



GROWING AREA ET

Mowery Point, Lubec to Shackford Head, Eastport
Washington County, Maine

SANITARY SURVEY REPORT

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Executive Summary

This is a Sanitary Survey report for growing area ET written in compliance with the requirements of the 2013 Model Ordinance and the National Shellfish Sanitation Program (NSSP). One new pollution source was identified during this survey that resulted in a new closure 57 A1. Three upgrade proposals are being suggested for 2016 based on information from this survey. There were three changes in classification during the 2012 review period. Area 56 Part E (Hobart Stream, Edmunds) was reclassified from "Restricted" to "Conditionally Approved", expanded and administratively renumbered to Area 56 Part C. Area 57 Part B (Timber Cove, Trescott) was reclassified from "Restricted" to "Conditionally Approved" and administratively renumbered to Area 57 Part C. Area 57 Part D (Western Carlos Cove, Trescott) was reclassified from "Restricted" to "Conditionally Approved". Area 58 Parts A and B (Pirates Creek and Johnson Bay) were administratively renumbered without classification changes. Area 59 Part A (Deep Cove, Eastport) was repealed and reclassified from "Prohibited" to "Approved". There were 10 administrative changes concurrent with reclassifications to clarify the closed area descriptions. In 2013, two stations were deactivated. ET73 was deactivated because it is remote with no nearby human habitation. ET80 was deactivated because the station is a stream sample during most tide stages except high tide. One station (ET69, Restricted) was deactivated in February of 2013 and reactivated in November of 2013 because it was inaccessible due to a locked gate. Because of this access problem it was only sampled once in the 2013 sampling season. There were two changes in classification and one administrative wording change during 2013. Carlos Cove (closure Area No 57, Part D, ET31.5) was upgraded to Approved. Coggins Head, Hershey Neck (closure Area No 56, Part B.4., ET88) was downgraded to Restricted based on observed water quality. Pirates Creek (closure Area No. 58 Part B.1., ET8 and ET8.3) was re-worded to clarify the legal notice. One Conditional station (ET57) was sampled only 5 times in the open status because of extensive sea ice in January. There were no new pollution sources identified during the review year. In 2014, Pirates Creek (closure Area No. 58 Part B.1) was reconfigured based on updated shoreline survey and a stream dilution calculation. Based on year end 2014 data, four areas were recommended for an upgrade in classification and one area was downgraded from approved to restricted. Two new Z stations (investigative) were added to help support upcoming classification changes. The next sanitary survey is due in 2026 and the next Triennial in 2017. The last sanitary survey was done in 2008 so this report covers 2008-2015 only. Sanitary survey reports were redistributed in 2013 to even workloads for the current staff, resulting in some sanitary survey reports being done in less than 12 years. All sanitary surveys are being done at a minimum every 12 years in compliance with the NSSP.

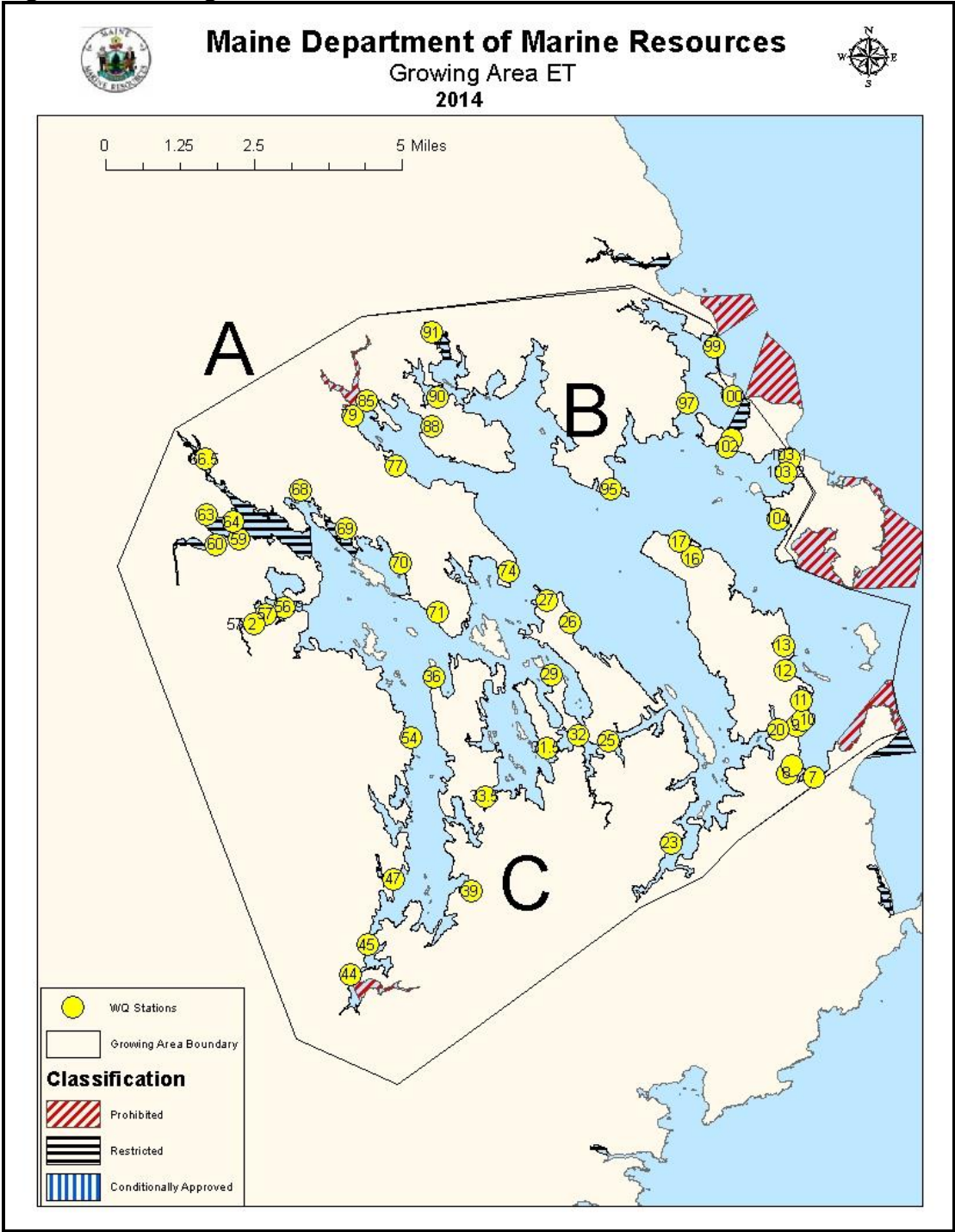
Growing Area ET is located in eastern Maine in Washington County. The shoreline described in this report includes all of Cobscook Bay stretching from Mowry Point, Lubec to Shackford Head, Eastport. The area encompasses 117 square miles, and includes the near sub-tidal waters, inter-tidal flats and a zone that extends inland to a defined upland boundary. The upland land cover (Figure 3) is predominately evergreen, deciduous and wetland forest with minimal development. There are several large grass hay fields. There is no heavy industry in the growing area. The villages of Lubec (population 1,523), Whiting (population 456), Dennysville (population 302), Pembroke (population 875) and Eastport (population 1,582) have the largest population concentrations (2007-2008 Maine Municipal Directory). Development along these shores is spotty with clusters of homes separated by undeveloped land. The next triennial report is due in 2017 and the next sanitary survey report is due in 2026.

