GROWING AREA EF

Blue Hill Bay

Sanitary Survey Report

2009 - 2020

Final

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Sanitary Survey Officer signature: _____ **Date:** 6/2/22

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Executive Summary

This is a Sanitary Survey report for Growing Area EF in Hancock County written in compliance with the requirements of the 2019 Model Ordinance and the National Shellfish Sanitation Program. One area in Growing Area EF will be reviewed for a possible upgrade in 2020: Blue Hill Salt Pond (Blue Hill). One investigative station (EF 22.91) has the required 30 samples at end of year 2020 and can be changed to an active water quality station. There were no new actual or potential pollution sources found. Four water quality stations were deactivated during the review year, EF 9, EF 9.7, EF 12.1, and EF 16. Water quality has remained consistent overall with some improvement in water quality. The next sanitary survey is due in 2032 and the next triennial in 2023.

Description of Growing Area

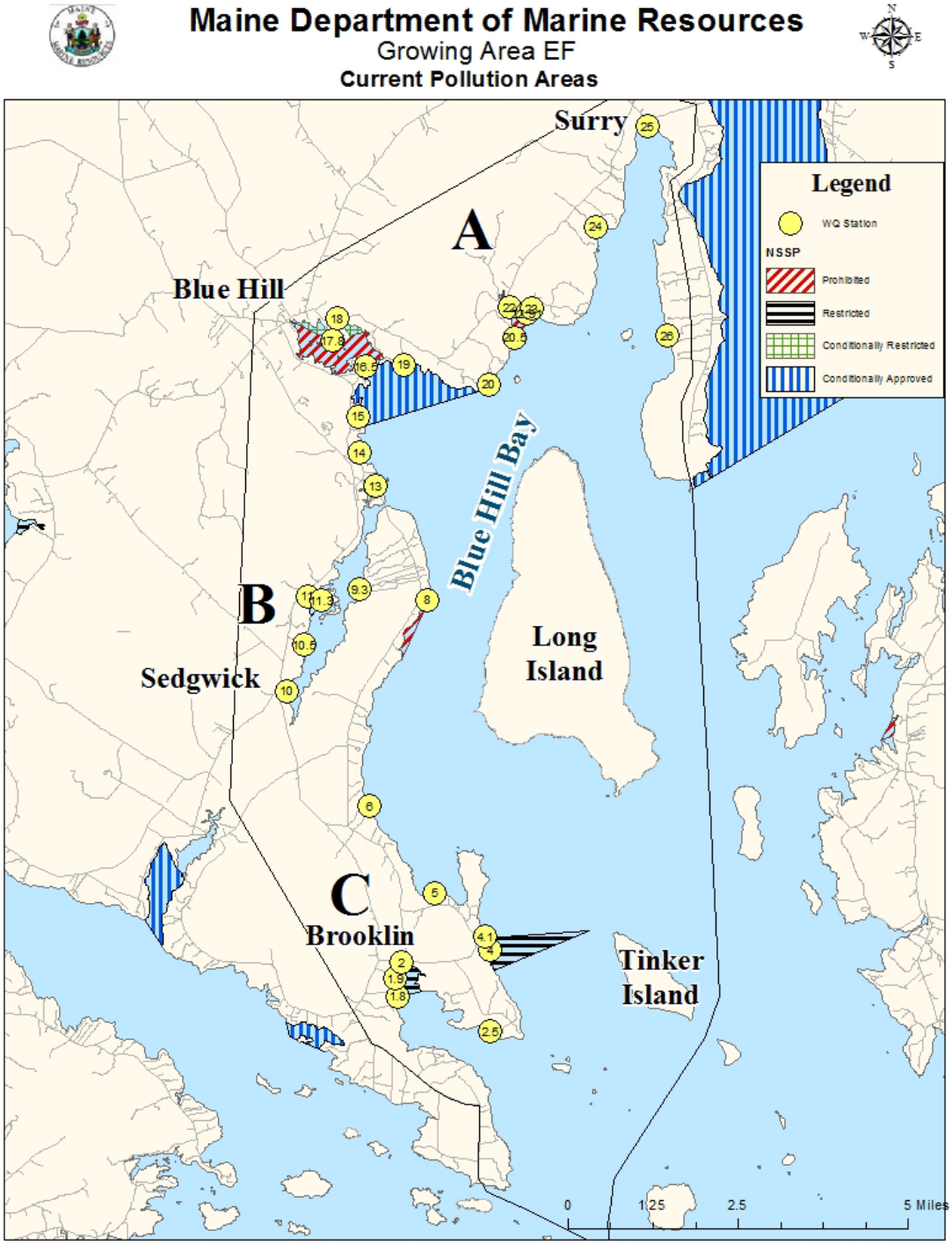
Growing Area EI includes the western portion of Blue Hill Bay in Hancock County, Maine. The shoreline included in this growing area extends from the southern tip of Naskeag Point in Brooklin to the southern tip of Newbury Neck in Surry. The area includes all of Blue Hill Harbor, the Blue Hill Salt Pond, and Morgan Bay. The shorelines are in the towns of Brooklin (pop. 824), Sedgwick (pop. 1,196), Blue Hill (pop. 2,686), and Surry (pop. 1,466) (2010 Census). The largest population concentration is in Blue Hill with many seasonal residents (June-September). Development along the shoreline is spotty with clusters of homes separated by undeveloped land. There is one Wastewater Treatment Plant (WWTP) located in Blue Hill. There are 2 licensed overboard discharges (OBD's), no OBDs were removed in growing area EF during the 2020 season.

The upland cover is primarily deciduous trees, some evergreens and wetland forest with minimal development. Blueberry and grass fields are scattered through the area. Freshwater influence along these shores is predominately from numerous brooks and small streams throughout the Growing Area. There are no large rivers or lakes impacting the area. Wildlife in the area includes migrating birds, various rodents, deer, harbor seals, etcetera.

There are three shellfish aquaculture leases and ten shellfish Limited Purpose Aquaculture permits (LPAs) in this growing area. There are no wet storage permits issued to certified shellfish dealers in this area. The activities associated with the LPAs, leases, and wet storage facilities are monitored in accordance with the Model Ordinance.

Below is the map with Pollution Area boundaries and growing area boundaries. Closures within the growing area can be found in legal notices in DMR central files on the DMR website.

Figure 1. Growing Area EF Overview Map with Active Water Stations



History of Growing Area Classification

Reclassification addendums to the sanitary survey report are in the DMR central files.

Pollution Sources Survey

Summary of Sources and Location

The growing area shoreline is divided into 2-mile segments that are identified using unique Growing Area Shoreline Survey Identification (GASSID) numbers. All properties and potential pollution sources within 250 feet of the shoreline are identified and inspected. The inspection includes a property description, physical address, location of the septic system and any other relevant potential or actual pollution sources. A GPS point to identify the source location(s) and the data are entered electronically in the field and stored in DMR central files.

