's follow-up need for a few storm drain connections that need their sources tracked down including dye testing to verify they are not sewer pipe. The town will also continue televising priority sewer and stormwater areas in 2016, and in 2017, the town plans to conduct door to door surveys for Rawson Ave. pump Station area. Once this work is complete, all buildings in town will have been surveyed and eventually Camden plans to inspect and televise all 17 miles of sewer system.

Lincolnton

In an effort to improve the quality of Lincolnton's water resources, MHB has supported Lincolnton's efforts to address pollution issues at its coastal beaches, recreation areas and freshwater resources. This work has included enhanced monitoring, sanitary surveys, beach clean-ups, and more to improve water quality. As a result, the town has worked with property owners to remediate over a dozen sources and has conducted feasibility studies, enacted legislation, and continues to hire contractors to pursue funding sources to improve and expand wastewater infrastructure. For example, in 2015 Lincolnton acquired a \$250,000 grant from the federal northern region commission to improve wastewater infrastructure on Lincolnton beach.

MHB also assisted the town with assessing water quality at the Ducktrap River Recreation Area. This included 14 samples for Enterococci over the course of the monitoring season. Results ranged from <10 MPN to 2909 MPN/100mls of sample water with a geometric mean of 221MPN/100 ml. The recreation area is continues to be under a permanent advisory for swimming and closed to shellfish harvesting.

Bar Harbor, Mt. Desert and Acadia

MHB has supported local water quality initiatives on Mount Desert Island including enhanced monitoring, surveys, special projects, Stakeholder Workshops, and more. In 2015, Bar Harbor began implementing precautionary rainfall advisories in support of public health and continued to fund consultants to assess harbor water quality, especially the impact of cruise ships (Appendix H). As a part of this work, MHB supported the analysis of 72 Enterococci samples at 4 monitoring sites. Results ranged from <10 to 41 MPN. The town supported analyses of additional parameters including phytoplankton communities, biological oxygen demand, dissolved oxygen, nutrients, nitrogen, salinity, transparency/turbidity, and chlorine. Results from this study indicated that the overall water quality in the harbor is very good. Additionally, the Community Environmental Health Laboratory at the MDI Biological Laboratory partnered with the NEST project to conduct enhanced rainfall monitoring of 6 watersheds on MDI and MHB plans to use this information to augment rainfall advisories. MHB also supported Acadia in its efforts to assess water quality on Sand Beach by supporting the analysis of 16 samples collected at a site capturing marsh/stream runoff behind the public beach area. Results ranged from <10 to 121 MPN/100mls of sample water with a geometric mean of 24 MPN/100ml.