The most important aspects of hydrography and meteorology and its influence on pollutant transport in Growing area ET is the impact of rainfall events >1.0" in 24 hours with resultant upland runoff from both point and non-point sources. Rainfall is heaviest in April-May and



October-November and snowmelt in the late spring adds to the runoff, releasing any frozen feces from wild and domestic animals or failing septic systems. Streams and ditches funnel this runoff to the saltwater. Sample stations near significant fresh water inflow pollution sources are in Prohibited or Restricted classified areas. River flow does not appear to impact pollution loading in the Orange, Dennys or Pennamaquan Rivers; however seasonally does influence the bacterial loading in the Dennys River with the summer months showing the most impact.

Figure 1: Growing Area ET





History of Growing Area Classification

2008: No changes.

2009: April 3, 2009; Area No. 56, Northwest Cobscook Bay (Edmunds, Dennysville, Pembroke, Perry); Ox Cove was reclassified from restricted to approved due to water meeting approved classification criteria, reducing the size of the restricted area to around Burnt Island.

April 3, 2009; Area No. 56, Northwest Cobscook Bay (Edmunds, Dennysville, Pembroke, Perry); The restricted area in the Dennys and Hardscrabble Rivers were combined and the restricted area boundary line was moved further downriver to the next approved sample station (ET 59) due to water quality not meeting approved classification criteria at the previous boundary station.

April 3, 2009; Area No. 58, Lubec; Three separate rules (Area 58C, Pirates Creek; Area 58F, The Haul-up; Area 58, Lubec and South Lubec) were combined into a single closure. Also, a new restricted area was promulgated in Morong Cove, due to water quality not meeting approved classification criteria and this closure was included in the combined regulation. A new boundary sample station, ET 31.5, was established at the Morong Cove closure margin.

2010: February 24, 2010; Area 56 (part D), Dennys River, a downward classification from approved to restricted due to water quality not meeting the approved standards at ET 59.

February 24, 2010; Area 57 (part D) Carlos Creek, a downward classification from approved to restricted due to water quality not meeting the approved standards at ET 33.5.

February 24, 2010; Area 56 (part E) Hobart Stream, a downward classification from approved to restricted due to water quality not meeting the approved standards at ET 57.2.

February 24, 2010; Area 57 (part C) Crane Mill Brook, a downward classification from approved to restricted due to water quality not meeting the approved standards at ET 47.

2011: January 5, 2011; Area 56 (part A) Pennamaquan River, a downward classification from approved to prohibited due to water quality not meeting the approved standards at ET 79.

January 5, 2011- Area No. 56, Northwestern Cobscook Bay (Edmunds Twp., Dennysville, Pembroke, Perry); The amendment enlarged the prohibited area in the Pennamaquan River due to water quality no longer meeting approved standards at the area boundary station.

June 30, 2011- Area No. 58, Lubec; This amendment reclassified The Haul-Up from prohibited to approved, and Morong Cove and the northern portion of Pirates Creek from restricted to approved, due to water quality meeting the approved standards in those areas. The southern portion of Pirates Creek remained classified as restricted due to intermittent bacterial pollution still impacting that area.

2012: Pollution Area No. 56 Part E, Northwestern Cobscook Bay. On 9 February Hobart Stream was reclassified from "Restricted" to "Conditionally Approved", expanded to cleanly contain the tidal stream which was the area of concern and administratively renumbered to Area 56 Part C. Four administrative changes renumbering and clarifying line items in Area 56 were made concurrent with this notification. A complete addendum for these changes may be found in DMR's central files.



Pollution Area No. 57 Part B, Whiting Bay. On 9 February Timber Cv. was reclassified from "Restricted" to "Conditionally Approved" and administratively renumbered Area 57 Part C. Two administrative changes renumbering and clarifying line items in Area 57 were made concurrent with this notification. A complete addendum for these changes may be found in DMR's central files.

Pollution Area No. 57 Part D: Whiting Bay. On 9 February Carlos Cove was reclassified from "Restricted" to "Conditionally Approved". A complete addendum for these changes may be found in DMR's central files.

Pollution Area No. 58 Part A, Lubec. On 17 April Pirates Creek was administratively renumbered to Area No. 58 Part B.1 along with clarifications to line items. A complete addendum for these changes may be found in DMR's central files.

Pollution Area No. 58 Part B, Lubec. On 17 April Johnson Bay and Lubec Narrows were administratively renumbered to Area No. 58 Part A along with clarifications to line items. A complete addendum for these changes may be found in DMR's central files.

Pollution Area No. 59 Part A, outer Cobscook Bay. On 2 March Deep Cove was repealed and reclassified from "Prohibited" to "Approved". Two administrative changes renumbering and clarifying line items in Area 59 were made concurrent with this notification. A complete addendum for these changes may be found in DMR's central files.

Conditional Area No. 56 Part C (Hobart Stream) is "Conditionally Approved". It was established 9 February. The area was established during the "Open" period and closed as scheduled on 1 July in accordance with the conditional area management plan (CAMP). The area is conditionally opened, based on season, closing 1 July to 31 December due to water quality scores having increased variability during the closed months. The area is monitored by stations ET57 and ET57.2. Water quality met the "Approved" standard during the open period. The new CAMP and annual review are located in the DMR central files.

Conditional Area No. 57 Part C (Timber Cove) is "Conditionally Approved". It was established 9 February. The area was established during the "Open" period and closed as scheduled on 1 May and re-opened on 1 October in accordance with the CAMP. The area is conditionally opened, based on season, closing 1 May to 1 October due to water quality scores having increased variability during the closed months. The area is monitored by station ET39. Water quality met the "Approved" standard during the open period. The new CAMP and annual review are located in the DMR central files.

Conditional Area No. 57 Part D (Carlos Cove) is "Conditionally Approved". It was established 9 February. The area was established during the "Open" period and closed as scheduled on 1 May and re-opened on 1 November in accordance with the CAMP. The area is conditionally opened, based on season, closing 1 May to 1 November due to water quality scores having increased variability and clusters of elevated fecal testing scores during the closed months. The area is monitored by station ET33.5. Water quality met the "Approved" standard during the open period. The new CAMP and annual review are located in the DMR central files.

2013: Pollution Area No. 56 Part B.4. Coggins Head, Hershey Neck (Pembroke, Station ET88) was downgraded from Approved to Restricted on 19 February 2013. A complete addendum for these changes may be found in DMR's central files.



Pollution Area No. 57 Part D. Carlos Cove (Trescott, Station ET33.5) was upgraded from a Conditionally Approved area to an Approved area on 17 September 2013. A complete addendum for these changes may be found in DMR's central files.

Pollution Area No. 58 Part B.1. Pirates Creek, Johnson Bay (Lubec) had a description change without upgrading or downgrading or changing the size of the closed area by legal notice to more clearly describe the location of the boundary on 19 February. A complete addendum for these changes may be found in DMR's central files.

2014: No Changes.