Figure 2. Growing Area EF Pollution Map A

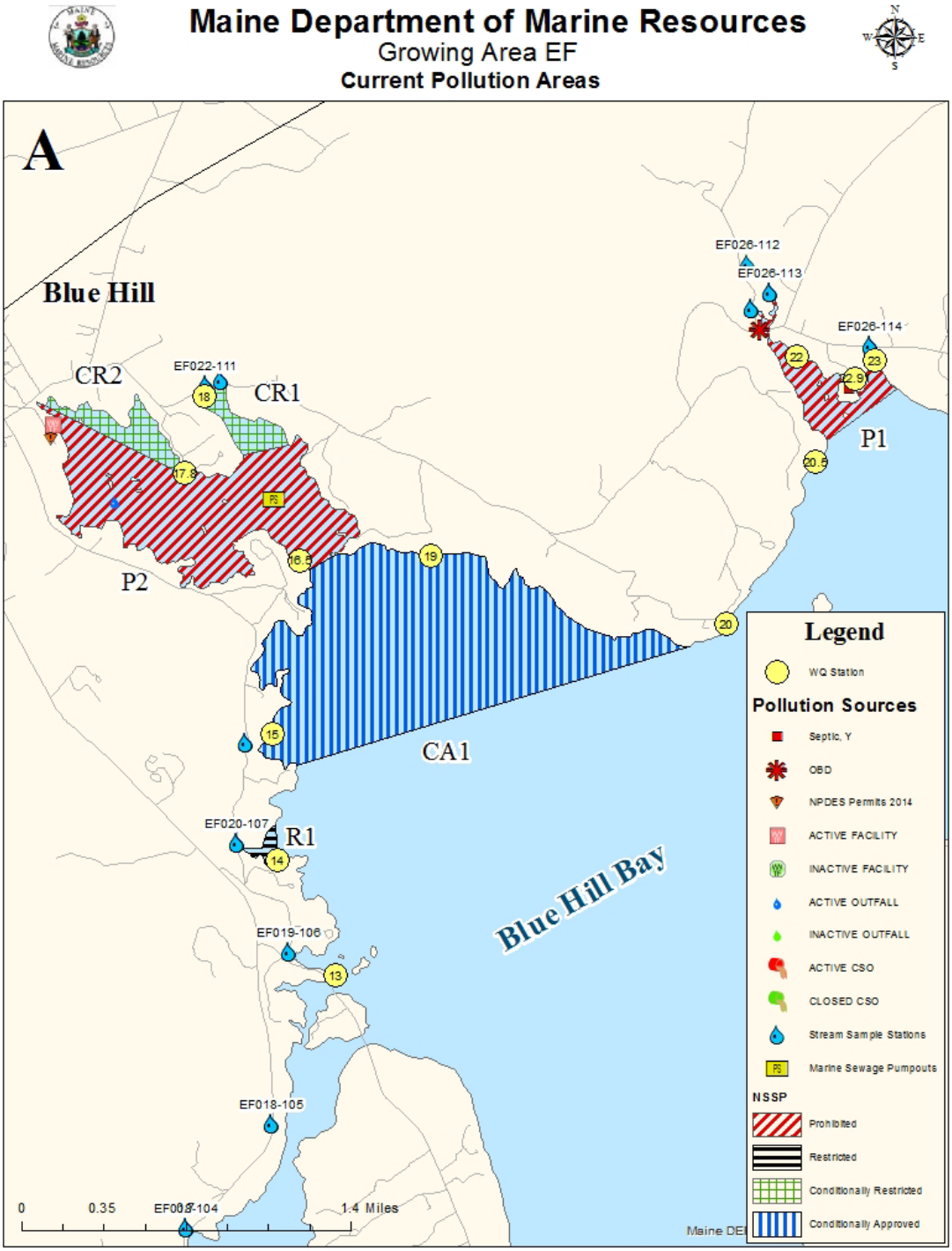


Figure 3. Growing Area EF, Pollution Map B

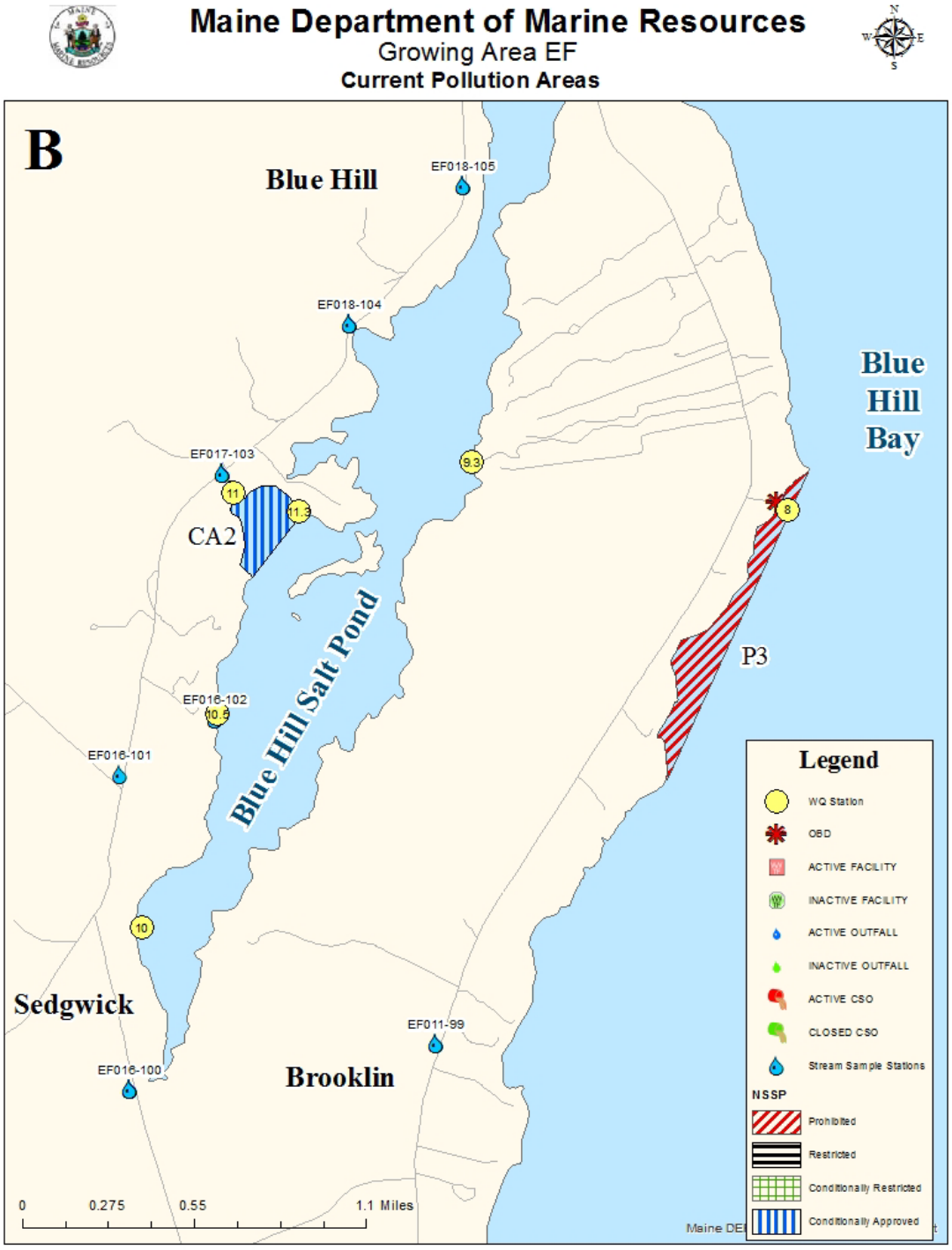
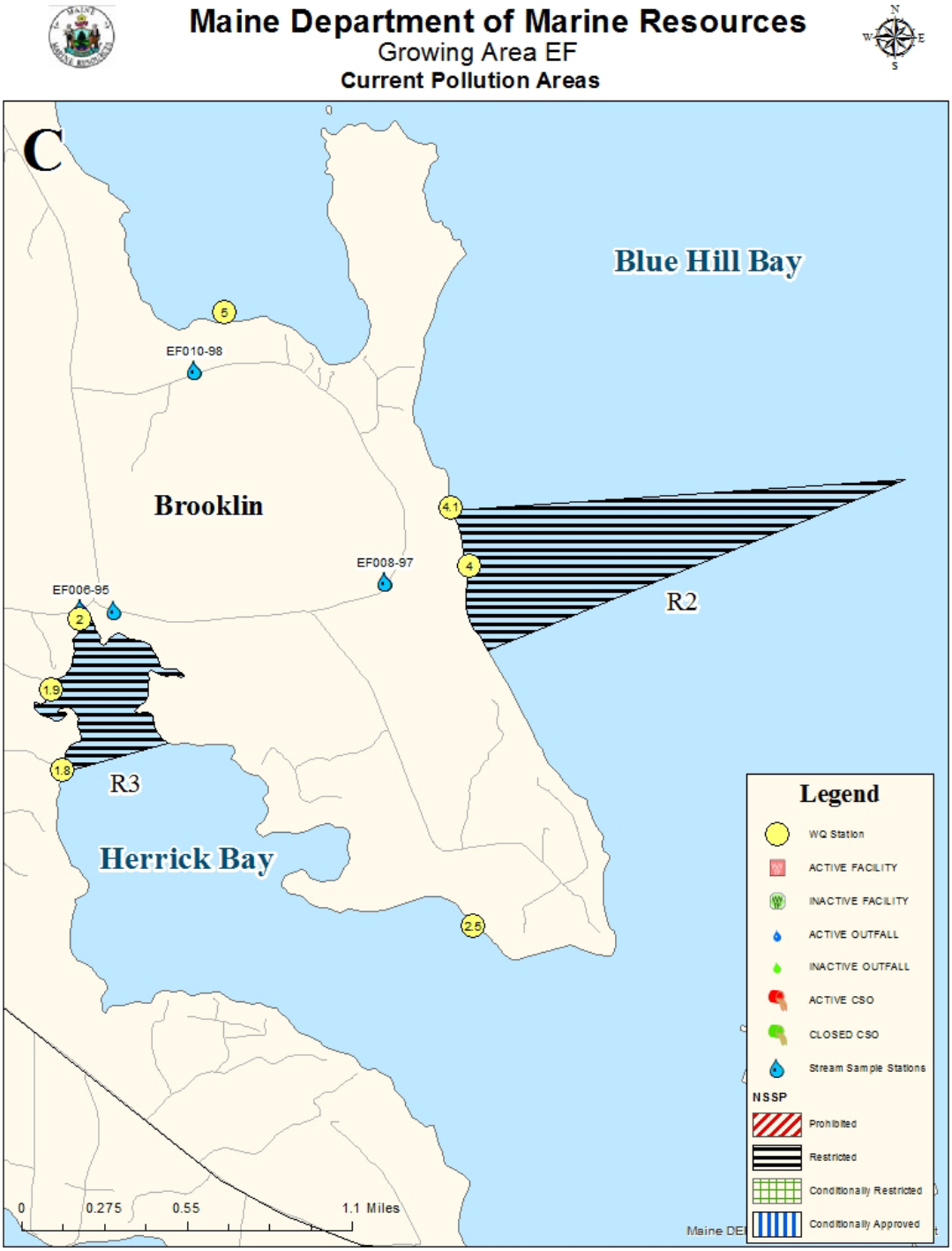


Figure 4. Growing Area EF, Pollution Map C



State and Federal Licensed Waste Discharge Permits

Overboard Discharges (OBDs)

There are 2 overboard discharges (OBDs) that discharge their treated effluent into the waters of Growing Area EF. One OBD discharges into the waters of McHeard Cove (Figure 2) and one OBD discharges into Blue Hill Harbor (Figure 3). A total of 9 OBDs have been removed from 2009-2020. No OBDs were removed during the review year of 2020.

An overboard discharge (OBD) is the discharge of wastewater from residential, commercial, and publicly owned facilities to Maine's streams, rivers lakes, and the ocean. Commercial and residential discharges of sanitary waste have been regulated since the mid-1970's when most direct discharges of untreated waste were banned. Between 1974 and 1987 most of the "straight pipes" were connected to publicly-owned treatment works or replaced with standard septic systems. Overboard discharge treatment systems were installed for those facilities that were unable to connect to publicly-owned treatment works or unable to install a septic system because of poor soil conditions or small lot sizes.

All overboard discharge systems include a process to clarify the wastewater and disinfect it prior to discharge. There are two general types of treatment systems; mechanical package plants and sand filters. Sand filter systems consist of a septic tank and a sand filter. In such systems, the wastewater is first directed to a holding tank where the wastewater solids are settled out and undergo partial microbial digestion. The partially treated wastewater then flows from the tank into a sand filter, consisting of distribution pipes, layers of stone and filter sand, and collection pipes within a plastic liner. The wastewater is biologically treated as it filters down through the sand, and is then collected and discharged to a disinfection unit. Mechanical package plants consist of a tank, where waste is mechanically broken up, mixed and aerated; mechanical systems require electric power, and must have an operating alarm on a separate electrical circuit that will activate if the treatment unit malfunctions due to a power failure. The aerated treated wastewater is held in a calm condition for a time, allowing for solids to settle and for the waste to be partially digested by naturally occurring bacteria. The clarified water from the tank is then pumped off the top into a disinfection unit. There are two types of disinfection units, UV and chlorinators (most common). In a chlorinator, the treated water contacts chlorine tablets and remains in a tank for at least 20 minutes where bacteria and other pathogens are killed. The treated and disinfected water is discharged from the disinfection unit to below the low water mark of the receiving waterbody (the ocean, a river, or a stream) via an outfall pipe.

OBDs are licensed and inspected by the Maine Department of Environmental Protection. At each inspection, DEP looks for tags on each treatment unit identifying the service contractor and the last date of service. If an OBD is not properly maintained, or if the OBD malfunctions, it has the potential to directly discharge untreated wastewater to the shore; therefore, preventative closures are implemented surrounding every OBD located in growing area EF (Table 1). The size of each closure is determined based on a dilution, using the permitted flow rate of the OBD (in gallons per day, GPD), and the depth of the receiving water that each OBD discharges to; the fecal concentration used for this dilution

calculation is $1.4X10^5$ FC /100 ml. Single OBD systems associated with more than one residence will have multiple permit IDs. All current closures are of adequate size to protect public health.

Table 1. Overboard Discharges (OBDs).

Closure Area	OBD ID #	Location	Receiving Waterbody	Flow (gpd)	Acres Needed for Closure	Current Prohibited Acreage
EF (P1)	6864	Blue Hill	McHeard Cove	315	8.8	56 Acres
EF (P3)	7086	Blue Hill	Blue Hill Harbor	300	8.4	46 Acres

National Pollutant Discharge Elimination System (NPDES)

Table 2. NPDES Permitted Discharges

Closure Area	Permit ID	Type	Facility	Waterbody
EF (P2)	ME0101231	POTW-Major	Blue Hill WWTF	Blue Hill Harbor

There is one wastewater treatment plant/facility (WWTP/WWTF) in growing area EF, in the town of Blue Hill. Since 2017 the WWTP inspection reports have been available in DMR central files. This facility discharges into a Prohibited Area that is larger in area than the calculated dilution zone for the effluent (Table 4).

Blue Hill Wastewater Treatment Facility-
The plant is a secondary treatment system that discharges into Blue Hill Harbor. Influent is domestic and commercial waste water with no significant industrial users contributing to the flow. Licensed monthly average flow is 0.1 million gallons per day (MGD).