2015: Area 56 Northwestern Cobscook Bay (Edmunds Twp, Dennysville, Pembroke, Perry): This change reclassifies the Restricted area in Coggins Head (Pembroke) to Approved and reduces the size of the Prohibited area in the upper Pennamaquan River (Pembroke) due to water quality meeting Approved standards. This notice also changes the headings and numbers of some pre-existing closed areas due to administrative changes to the legal notice form. All existing pollution and red tide/PSP closures remain in effect.

Area No. 57, Whiting Bay (Edmunds Twp, Trescott Twp): This change reduces the size of the current Restricted area near Crane Mill Brook due to water quality meeting Approved standards. This notice also makes administrative changes to the headings and numbers of some pre-existing closed areas. All existing pollution and red tide/PSP closures remain in effect.

Area No. 57, Whiting Bay (Whiting, Edmunds, Trescott): This notice increases the size of the prohibited area near East Stream due to the identification of a point source of pollution during a routine shoreline survey. All existing pollution and red tide/PSP closures remain in effect.

Area No. 58, Lubec: This notice creates a new Restricted area in Globe Cove due to water quality no longer meeting Approved standards. All existing pollution and red tide/PSP closures remain in effect.

Current Classifications

The following legal notices describe the shellfish classification boundaries in Shellfish Growing Area ET and can be found on the DMR website at:

http://www.maine.gov/dmr/rm/public_health/closures/closedarea.htm#

Prohibited:

- 56 (A): Pennamaquan River (Pembroke)
- 57 (A) East Stream (Trescott TWP)
- 58 (A) Lubec waterfront (Lubec)

Restricted

- 56 (B1) Sipp Bay (Perry)
- 56 (B2) Upper Dennys River (Dennysville)
- 56 (B3) Burnt island (Pembroke)
- 58 (B1) Pirates Creek (Lubec)
- 58 (B2) Mowery Flats (Lubec)
- 58 (B3) Quoddy Head (Lubec)



58 (B4) Globe Cove (Lubec)
59 (B2) Half Moon Cove (Eastport)

Conditionally Approved:

56 (C) Hobart Stream (Edmunds)
57 (C) Timber Cove (Trescott)

Activity during Review Period

2009: Drives through surveys of the area were done during routine water sampling runs.

October 7, 2009; a review survey of the Pirates Creek area was conducted to verify current survey information surrounding the restricted Area No 58 (part C).

2010: May 10, 2010- Orange River (Whiting); a reported white pipe behind gas station/store adjacent to the Orange River was identified and determined to be a land drain and not a bacterial pollution source.

July 20, 2010- Hersey Cove (Pembroke); a new seasonal camp trailer was situated adjacent to sample site ET 88. The trailer is connected to a new in-ground septic system to the left of the drive. No problems were identified.

July 20, 2010- The Timber Cove (Trescott); the area was surveyed to attempt to identify the source of elevated bacterial levels at sample station ET 39. Approximately 200 feet from ET 39, a small stream that feeds from a small pond into the head of the cove. A sample of the stream had a fecal coliform value of 28 FC/100ml and a flow rate of 150 gallons per minute. No source of pollution was identified.

August 31, 2010- The Morong Cove (Lubec); the area was surveyed to attempt to identify the source of elevated bacterial levels at sample station ET 32. No source of pollution was identified.

October 5, 2010- The Timber Cove (Trescott); the area was re-surveyed to attempt to identify the source of elevated bacterial levels at sample station ET 39. A sample of the stream had a fecal coliform value of 46 FC/100ml and a flow rate of 224 gallons per minute. No source of pollution was identified.

October 5, 2010- The Carlos Creek (Trescott); the area was surveyed to attempt to identify the source of elevated bacterial levels at sample station ET 33.5. The cove is remote and no structures were identified. Approximately 500 feet from ET 33.5, a small stream that feeds from a wooded area into the head of the cove. A sample of the stream had a fecal coliform value of 260 FC/100ml and a flow rate of 337 gallons per minute and a stream survey showed evidence of past beaver activity.

2011: Drive through survey conducted during random scheduled runs. No new pollution sources found.

2012: Repairs to a septic field were inspected on 7/18, no breakouts were observed. Drive through surveys of all, or part, of the growing area are conducted by trained staff while collecting water samples. Drive through surveys were conducted on: 1/4, 2/6, 2/27, 2/28, 2/29, 3/5, 3/7, 4/4, 5/8, 5/9, 5/23, 6/6, 5/12, 6/18, 6/19, 7/24, 7/25, 7/31, 8/1, 8/8, 9/12, 9/17, 9/18, 9/19, 10/10, 11/6, 11/7, 11/14, 11/26 and 12/4.

2013: During 2013 drive by surveys, by land, of all or part of the growing area were conducted on: 1/8, 1/15, 2/5, 2/26, 2/27, 3/5, 3/6, 3/11, 4/3, 4/23, 4/24, 4/29, 5/8, 5/29, 6/4, 6/5, 6/12, 6/17, 6/18, 6/26, 7/2, 7/10, 8/7, 8/12, 8/14, 8/19, 8/21, 9/10, 9/11, 9/17, 9/18, 9/23, 9/25, 10/2, 10/30, 11/5, 11/6, 11/13, 11/18 and 12/9 during sample collection. A dedicated drive through survey of the area was conducted on 5/13. No new pollution sources were identified. Shoreline survey work and a stream dye study were conducted around Carlos Cove (Trescott) in May. The



information was used to enact the 17 September upgrade of Carlos Cove to Approved (Pollution Area 57 Part D).

2014: Dedicated drive through surveys for the 2014 Triennial were conducted on the following dates 7/30/14 covering Lubec through Commissary Point, (Trescott). No problems were identified. On 8/1/14 the area from Commissary Point (Trescott) to Half Moon Cove (Eastport) was surveyed and once again no new problems were identified.

2015: The entire growing area was surveyed and only one new point source of pollution was identified.

Pollution Source Survey

The following sections include information on pollution sources which do or may impact water quality in growing area ET. Pollution sources that are reviewed in this section include domestic waste, both private inground systems and over board discharges (OBDs), marinas and mooring fields, stormwater and pollution from non-point sources (streams), farms and other agricultural activities, domestic animals and wildlife areas, and recreational areas.

Table 1. Area ET Pollution Source Table

Town	GASS ID	Pollution Area	Major PS	PS Type	Problem	Impact	DESCRIPTION
Lubec	ET003	58 (B1)	Stream	ST	Y	AD	first stream on Spring Brook Lane
Lubec	ET003	58 (B1)	Stream	ST	Y	AD	Pirates Creek head of tide
Trescott	ET049	57 (D1)	Stream	ST	Y	AD	Timber Cove stream
Whiting	ET056	57 (A1)	Septic	IG	Y	AD	Whiting Store
Perry	ET090	56 (B1)	Stream	ST	Y	AD	Sipp Stream
Pembroke	ET091	56 (A1)	Stream	ST	Y	PD	cow pasture near ET 88