The waste water treatment facility provides secondary treatment via an extended aeration activated sludge system. Treatment consists of a grinder, 3000 gallon anoxic selector basin, two (2) aeration basins, two (2) secondary clarifiers, and a chlorine contact chamber. Seasonal disinfection is with sodium hypochlorite and dechlorination with sodium bisulfite. Regular maintenance is done with daily checks\repairs. There is 2 miles of collection system piping with two (2) pump stations. Effluent is discharged mainly through an 8” diameter into the waters of Blue Hill Harbor at 6’ depth at low water. Digester biosolids are hauled to the Ellsworth WWTF for processing.

The regulation Prohibited closure size exceeds the computed effluent dilution zone (dilution calculation=219 acres / closure size= 307 acres). There are no combined sewer overflows and no bypass capability at the plant.

Table 3. Growing area EF WWTP Dilution Calculations.

Blue Hill Wastewater Treatment Facility		
Flow rate=	100,000	Gallons/day(GPD)
There are 7.481 gallons in one cu.ft., so GPD divided by 7.481=	13,367	Cu.Ft./day
There are 283 100ml units in one cu.ft., so 283 times Cu. Ft./day=	3,782,917	100ml. Units/day
Bacteria load=	140,000	FC colonies/100ml
Bacteria load times the number of 100ml. Units/day=	529,608,341,131	Total FC/day
or	5.30E+11	Total FC/day
FC colonies/day divided by 14=	37,829,167,224	100ml units of receiving waters for dilution.
There are 283 100ml units per cu.ft., so 100ml. Units divided by 283=	133,671,969	cu.ft. of receiving waters for dilution.
Average depth of receiving waters =	14	Ft.
Cu.ft. of receiving waters / by average depth=	9,547,998	Square ft. of surface water, or closure size.
Square ft. times 0.092903 =	887,038	Square meters
Square meters times 0.0002471=	219.2	acres

Residential

All residential pollution sources are reported to the local plumbing inspector (LPI). Once the system has been documented as being fixed, staff members from DMR can re-assess the water quality data and shoreline survey information to determine if the area is safe for shellfish harvest. Table 4 shows all new and pre-existing pollution sources in area EF that are considered discharges into the Growing Area and effect water quality.

Table 4. Growing Area EF Residential Pollution Sources.

Closure Area	Location ID	Date Surveyed	Direct or Indirect	Problem	Description	Town
P1	EF026	2017	Direct	Y	Potential straight pipe	Blue Hill

Industrial Pollution

There are no major industrial pollution sites in growing area EF such as chemical plants, steel mills, shipyards, or refineries. None of the small industries (small boat builders and boat storage yards) were identified as pollution sources during the 2008 survey. All the shellfish areas adjacent to the businesses meet their present area classifications.

Small individual storage tanks for gasoline and diesel are located in the growing area. These tanks are near the shore. Tanks have containment walls and booms in the event of an accidental leak in a tank or spillage when unloading. The oil response team from the Maine DEP contacts Maine Marine Resources when a spill occurs and a decision will be made whether a shellfish closure is necessary.

The Kerramerican Mine property is located on Route 15/176 in Blue Hill and is no longer active. The most recent operation was from 1965-1977 producing Zinc and Copper from ore located under Second pond. When mining operations ceased, the tailings ponds were covered with 12 inches of fill material and seeded. In 1981, to comply with an administrative enforcement agreement made previously with the Maine Department of Environmental Protection (DEP), Kerramerican covered all exposed mine tailings to prevent contamination of surface water and groundwater. Since 1981 some of the soil covering waste metal deposits has eroded to expose waste tailings. According to the EPA website on Waste Site Cleanup, during a visit to the property in 1994, water with a pH of 2.8 was observed on the tailings pond and leading toward the auxiliary pond. Analytical results of source samples collected from the property in 1995 and 1999 indicated the presence of arsenic (As), silver (Ag), mercury (Hg), iron (Fe), cadmium (Cd), lead (Pb), zinc (Zn), copper (Cu), and chromium (Cr). Previous investigations of the property include: periodic surface water sampling by the Environmental Improvement Commission (EIC) and DEP between 1971 and 1982; a Preliminary Assessment (PA) completed in 1995; a Site Inspection (SI) completed in 1996; and an Expanded Site Inspection (ESI) completed in 1999. Finally, in 2006 a consent agreement between Kerramerican and the DEP was reached, and Emsource Blue Hill a Portland based company agreed to remediate the site. Work started in September of 2006 and continued through 2007 when the cap at the former mine operations site was completed.

This site is of interest to Marine Resources because it borders Carleton Stream which flows from the mine location down through First Pond and then into the Blue Hill Salt Pond. The possibility of transport for heavy metal contamination is therefore a potential threat to shellfish. The DEP Surface Water Ambient Toxics (SWAT) monitoring program has conducted tests of blue mussels in this area. Mussel tissues were analyzed for metals, pesticides, PCBs, and PAHs (polynuclear aromatic hydrocarbons) from Blue Hill Falls. All results fell within the normal ranges.

Marinas

The marina community in Maine only operates for a portion of the year due to adverse winter weather conditions. The management of marinas in Maine allows for shellfish growing areas to be available to harvesters, for at least a portion of the year, to direct market harvest by utilizing conditional area management plans. Small mooring fields are scattered throughout the growing area with the largest number (groups of 10 or more moorings) of boats at Naskeag Point, Sand Point, Blue Hill Harbor, and McHeard Cove. There is a boat pump out facility in Blue Hill Harbor in Blue Hill.

Mooring fields in Naskeag Point harbor is almost exclusively work boats (lobster boats, trawling vessels) without heads and 2-4 pleasure boats. It is not a common overnight stopping areas for recreational boaters and not identified as a pollution risk due to the number of boats and types of usage. Sand Point, Blue Hill Harbor, and McHeard Cove are all contained in current Prohibited areas.

Storm water

Storm water runoff is generated when precipitation from rain and snowmelt events flows over land or impervious surfaces and does not percolate into the ground. As the runoff flows over the land or impervious surfaces (paved streets, parking lots, and building rooftops), it accumulates debris, chemicals, sediment or other pollutants that could adversely affect water quality if the runoff is discharged untreated (US EPA 2009). Thus, storm water pollution is caused by the daily activities of people within the watershed. Currently, polluted storm water is the largest source of water quality problems in the United States.

The primary method to control storm water discharges is the use of best management practices (BMPs). In addition, most major storm water discharges are considered point sources and require coverage under a NPDES permit. In 1990, under authority of the Clean Water Act, the U.S. EPA promulgated Phase I of its storm water management program, requiring permitting through the National Pollution Discharge Elimination System (NPDES). The Phase I program covered three categories of discharges: (1) "medium" and "large" Municipal Separate Storm Sewer Systems (MS4s) generally serving populations over 100,000, (2) construction activity disturbing five acres of land or greater, and (3) ten categories of industrial activity. In 1999, US EPA issued Phase II of the storm water management program, expanding the Phase I program to include all urbanized areas and smaller construction sites.

Although it is a federal program, EPA has delegated its authority to the Maine DEP to administer the Phase II Small MS4 General Permit. Under the Small MS4 GP, each municipality must implement the following six Minimum Control Measures: (1) Public education and outreach, (2) Public participation, (3) Illicit discharge detection and elimination, (4) Construction site storm water runoff control, (5) Post-construction storm water management, and (6) Pollution prevention/good housekeeping. The permit requires each city or town to develop a draft Storm Water Management Plan that establishes measurable goals for each of the Minimum Control Measures. The City or Town must document the implementation of the Plan, and provide annual reports to the Maine DEP. Currently the discharge of storm water from 30 Maine municipalities is regulated under the Phase II Small MS4 General Permit however, no municipalities located within the boundaries of growing area EI fall under these regulations. Additionally, the Maine Storm Water Management Law provides storm water standards for projects located in organized areas that include one acre of more of disturbed area (Maine DEP 2009).

There are no municipal storm water systems in this Growing Area.

Non-Point Pollution Sources

Non-point source (NPS) pollution is water pollution affecting a water body from diffuse sources, such as polluted runoff from agricultural areas draining into a river, significant rainfall, high river flows or astronomical high tides. Nonpoint source pollution can be contrasted with point source pollution, where discharges occur to a body of water at a sole location, such as discharges from a chemical factory, urban runoff from a roadway storm drain or from ships at sea. NPS may derive from various sources

with no specific solution to rectify the problem, making it difficult to regulate. Freshwater streams, drainage from rainstorm runoff and tidal creeks are the major source of non-point discharge into Growing Area EF. A total of 131 samples were taken from freshwater streams during the review period (Table 5, Figures 2-4).

Stream EF020-107 is associated with an ongoing study of pollution from potential sources in the upper drainage that have previously impacted water quality in the receiving waters. This stream is collected quarterly throughout the year to monitor pollution being transported to the growing area. Because the stream was previously considered a source of pollution, the area around the mouth of the streams is enclosed in a Restricted area; however, the most recent data from the stream do not show fecal scores elevated to a concerning level. A new station will be added in the Restricted area to determine if the closure is still required.

Samples from stream EF006-95 from 12/7/2015 were taken at 15 minute intervals for a stream variability study.

Streams associated with consistently high scores are monitored to determine if they affect the water quality of growing area waters.

Table 5. Stream Samples in Growing Area EF 2009-2020; Scores > 163 cfu/100ml are highlighted in red.

Location ID	Date	Pollution Source	Score CFU/100ml
EF005-94	5/17/2011	Stream	18
EF005-94	5/5/2014	Stream	<2
EF005-94	6/24/2014	Stream	>1600
EF005-94	9/17/2014	Stream	38
EF005-94	9/18/2014	Stream	130
EF005-94	9/29/2014	Stream	10
EF005-94	4/15/2015	Stream	<2
EF005-94	8/23/2015	Stream	380
EF005-94	8/31/2016	Stream	240
EF005-94	5/4/2017	Stream	<2
EF005-94	8/2/2017	Stream	22
EF005-94	10/30/2018	Stream	4
EF005-94	7/15/2020	Stream	42
EF006-95	5/17/2011	Stream	38
EF006-95	5/5/2014	Stream	73
EF006-95	6/26/2014	Stream	>1600
EF006-95	9/17/2014	Stream	130
EF006-95	9/29/2014	Stream	25

Location ID	Date	Pollution Source	Score CFU/100ml
EF006-95	4/15/2015	Stream	71
EF006-95	6/30/2015	Stream	160
EF006-95	8/23/2015	Stream	1220
EF006-95	12/7/2015	Stream	<2
EF006-95	12/7/2015	Stream	13
EF006-95	12/7/2015	Stream	14
EF006-95	12/7/2015	Stream	25
EF006-95	12/7/2015	Stream	25
EF006-95	12/7/2015	Stream	25
EF006-95	12/7/2015	Stream	40
EF006-95	12/7/2015	Stream	48
EF006-95	12/7/2015	Stream	68
EF006-95	12/7/2015	Stream	78
EF006-95	5/4/2017	Stream	4
EF006-95	10/30/2018	Stream	114
EF006-95	7/15/2020	Stream	380
EF008-96	5/17/2011	Stream	160
EF008-96	5/4/2017	Stream	80
EF008-96	10/30/2018	Stream	118
EF008-97	5/17/2011	Stream	35
EF008-97	5/4/2017	Stream	72
EF010-98	5/4/2017	Stream	<2
EF011-99	8/31/2016	Stream	8
EF011-99	5/30/2017	Stream	25
EF016-100	5/17/2011	Stream	24
EF016-100	5/5/2014	Stream	<2
EF016-100	6/26/2014	Stream	1380
EF016-100	9/17/2014	Stream	31
EF016-100	9/29/2014	Stream	15
EF016-100	8/31/2016	Stream	94
EF016-100	5/30/2017	Stream	28
EF016-101	5/30/2017	Stream	76
EF016-102	5/30/2017	Stream	10
EF017-103	5/17/2011	Stream	8
EF017-103	7/19/2011	Stream	<2
EF017-103	5/5/2014	Stream	<2
EF017-103	6/26/2014	Stream	240

Location ID	Date	Pollution Source	Score CFU/100ml
EF017-103	9/17/2014	Stream	29
EF017-103	9/29/2014	Stream	10
EF017-103	8/31/2016	Stream	46
EF017-103	5/30/2017	Stream	4
EF017-103	10/30/2018	Stream	7.3
EF018-104	5/17/2011	Stream	2
EF018-104	5/5/2014	Stream	<2
EF018-104	9/17/2014	Stream	<2
EF018-104	9/29/2014	Stream	<2
EF018-104	5/30/2017	Stream	4
EF018-105	5/30/2017	Stream	<2
EF019-106	4/15/2015	Stream	<2
EF019-106	6/29/2015	Stream	120
EF019-106	5/30/2017	Stream	104
EF020-107	5/17/2011	Stream	25
EF020-107	7/19/2011	Stream	420
EF020-107	8/23/2015	Stream	380
EF020-107	5/23/2016	Stream	11
EF020-107	7/25/2016	Stream	200
EF020-107	9/26/2016	Stream	2
EF020-107	11/30/2016	Stream	900
EF020-107	1/30/2017	Stream	27
EF020-107	4/18/2017	Stream	30
EF020-107	7/25/2017	Stream	126
EF020-107	10/11/2017	Stream	96
EF020-107	1/22/2018	Stream	6
EF020-107	4/19/2018	Stream	<2
EF020-107	7/18/2018	Stream	102
EF020-107	10/30/2018	Stream	92
EF020-107	3/27/2019	Stream	42
EF020-107	5/13/2019	Stream	8
EF020-107	8/21/2019	Stream	50
EF020-107	12/30/2019	Stream	15
EF020-107	3/30/2020	Stream	48
EF020-107	6/24/2020	Stream	7.3
EF020-107	9/30/2020	Stream	148
EF020-108	5/30/2017	Stream	16

Location ID	Date	Pollution Source	Score CFU/100ml
EF020-108	10/30/2018	Stream	35
EF022-111	5/17/2011	Stream	16
EF022-111	8/31/2016	Stream	40
EF022-111	5/30/2017	Stream	33
EF023-110	5/17/2011	Stream	24
EF023-110	7/19/2011	Stream	15
EF023-110	5/30/2017	Stream	6
EF026-111	5/30/2017	Stream	54
EF026-111	10/30/2018	Stream	34
EF026-111	10/15/2019	Stream	10
EF026-112	5/30/2017	Stream	7.3
EF026-113	5/25/2011	Stream	22
EF026-113	7/19/2011	Stream	54
EF026-113	5/30/2017	Stream	25
EF026-113	10/15/2019	Stream	9.1
EF026-114	5/25/2011	Stream	8
EF026-114	4/15/2015	Stream	11
EF026-114	6/29/2015	Stream	360
EF026-114	8/23/2015	Stream	220
EF026-114	5/30/2017	Stream	33
EF026-114	10/30/2018	Stream	14
EF026-114	10/15/2019	Stream	14
EF028-115	10/15/2019	Stream	12
EF029-116	8/4/2010	Stream	>1600
EF029-116	8/18/2010	Stream	44
EF029-116	8/25/2010	Stream	22
EF029-116	9/27/2010	Stream	38
EF029-116	10/12/2010	Stream	2
EF029-116	5/25/2011	Stream	8
EF029-116	7/19/2011	Stream	9.1
EF029-116	5/5/2014	Stream	2
EF029-116	6/26/2014	Stream	>1600
EF029-116	9/17/2014	Stream	3.6
EF029-116	10/1/2014	Stream	62
EF029-116	10/30/2018	Stream	10
EF029-116	10/15/2019	Stream	<2
EF029-117	8/8/2011	Stream	620