Figure 2. Growing Area ET Pollution Source Map A

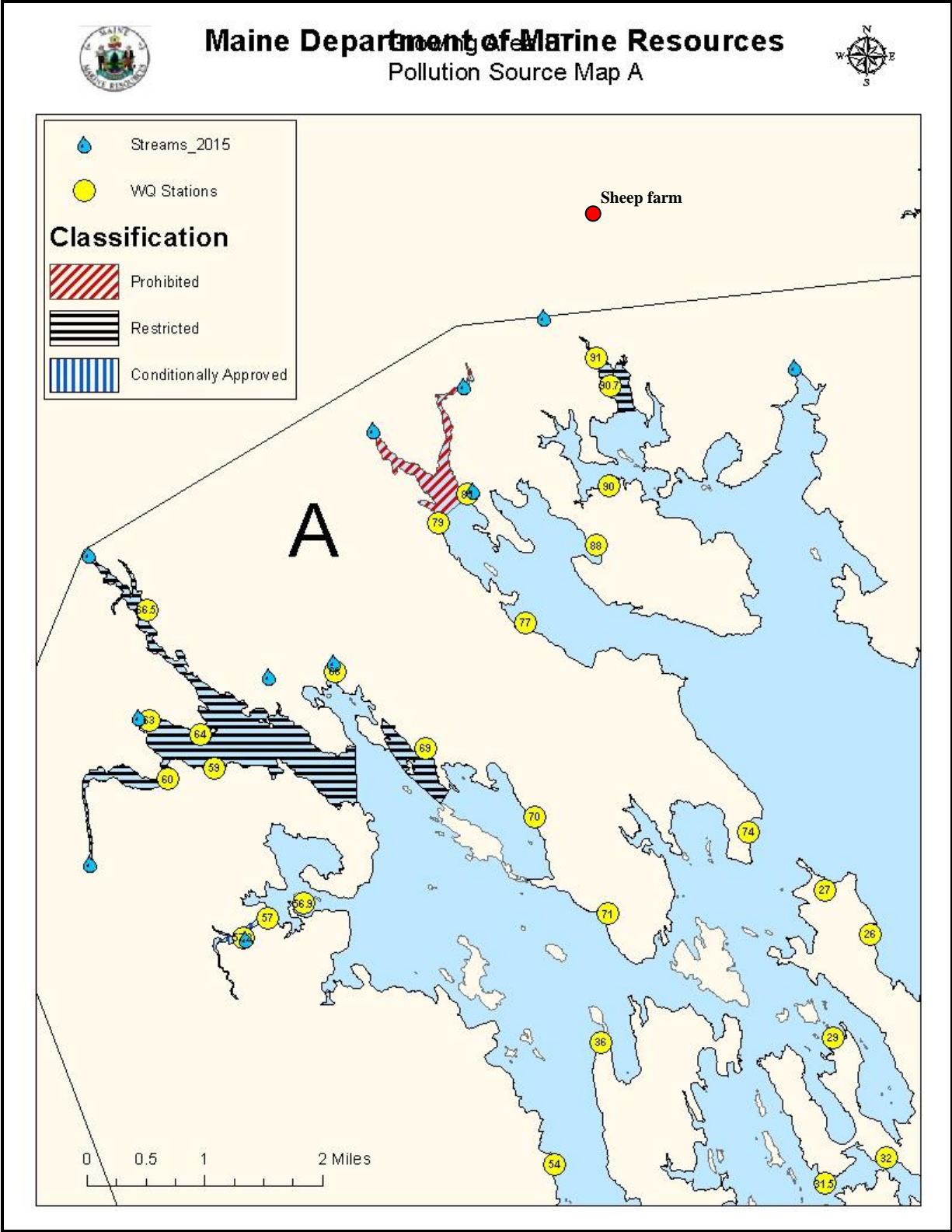


Figure 3 Growing Area ET Pollution Source Map B

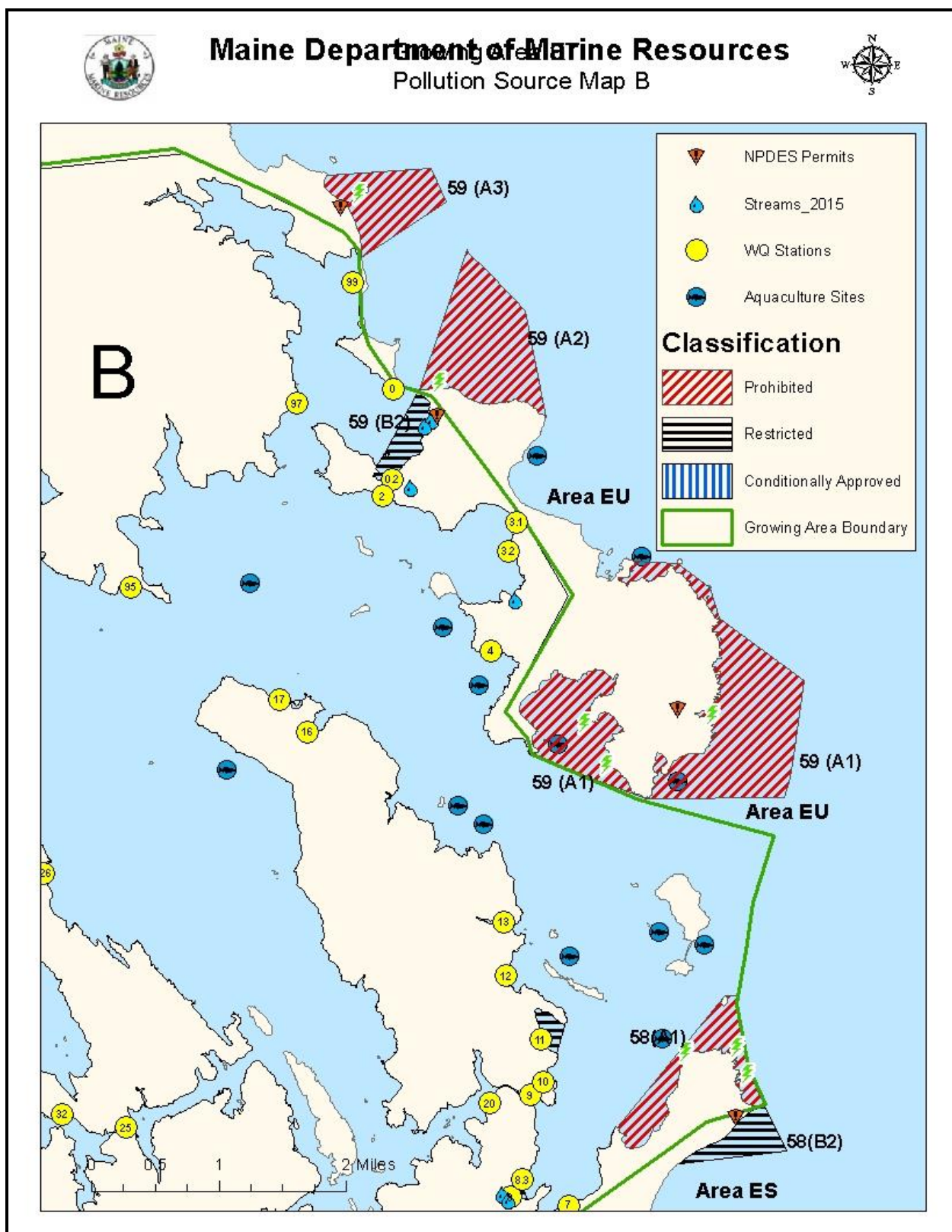
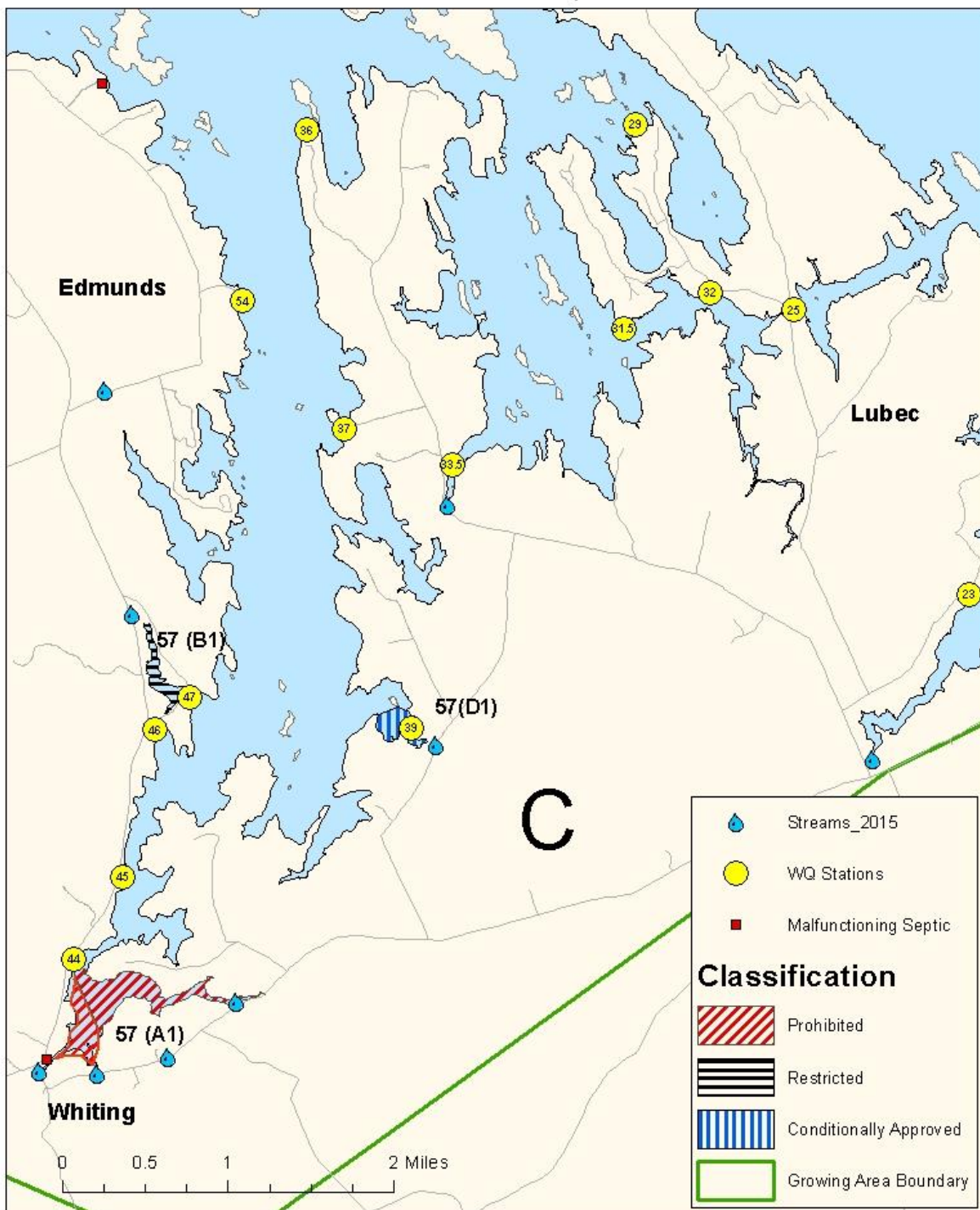


Figure 4 Growing Area ET Pollution Source Map C



Maine Department of Marine Resources

Growing Area ET
Pollution Source Map C





Domestic Waste (IG Systems and OBDs)

Growing area ET consists of 117 two mile segments (GASSIDs) all within the towns of Lubec, Trescott, Whiting, Edmunds, Pembroke, Dennysville, Perry and Eastport. The growing area consists of 747 residential in ground systems. All domestic waste systems were visited in 2015 during the sanitary survey. There is only one known issues with residential septic systems. Two problem forms were filed with the town during the Shoreline Survey review period. One of these resulted in the expansion of closure 57 (A1) in Whiting due to a septic breakout. The other issue found did not result in a closure.

Municipal Wastewater Treatment Facilities

The Lubec WWTP license W-006306-59-B-R (ME0102016) is a primary treatment facility that serves approximately 600 households. The permit allows the discharge of a monthly average flow of 0.166 million gallons per day (MGD) of primary treated sanitary waste water to Passamaquoddy Bay (Lubec Narrows) in Lubec, Maine. Sanitary waste water received at the treatment facility is generated by residential and commercial entities in the Town of Lubec. The facility does not receive more than 10% of its flows from industrial sources. Waste water enters the influent pump station wet well through gravity sewer, is pumped by the influent self-priming centrifugal pumps to the headworks grit removal and then flows to the two (2) Imhoff primary treatment tanks. The sludge and scum are stored in the lower compartments of the tanks for anaerobic digestion and then seasonally disposed of by liquid sludge land application or dewatered in drying beds and either land applied, land filled or sent to another facility for further treatment and disposal.

Fecal coliform bacteria permitting action established seasonal (May 10 – October 15) monthly average (geometric mean) and daily maximum limits of 15 colonies/100 ml and 50 colonies/100 ml respectively, with a monitoring frequency of once/week. These are consistent with limitations in the National Shellfish Sanitation Program.

The waste water collection system consists of five (5) miles of gravity collector sewers and force mains and four (4) submersible pump stations. There are no combined sewer overflow (CSO) outfalls in the collection system. The collection system consists of a duplex submersible effluent pump station at the treatment plant, 2,600 linear feet of 10-inch diameter force main and 450 feet of 8-inch diameter outfall pipe which discharges treated waste water to the tidal waters of Lubec. There is increased flow due to infiltration during wet weather.

The plant has standby power that allows operation of the entire treatment process (diesel generators); high water, power failure and breakdown alarms; regular maintenance (daily checks/repair), and the alarm system notifies (1) Operator (2) Washington County Sheriffs Office. A 10-inch diameter force main between the treatment plant and the de-chlorination facility acts to provide the necessary detention time to provide disinfection of the waste water flow. There is a de-chlorination facility at the terminus of the effluent force main approximately 2,600 feet from the main treatment facility. Disinfection of the effluent is conducted during the summer season (May 10 to October 15). Sodium hypochlorite is injected into the force main in a chemical addition manhole to disinfect the waste water. Effluent flow monitoring and sampling are conducted at the de-chlorination facility. No non-compliance records have been found in either EPA or Maine DEP sites.

This plant discharges into receiving waters with an average mid-tide depth of 32 feet. Adjacent waters quickly exceed depths of over 100 feet. This plant discharges into Area 58 (part C). Based



on a 0.166 MGD flow, 1,000,000 FC/100ml in effluent before chlorination and an average depth of 32 feet for the receiving water; the dilution calculation results in a required 170 acre closure. The current Prohibited zone is 223 acres. This calculation indicates that the current closure is large enough to encompass the impact from the plants discharged effluent and closure margins would meet water quality approved standards criteria.