Location ID	Date	Pollution Source	Score CFU/100ml
EF029-117	6/26/2014	Stream	>1600
EF029-117	9/18/2014	Stream	13

Agricultural Activities

There are no large-scale agriculture activities within proximity to the shore in Growing Area EF. No significant sources of agricultural pollution were identified in the survey area in 2008. Five properties were identified with small agricultural operations with only one showing recent evidence of being active. The one active location had up to three horses approximately 0.75 miles inland from Bragdon Brook. The water quality station EF14 near the mouth of Bragdon Brook shows no impact of pollution from this agriculture operation and the stream station on Bragdon Brook, EF020-107, is sampled quarterly. This stream station has not shown elevated samples for the last four years of sampling. The other four operations are located >1000 feet from the shore and do not impact water quality. Pollution from small agriculture operations can be introduced into the growing area as nonpoint source pollution transported by runoff from large rainfall or snowmelt events. Smaller farms are encouraged to follow best management practices to help avoid effects animal waste and agricultural pollutants can have on water quality. None of these small farms appeared to be directly impacting the growing area during the 2008 shoreline survey.

Domestic Animals and Wildlife Activity

The salt marshes and mudflats of the growing area provide valuable habitat to a variety of wildlife. Commonly observed bird species include a variety of gulls, sea and inland ducks, cormorants, geese, great blue herons, egrets, swans, and others. Mammals living within the growing area include dogs, cats, whitetail deer, muskrat, squirrels, chipmunks, rabbits, moles, mice, bats, shrews, weasels, skunks, raccoons, and others. Maine Inland Fish and Wildlife surveys indicate that migratory waterfowl numbers begin to increase in the early autumn months, and typically peak in late fall or early winter. Although large numbers of birds can, in theory, pose a threat the growing area water quality, such occurrences are very difficult to document.

Recreation Areas (beaches, trails, campgrounds, etc.)

The concern for actual or potential pollution from recreational areas is because many of them allow dogs and some have bathroom facilities. Activities at the recreational areas may contribute to water quality problems by placing added pressure on the watershed. For instance, they may contribute to erosion (trails, building footbridges, etc.), dog waste not picked up may accumulate and wash off after rainfall, new trails may be put into areas that didn't have human activity before and they may put added pressure on wildlife to congregate in other places where we may see water quality decline.

This section of the coast of Maine is considered a major tourism area and sees a large influx of recreational users especially in the summer months. There is a park at Naskeag Point, Blue Hill, East Blue Hill, and the head of Morgan Bay that are for day use. There are no large campgrounds and one country club in Blue Hill. Although there are a few gravel and sand beaches in the area, swimming is relatively rare, as the water temperatures rarely exceed 65°F.

Hydrographic and Meteorological Assessment

Tides

Coastal Maine experiences a mixed, semi-diurnal tide, with diurnal inequalities that are more pronounced on spring tides. Except for very few isolated areas with extensive saltwater marshes, tides are not considered to be contributors to fecal contamination. The National Oceanic and Atmospheric Administration data for a station at Eastport indicate a mean tidal range of 18.35 ft. The mean tidal range for most of Maine is 9 feet to 13 feet. Unlike areas with small diurnal tides, this extreme volume exchange results in significant bacterial dilutions. Currents in the area are predominantly driven by the tides.

Rainfall

The mean annual precipitation in growing area EF is approximately 44 inches and the precipitation is not evenly distributed throughout the year. The wettest months are generally April and November while August is typically the driest month. Much of the precipitation in the winter comes as snow and may affect runoff rates in spring upon melting. Flood closures are implemented when areas receive greater than two inches of rainfall in a twenty-four-hour period. Rainfall is monitored by numerous rain gauges located along the entire Maine coast and reported primarily through the Weather Underground website. Some areas of Maine have documented fecal influences resulting from rainfall of greater than one inch in a twenty-four-hour period. These areas are considered rainfall conditional areas and are Conditionally Approved based on the one-inch closure trigger. No rainfall areas have been identified in growing are EF.

Maine DMR is working collaboratively with the University of Maine on a statewide coastal project determining how various watershed characteristics influence fecal contamination of marine waters during rainfall events. This research clusters watersheds based on similar characteristics then models how rainfall and associated pollution is distributed. The model is being refined to incorporate margin watershed influences.

Winds

Migratory weather systems cause winds that frequently change in strength and direction. Gulf of Maine winds are generally westerly, but often take on a northerly component in winter and a southerly one in summer. Strongest winds are generated by lows and cold fronts in fall and winter and by fronts and thunderstorms during spring and summer. Extreme winds are usually associated with a hurricane or

severe nor'easter and can reach 125 knots. In Maine wind is not a contributor to fecal pollution because marine currents are primarily influenced by the size and duration of the normal tidal cycle.

River Discharge

Stream flow in Maine exhibits seasonal variation, with the highest flows occurring in the spring (due to snowmelt, spring rains, and low evapo-transpiration) and the mid-to late fall (due to fall rains and low evapo-transpiration). There are no large river discharges into growing area EF. There are many small streams that discharge into the growing area and these streams are discussed in the section about nonpoint source pollution.

Hydrographic Influence

Water circulation in Growing Area EF is dominated by tides. Tides are caused by the gravitational effects of the moon and sun on the ocean; other influences are heavy rainfall, low barometric pressure and strong onshore winds which will increase tides. Tide levels fluctuate during the month based on the positions of the sun, moon and earth. These fluctuations and the speed and direction of the tidal currents constantly change during a tidal cycle. Tidal currents have the greatest energy when water is pushed in and out of bays and channels during the highest and lowest tide levels. Growing area EF is subject to a semidiurnal tidal cycle with two high tides and two low tides per day. The tidal cycle is 12 hours and 25 minutes long, so that high and low tides are 50 minutes later each day.

Water Quality Studies

Map of Sampling Stations

Most marine fecal pollution of Maine waters comes from non-point sources. DMR uses Systematic Random Sampling (SRS) to monitor this influence and uses a pre-established schedule at an adequate frequency to capture all meteorological, hydrographic and/or other pollution events that trigger non-point pollution contribution. Using SRS will detect intermittent and unfavorable change in water quality and the program accepts the estimated 90th percentile (P90) as the standard to measure variance of a data set.

There are presently 29 active water sampling sites in Growing Area EF and no investigative stations. It is recognized that access, icing, and safety considerations prevent some stations from being sampled on scheduled dates. Currently all stations in Growing Area EF meet their current NSSP classification standard. One water quality station (EF 11) now has water quality that meets the standards for Approved harvest year round and will be evaluated for an upgrade in 2021.

Water Quality Discussion and Classification Determination

P90s for all active stations with a minimum of 30 samples were calculated and all stations meet their classification standards (Tables 6, 7). Three stations showed a substantial in P90 score, but all still meet their current classification standards. Only one of the three, EF 6, is in danger of failing to meet its current classification standards. Overall, the water quality in growing area EF appears to be improving or remaining constant.

Table 6. P90 calculations for stations with a minimum of 30 samples. Geomeans and P90s not meeting current classifications are highlighted in red.