Based on the latest plant review this dilution zone is being reevaluated by DMR. Using the max wet weather flow of .266 mgd (2014 FDA WWTP evaluation form) and 1.4×10^5 for fecal loading (DMR's policy for partially treated effluent) the calculation was updated and the resulting Prohibited zone figure is 276 acres. DMR will investigate the current Prohibited zone and determine if the adjacent Restricted zone of 90 acres should be reclassified to conditionally Restricted based on plant performance. In either case, the current prohibited zone of 223 acres added with the restricted zone of 90 acres provides a total of 310 acres of dilution. There is no depuration activity in the Restricted zone.

WWTP Areas: Lubec WWTP reviews can be found in DMR's central files.

1. Pollution Area 58 A1.Lubec Narrows

Residential Licensed Overboard Discharges

There are no residential licensed overboard discharges in Growing Area ET.

Marinas and Mooring Fields

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 in Lubec and Eastport. These two locations have wharfs, fuel, slips, etc. Both are within Prohibited areas. Scattered moorings are almost exclusively work boats (lobster boats, trawling vessels) and 2-4 pleasure boats. These are not common overnight stopping areas for recreational boaters and not identified as pollution risks due to the number of boats and types of usage. Based on the numbers of live-aboard boats or areas classified prohibited, mooring areas are classified correctly to protect public health

Storm Water Discharges

Stormwater 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, stormwater pollution is caused by the daily activities of people within the watershed. Currently, polluted stormwater is the largest source of water quality problems in the United States.

The primary method to control stormwater discharges is the use of best management practices (BMPs). In addition, most major stormwater discharges are considered point sources and require coverage under an NPDES permit. In 1990, under authority of the Clean Water Act, the U.S. EPA promulgated Phase I of its stormwater 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 5 acres of land or greater, and (3) ten categories of industrial activity. In 1999, US EPA issued Phase II of the stormwater management program, expanding the Phase I program to include all urbanized areas and smaller construction sites.

Although it is a federal program, in the state of Maine, the Phase II Stormwater permit is issued and regulated by the Maine DEP (Chapter 500 and 502). Under the MS4 regulations, 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 stormwater management, and (6) Pollution prevention/good housekeeping. The permit required each city or town to develop a draft Stormwater Management Plan by September 3, 2003 that will establish measurable goals for each of the Minimum Control Measures. The Town must document the implementation of the Plan, and provide annual reports to the Maine DEP. Currently the discharge of stormwater from 28 Maine municipalities is regulated under the Phase II permit requirements, however, no municipalities located within the boundaries of growing area EA fall under these regulations. Additionally, the Maine Stormwater Management Law provides stormwater standards for projects located in organized areas that include one acre or more of disturbed area (Maine DEP 2009).

None of the towns in ET have storm water systems.

Tidal Creeks, Streams, and Wetland Discharges

Freshwater streams, drainages and tidal creeks are the major source of non-point discharge into Growing Area ET. Because of this we manage streams like point source discharges and will calculate dilution areas around them if they impact water quality in the area. A total of 77 samples were taken from freshwater streams during the review period. See pollution maps for stream and drainage locations and Table 2 for stream sample results. One area, 58 B1 Pirates Creek (Lubec) is based on a stream dilution calculation for stream 3-18 and 3-19. The full write up for this calculation can be found in the DMR central files.

Table 2: Streams Sampled in Growing Area ET

Town	Stream ID	date	CFU/100ml	Flow	Flow Unit	Area No
Lubec	ET003-18	9/9/14	106		GPM	58 (B1)
Lubec	ET003-18	10/1/14	24	5	GPM	58 (B1)
Lubec	ET003-18	5/11/16	140	0.11	CFS	58 (B1)
Lubec	ET003-18	10/7/14	35	12	GPM	58 (B1)
Lubec	ET003-18	8/14/14	1700		GPM	58 (B1)
Lubec	ET003-18	6/30/15	66	16	GPM	58 (B1)
Lubec	ET003-18	7/17/14	150	10	GPM	58 (B1)
Lubec	ET003-18	12/1/14	27	535	GPM	58 (B1)
Lubec	ET003-18	7/30/14	96	10	GPM	58 (B1)
Lubec	ET003-18	9/15/14	25	5	GPM	58 (B1)
Lubec	ET003-19	7/17/14	440	5	GPM	58 (B1)
Lubec	ET003-19	5/22/14	1700		GPM	58 (B1)
Lubec	ET003-19	12/1/14	1700	8	GPM	58 (B1)



Town	Stream ID	date	CFU/100ml	Flow	Flow Unit	Area No
Lubec	ET003-19	7/30/14	1700	3	GPM	58 (B1)
Lubec	ET003-19	10/1/14	1580	0.5	GPM	58 (B1)
Lubec	ET003-19	5/11/16	140	0.02	CFS	58 (B1)
Lubec	ET003-19	9/15/14	6600	1	GPM	58 (B1)
Lubec	ET003-19	9/9/14	900	0.75	GPM	58 (B1)
Lubec	ET003-19	10/7/14	7200	1	GPM	58 (B1)
Lubec	ET003-19	8/14/14	1700	1.5	GPM	58 (B1)
Lubec	ET018-401	7/6/11	14			open
Edmunds	ET039-7	5/12/14	2		GPM	open
Edmunds	ET039-7	6/30/15	9.4	9.4	CFS	open
Edmunds	ET039-7	10/5/10	260			open
Edmunds	ET039-7	10/1/14	520	1	GPM	open
Edmunds	ET049-1	10/1/14	24	2	GPM	57 (D1)
Edmunds	ET055-402	7/6/11	9.1			57 (A1)
Whiting	ET056-405	10/1/14	74		GPM	57 (A1)
Whiting	ET056-405	7/5/11	2			57 (A1)
Whiting	ET056-405	8/13/08	40			57 (A1)
Whiting	ET056-405	9/24/14	32	1	CFS	57 (A1)
Whiting	ET056-405	6/24/14	14	0.3	GPM	57 (A1)
Whiting	ET056-405	6/30/15	7.3		CFS	57 (A1)
Whiting	ET056-405	5/12/14	4		GPM	57 (A1)
Edmunds	ET058-406	10/1/14	12	6	GPM	57 (B1)
Edmunds	ET058-406	8/13/08	78			57 (B1)
Edmunds	ET058-406	6/24/11	38	1	GPM	57 (B1)
Edmunds	ET058-406	5/12/14	9.1		GPM	57 (B1)
Edmunds	ET058-406	9/24/14	1.9	1	CFS	57 (B1)
Edmunds	ET058-406	6/30/15	25	43.2	GPM	57 (B1)
Edmunds	ET058-406	7/5/11	18			57 (B1)
Edmunds	ET060-407	8/13/08	140			open
Edmunds	ET066-408	7/5/11	4			56 (D1)
Edmunds	ET066-408	8/13/08	82			56 (D1)
Edmunds	ET066-408	9/24/14	2	1	MPS	56 (D1)
Edmunds	ET072-409	8/13/08	60			56 (B2)
Edmunds	ET073-410	8/13/08	74			56 (B2)
Edmunds	ET074-411	8/13/08	68			56 (B2)
Edmunds	ET074-411	6/30/15	20	129	CFS	56 (B2)
Pembroke	ET077-412	8/13/08	280			56 (B2)
Pembroke	ET077-412	7/5/11	9.1	0		56 (B2)
Pembroke	ET078-413	8/13/08	500			open
Pembroke	ET088-414	6/30/15	146	38	CFS	56 (B1)