Station	Class	Count	GM	SDV	MAX	P90	Min_Date
EF001.80	A	30	5	0.48	58	20.6	3/5/2018
EF001.90	R	30	7.2	0.59	106	41.6	4/12/2016
EF002.00	R	30	8.9	0.76	860	84.9	10/26/2016
EF002.50	A	30	2.9	0.39	62	9.2	7/26/2016
EF004.00	R	30	4.6	0.76	880	44.6	5/31/2016
EF004.10	A	30	3	0.42	180	10.5	11/18/2014
EF005.00	A	30	2.8	0.45	160	10.6	7/26/2016
EF006.00	A	30	4	0.68	560	30.8	7/26/2016
EF008.00	P	30	3.6	0.48	120	15.3	5/31/2016
EF009.30	A	30	2.6	0.33	40	6.9	5/31/2016
EF010.00	A	30	3.3	0.33	36	9	3/5/2018
EF010.50	A	30	3.7	0.47	130	15.2	3/5/2018
EF011.30	A	30	4.1	0.51	84	18.7	5/31/2016
EF013.00	A	30	2.1	0.25	40	4.6	5/31/2016
EF014.00	A	30	3.4	0.47	108	13.9	5/31/2016
EF020.00	A	30	2.7	0.35	48	7.7	9/19/2016
EF020.50	A	30	2.4	0.31	58	6.3	7/26/2016
EF022.00	P	30	4.6	0.52	140	21.7	7/9/2018
EF022.91	P	30	2.9	0.34	20	8.2	7/26/2016
EF023.00	P	30	4	0.51	90	18.7	7/26/2016
EF024.00	A	30	2.9	0.35	26	8.4	7/26/2016
EF025.00	A	30	2.8	0.31	29	7.2	7/26/2016
EF026.00	A	30	3.3	0.47	112	13.6	7/26/2016

Emergency Closures: The reports summarizing emergency closures such as flood and biotoxin closures for the entire state are in the DMR central files.

Reclassifications: Reclassification addendums to the sanitary survey report are in the DMR central files.

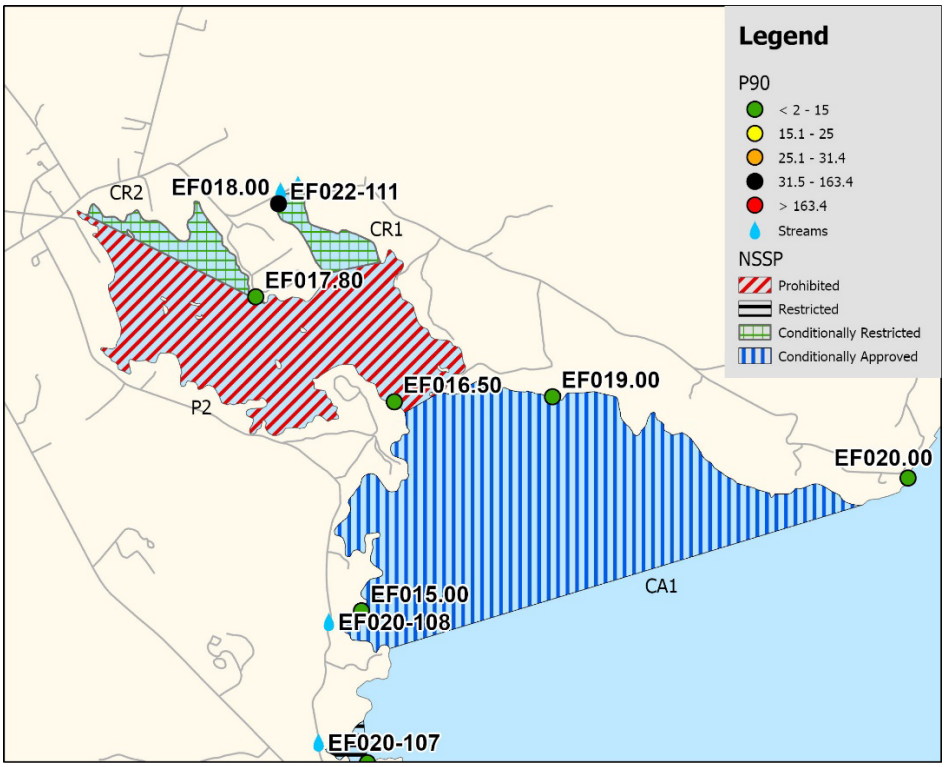
CAMP Reviews, Inspection Reports, and Performance Standards

Annual Review of Blue Hill WWTF, Blue Hill Conditional Area Management Plan

Scope

The Blue Hill WWTF conditional areas in Blue Hill Harbor in Blue Hill is classified as Conditionally Restricted and Conditionally Approved based on the function of the Blue Hill WWTF (Figure 5). One Conditionally Restricted area is north of a line beginning at the eastern prominence of Peters Point then running northeast to a red painted post located on a prominent point of land on the north shore of Blue Hill Harbor. This conditional area is monitored by water quality station EF 18. The second Conditionally Restricted area is north of a line beginning at the south tip of the point of land at the eastern side of the bridge over Mill Stream on Route 172/176 in downtown Blue Hill, then running southeast to the southwest prominence of Peters Point. This conditional area is monitored by water quality station EF 17.8. These areas are classified as Conditionally Restricted based on wastewater treatment plant function. The Conditionally Approved area is south of a line beginning at the west tip of Sculpin Point and running southwest to the east tip of Parker Point; AND north of a line beginning at the south tip of Woods Point, then running southwest to the northeast tip of Holden Point. This area is classified as Conditionally Restricted based on wastewater treatment plant function. This Conditional Area is monitored by water quality stations EF 15, 16.5, and 19.

Figure 5. Blue Hill WWTF, Blue Hill Conditionally Restricted and Conditionally Approved areas



Compliance with management plan

The Blue Hill WWTF Conditional Area remains in compliance with the current conditional area management plan (CAMP). Waste water treatment facility staff adequately report all bypass events and the area is closed to harvest within the reactionary window for emergency events. See CAMP annual reviews for information on annual compliance with the current CAMP.

Adequacy of reporting and cooperation of involved persons

The town of Blue Hill has an effective and cooperative local sewage plant operation staff. Waste water treatment facility staff report any sewage bypass events to the department immediately when an untreated sanitary waste discharge occurs into the waters of Blue Hill Harbor during any active harvesting period. Reporting is done through the Maine Department of Marine Resources website or through the Maine Department of Marine Resources' Pollution Event Reporting Hotline.

Compliance with restricted growing area criteria

The area continues to meet the criteria for Restricted harvest during the open status based on P90 calculations meeting the standard for Restricted or Approved harvest as applicable during the open status (Table 7) and no other known point sources of pollution.