Town	Stream ID	date	CFU/100ml	Flow	Flow Unit	Area No
Pembroke	ET088-414	8/13/08	420			56 (A1)
Pembroke	ET088-414	7/5/11	64			57 (A1)
Pembroke	ET089-415	8/13/08	6			58 (A1)
Pembroke	ET089-415	7/5/11	25			59 (A1)
Pembroke	ET089-415	6/30/15	2	840	gpm	60 (A1)
Pembroke	ET090-1	10/7/14	280		GPM	61 (A1)
Perry	ET098-416	8/13/08	320			56 (B1)
Perry	ET098-416	6/24/11	18	0.1	CFS	57 (B1)
Perry	ET098-416	7/5/11	24			58 (B1)
Perry	ET098-416	5/12/14	24	1.5	FPS	59 (B1)
Perry	ET098-416	5/11/16	1.9	0.53	CFS	60 (B1)
Perry	ET098-416	10/1/14	1.9	3	GPM	61 (B1)
Perry	ET098-416	6/30/15	20	20	CFS	62 (B1)
Perry	ET102-417	7/5/11	4			open
Perry	ET102-417	9/14/14	10	3	MPS	open
Perry	ET102-417	5/12/14	6		FPS	open
Perry	ET102-417	6/30/15	35		CFS	open
Perry	ET102-417	8/13/08	80			open
Perry	ET102-417	6/25/14	2	1	GPM	open
Perry	ET102-417	9/24/14	2	1	MPS	open
Perry	ET102-417	10/1/14	18	5	GPM	open
Perry	ET112-418	8/13/08	70			59 (B2)
Perry	ET112-419	8/13/08	100			59 (B2)
Perry	ET113-420	7/5/11	8			59 (B2)

Non point pollution areas:

1. 56 (B1) Sipp Bay (Perry)
2. 56 (B2) Upper Dennys River (Dennysville)
3. 56 (D1) Hobart Stream (Edmunds)
4. 58 (B1) Pirates Creek (Lubec)
5. 58 (B4) Globe Cove (Lubec)
6. 59 (B2) Half Moon Cove (Eastport)
7. 56 (A1): Pennamaquan River (Pembroke)
8. 57 (A) East Stream (Trescott TWP)
9. 57 (B1) Crane Mill Stream (Edmunds)

Agricultural Sources

Only one commercial farm was identified in the 2014 survey. The property is a cattle farm in Edmunds. The cows are in pastures >200 feet from the water with large grass barriers. WQ Station 47 is located where the stream meets the saltwater and meets the standard for



approved harvest supporting the current classification line. There are no identified slaughter houses, large scale manure spreading operations or garden centers in the area.

Non point pollution areas: From upland runoff from wildlife and farming activity: 57 (B) Crane Mill Brook (Edmunds TWP)

Wildlife Activity

The salt marshes and mudflats of the growing area do provide valuable habitat to a variety of wildlife. Mammals living within the growing area include dogs, cats, whitetail deer, muskrat, squirrels, chipmunks, rabbits, moles, mice, bats, shrews, weasels, skunks, beaver and raccoons. Commonly observed bird species include a variety of gulls, sea and inland ducks, cormorants, geese, great blue herons, egrets, swans, and others. Maine Inland Fish and Wildlife surveys indicate that migratory waterfowl numbers begin to increase in the early summer 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. Areas to include the Hobart Stream (Edmunds), Crane Mill Brook (Edmunds), Dennys River (Dennysville), and Timber Cove (Trescott) have areas classified restricted due to non-point pollution with large populations of beaver and Canada geese up streams from the estuary. These areas will continue to be monitored and any possible corrective action taken through local town officials such as recommendations for dogs to be kept on a leash and their feces collected and carried out. These areas are monitored by routine water sampling sites and no pollution source impacts have been identified.

Conservation/Recreation Areas

Area ET includes both state and federal conservation lands. These lands include hiking trails and are visited heavily during the summer months. The entire growing area is subject to heavy influx of visitors during summer months. The primary destinations are Eastport and Coobscook Bay State Park. Currently, water quality studies do not indicate significant impacts to areas not currently closed to harvest.

There is one large campground in the study area which is Coobscook bay State Park There are maintained outhouses at this campground and no impact to the receiving waters was found. Although there are a few gravel beaches in the area, swimming in the ocean in this area is relatively rare, as the water temperatures rarely exceed 65F.

Industrial Wastes

There is no heavy industrial activity such as chemical plants, ship building, oil refineries or manufacturing plants in the growing area.

Fishing Wharves and Aquaculture Sites

Wharves in the review area are small privately owned piers for the loading or unloading of equipment, bait or catch and most are for lobster fishermen. There are no landings with >500 gallon fuel tanks identified during this survey.



Land Based Chemicals

(Information from the Pesticides Board of Maine in Augusta) "Inland blueberry fields close to the marine environment use several chemicals that may have some effect temporarily on fish or shellfish. *Guthion* is sprayed on blueberry fields in July and August to control the fruit fly larva. The half-life is variable around 21 days in aerobic soils and about 62 days in anaerobic soils. The soils in our area are generally considered to be aerobic. *Guthion* is short lived in water, however heavy rain after application causes high runoff of the chemical. *Guthion* is not very persistent in the environment. The chemical is degraded to many other compounds by microorganisms found in soil and water, by sunlight and by reacting with water. *Guthion* does not evaporate very quickly from soil and water. It attaches strongly to soil surfaces and does not easily move into groundwater below the soil surface. *Valpar* (Hexazinone) is a chemical used for the control of weeds and grasses. Hexazinone has a half-life of one month in blueberry soils. Breakdown varies depending on temperature and moisture with the main reason for degradation by soil microorganisms. Other factors affecting half-life include soil leaching, uptake by plants and breakdown by sunlight. Hexazinone has a low acute toxicity. It has an acute oral LD50 for mice (dose to kill 50 percent of test animals) of 1,690 mg/kg (or 0.026 oz/lb of body weight). Aspirin has the same toxicity level. Hexazinone is a class D compound - not classifiable as to human carcinogenicity. Hexazinone has been detected at low levels, in the parts per billion (ppb), range in ground-water in Maine that is under or near to blueberry fields that have been treated with *Velpar*. All detections were well below the maximum exposure guides of 210 ppb set by the Maine Department of Health and Human Services. The EPA "believes that water containing Hexazinone at or below the *Health Advisory Level* of 400 ppb is acceptable for drinking over the course of one's life, and does not pose any health risk. *Round-Up* is used for weeds resistant to *Valpar*. There are large blueberry fields directly adjacent to the western arm of Little Kennebec and north of Mill Pond. Published data and use regulations support minimal health risk from the use of these pest sprays. This information supports a minimal health risk for consumers of shellfish from chemicals used on blueberry fields. Possible or potential adverse impacts are associated with the immediate "footprint" of the field or application zone.