Water sampling compliance history

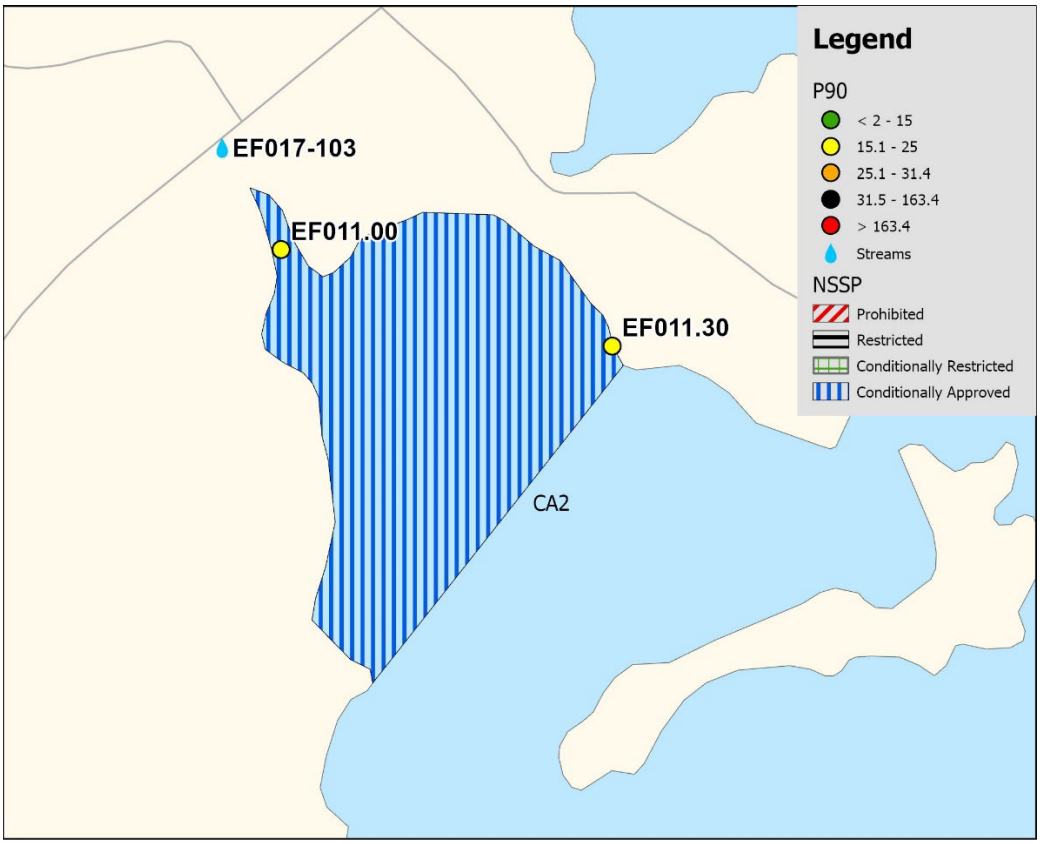
Water samples are collected at least monthly during the open status and throughout the year (Table 8). The P90 values meet the standard for Restricted or Approved harvest as applicable during the open status (Table 7).

Analysis-Recommendations
The Blue Hill WWTF Conditional Area continues to meet the standards for seasonal Restricted or Approved harvest as applicable to the designated closure areas during the open status and remains in compliance with the CAMP. Recommend continued water quality monitoring and open communication with waste water treatment facility staff to ensure continued compliance with the CAMP.

Annual Review of Blue Hill Salt Pond, Blue Hill Conditional Area Management Plan

Scope
The Blue Hill Salt Pond conditional area in Blue Hill is classified as Conditionally Approved seasonally with the open status for harvest from December 1 through May 31 (Figure 6). This area is north and west of a line beginning at a red painted post located a the northeast mouth of the cove into which Carleton Stream empties (Blue Hill), running southwest to the tip of an unnamed prominent point approximately 190 yards northwest of the west tip of Carleton Island. This area is classified as Conditionally Approved based on seasonal pollution. This Conditional Area is monitored by water quality station EF 11.

Figure 6. Blue Hill Salt Pond, Blue Hill Conditionally Approved area



Compliance with management plan
The Blue Hill Salt Pond Conditional Area remains in compliance with the current conditional area management plan (CAMP). The data continues to show winter pollution levels do not pose a risk to public health. See CAMP annual reviews for information on annual compliance with the current CAMP.

Adequacy of reporting and cooperation of involved persons
No reporting is required for this Conditional Area.

Compliance with restricted growing area criteria
The area continues to meet the criteria for Approved harvest during the open status of December 1 through May 31 based on P90 calculation at water quality station EF 11 during the open status and no other known sources of pollution in the area.

Water sampling compliance history
Water samples are collected at least monthly during the open status and throughout the year (Table 8). The P90 value meets the standard for Approved harvest during the open status (Table 7).

Analysis-Recommendations

The Blue Hill Salt Pond Conditionally Approved area continues to meet the standards for seasonal Approved harvest during the open status and remains in compliance with the CAMP. This area continues to show improving water quality year round and now meets standards for Approved harvest year round. Recommend continued water quality monitoring and the area should be reviewed for a potential upgrade in 2021.

Table 7. P90s for Conditional Area stations calculated using data from the open status. Geomeans and P90s not meeting current classifications are highlighted in red.

Station	Class	Count	GM	SDV	MAX	P90	Min_Date
EF011.00	CA	30	2.9	0.28	13	6.8	12/1/2015
EF015.00	CA	30	3.2	0.45	134	12.6	7/9/2018
EF016.50	CA	30	3	0.41	60	10.2	7/9/2018
EF017.80	CR	30	3	0.4	66	10.2	7/9/2018
EF018.00	CR	30	5.3	0.69	1700	42.1	7/9/2018
EF019.00	CA	30	2.9	0.44	220	10.9	7/9/2018

Recommendation for Future Work

Water quality station EF 11 (Blue Hill Salt Pond) meets the standard for Approved harvest year round at end of year 2020 and will be evaluated for a possible upgrade in 2021. No stations in growing area EF required a downgrade due to end of year 2020 P90 scores.

Table 8. Count table of samples collected in growing area EF during the 2016 season.

Station	Class	C	O	X	Total	Samples Required	Comments
EF001.80	A		7		7	6	
EF001.90	R		6		6	6	
EF002.00	R		10		10	6	
EF002.50	A		7		7	6	
EF004.00	R		7		7	6	
EF004.10	A		6		6	6	
EF005.00	A		7		7	6	
EF006.00	A		7		7	6	
EF008.00	P	7			7	6	
EF009.00	A	1	4		5	6	Deactivated
EF009.30	A		8		8	6	
EF009.70	A		2		2	6	Deactivated
EF010.00	A		7		7	6	
EF010.50	A		7		7	6	

Station	Class	C	O	X	Total	Samples Required	Comments
EF011.00	CA	3	6		9	6	
EF011.30	A		7		7	6	
EF012.10	A		1		1	6	Deactivated
EF013.00	A	4	7		11	6	
EF014.00	A		7		7	6	
EF015.00	CA		12		12	12	
EF016.00	CA		4		4	12	Deactivated
EF016.50	CA		12		12	12	
EF017.80	CR		12		12	12	
EF018.00	CR		12		12	12	
EF019.00	CA		12		12	12	
EF020.00	A		7		7	6	
EF020.50	A		7		7	6	
EF022.00	P	12			12	6	
EF022.91	X			7	7	6	
EF023.00	P	7			7	6	
EF024.00	A		7		7	6	
EF025.00	A		7		7	6	
EF026.00	A		7		7	6	

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Climatic and hydrographic information, US Coast Guard Coastal Pilot, 2005 edition

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Town information, 2007-2008 Maine Municipal Directory, Maine Municipal Association, Augusta, Maine 04330

Licensed discharge information, Maine Department of Environmental Protection, Augusta, Maine

Data Layers, Maine Office of GIS, Augusta, Maine

Rainfall data, National Weather Service, Caribou, Maine

Maine Combined Sewer Overflow 2016 Status Report, Maine Department of Environmental Protection, April 2017

Appendix A.

Key to Water Quality Table Headers

Station = water quality monitoring station
Class = classification assigned to the station; Prohibited (P), Restricted (R), Conditionally Restricted (CR), Conditionally Approved (CA) and Approved (A).
Count = the number of samples evaluated for classification, must be a minimum of 30.
GM = means the antilog (base 10) of the arithmetic mean of the sample result logarithm (base 10).
SDV = standard deviation
Max = maximum score of the 30 data points in the count column
P90 = 90th percentile, Approved standard is 31, Restricted standard is 163
Min_Date = oldest date sampled included in the calculations.
X = investigative station