Marine Biotoxins

The Marine Biotoxin Monitoring Program is administered by the Maine Marine Resource's Bureau of Public Health. It uses the standards outlined in the National Shellfish Sanitation Program (NSSP) to monitor levels of PSP ("Red Tide") and other marine biotoxins in the shellfish of the State of Maine. When toxin is found at levels near or above where human illness may occur, closures to the harvest of shellfish areas are implemented. Maine has historically had high levels of Paralytic Shellfish Poison (PSP), more commonly known as "Red Tide" during the warmer periods of the year. Shellfish samples are collected statewide between March and October and evaluated at the PSP laboratory Boothbay Harbor, in the western portion of the state. Data is then transmitted to the Growing Area Supervisor at the Boothbay and Lamoine facilities for interpretation and appropriate closures are made when necessary. This growing area is frequently impacted by near shore biotoxin closures in eastern Maine during summer months. Emergency closures for biotoxin by species affected are maintained in the DMR central files.

Hydrographic and Meteorological Characteristics



Tides and Currents

Coastal Maine experiences a mixed, semi-diurnal tide, with diurnal inequalities that are more pronounced on spring tides. National Oceanic and Atmospheric Administration data for a station at Eastport indicate a mean tidal range of 18.35 ft.

Currents in the area are predominantly driven by the tides. All along the coast of eastern Maine, the tide generally floods to the north and east and ebbs to the south and west. Along the coast and in the wider bays, the current seldom exceeds 2 knots. Weather conditions affect tidal ranges and current speeds, sometimes very strongly. Strong winds may reverse the direction of currents.

To examine the effects that tidal stage might have on fecal coliform concentrations, data collected under the Systematic Random sampling strategy (all months, all samples) were queried for all active sample sites (2003-2015). Then the geomean score for each station was calculated based on the following tide groupings; Ebb, Flood, H. HF, HE, L. LF and LE (Table 3). The results can be seen in Table 4 and Figure 3).

Table 3: Tide Stage Breakdown

Tide stage	Minutes from Low tide
Low	(+/-) 30 minutes
LF	30-90
Flood	91-270
HF	271-329
High	(+/-) 30 minutes
HE	(-270) - (-330)
Ebb	(-90) - (-270)
LE	(-30) - (-90)

Any station with a geomean greater than 14 CFU/100ml and a minimum sample count of 4 samples was judged to be negatively impacted by that tide stage. These stations can be seen in table 4.

Table 4: ET Geomean vs Tide Stage 2003 – 2015

Station ID	Tide Stage	Geomean	Sample Count
ET044.00	LE	18.3	4
ET059.00	E	27.8	10
ET060.00	E	34.1	9
ET063.00	E	44.5	7
ET063.00	F	15.4	30
ET064.00	E	24.3	9

Station ET 44 shows geomean scores > 14 on low ebb tide stages while stations 59, 60, 63, and 64 show elevated geomean on the Ebb tide stage. All these stations are located near the heads of drainages and these elevated scores on the ebb tide stages would indicate an issue with non-point runoff from the associated upland drainages. Currently station ET 44 is serves as



the boundary station of pollution area 57 (A1) and has a P90 score of 18.4. Stations 59, 60, 63 and 64 are located in area 56 (B3) and are all classified as restricted.

Rainfall

The mean annual precipitation in growing area ET is approximately 44 inches. The precipitation is not evenly distributed throughout the year. The wettest months are November and April. 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. It is likely that after prolonged periods of dry weather, significant rainfall (>1" over 24 hours) will cause some pollution from non-point runoff. It is unclear how much of an effect major rainfall events have on water quality due to variability of ground water saturation, history of recent significant rainfall that may have washed non-point pollution sources away, hard ground or ledge or wildlife or agriculture activity.

To analyze rain and its effects on the growing area, 72 hour rain data for each station from 2003-2015 was binned into dry data; rain between 0.01-0.50"; 0.51-1.00"; and >1.00". The geomean score for each binned rain amount can be found in Table 5. Please note that adverse flood data was not included in this analysis and each station needed a minimum of 4 samples before a geomean was calculated. Stations with geomean greater than 14 CFU/100ml were deemed affected by rainfall.

Table 5: geomean in relation to rainfall amount (2003-2015)

Station	Geo. Dry	Dry Count	Geo.01-.5	Count.01-.5	Geo.51-1	Count .51-1	Geomean >1	Count >1
ET007.00	2.9	31	3.2	36	4.9	9	13.4	8
ET008.00	7.5	27	6.8	39	6.2	11	12.9	12
ET008.30	4.6	26	3.8	34	5.2	8	10.3	8
ET009.00	2.9	23	4.3	39	2.5	9	7.0	8
ET011.00	3.8	24	5.0	42	7.7	10	5.1	6
ET012.00	3.3	23	4.0	39	2.4	10	3.5	6
ET013.00	3.4	23	3.7	41	5.6	8	7.9	6
ET017.00	2.7	24	3.7	36	3.4	10	2.6	8
ET020.00	2.4	23	3.5	38	3.3	9	6.7	9
ET023.00	2.8	23	3.5	40	4.3	9	8.3	7
ET025.00	2.5	23	3.1	39	4.7	10	7.3	7
ET026.00	2.0	24	2.7	38	2.8	9	4.2	7
ET027.00	2.0	23	2.9	38	2.9	10	7.1	7
ET029.00	2.3	23	2.9	38	3.2	9	2.7	8
ET031.50	2.5	15	2.0	18	2.2	6	2.3	4
ET032.00	2.2	22	3.6	40	5.3	9	8.9	8
ET033.50	3.2	24	3.2	46	3.4	11	12.9	11
ET036.00	2.2	23	3.6	38	5.0	10	4.0	7
ET039.00	4.2	28	3.4	51	6.9	15	18.4	7
ET044.00	2.8	23	4.3	38	5.7	10	11.2	7
ET045.00	2.2	23	3.0	37	4.3	10	7.6	8
ET047.00	2.6	23	3.8	40	9.5	10	18.4	6



Station	Geo. Dry	Dry Count	Geo.01-.5	Count.01-.5	Geo.51-1	Count .51-1	Geomean >1	Count >1
ET054.00	2.4	26	2.8	38	3.2	10	4.8	5
ET057.00	4.1	23	5.2	53	4.9	13	10.8	10
ET057.20	4.7	23	5.0	54	7.4	13	33.1	9
ET059.00	4.1	18	6.0	42	5.0	9	16.2	9
ET060.00	7.5	17	10.5	43	11.5	9	21.4	9
ET063.00	5.8	15	11.5	29	26.6	9	33.2	7
ET064.00	5.2	14	8.3	31	11.9	8	41.7	7
ET066.50	3.9	19	4.1	42	7.1	9	36.2	8
ET068.00	3.1	19	3.8	43	8.4	8	7.3	8
ET069.00	4.2	18	3.8	40	22.6	7	6.6	8
ET070.00	3.5	19	4.0	42	9.2	8	9.1	9
ET071.00	2.4	19	3.3	43	12.0	8	7.7	8
ET074.00	2.3	19	3.0	44	4.0	8	4.1	8
ET077.00	3.1	18	3.6	44	6.0	8	6.4	9
ET079.00	3.0	19	5.9	43	4.3	8	15.3	8
ET085.00	5.3	19	4.8	43	5.7	8	14	8
ET088.00	2.4	19	3.7	44	4.8	9	9.7	7
ET090.00	2.5	19	2.9	39	3.3	10	6.5	10
ET091.00	2.7	17	3.3	41	15.5	11	56.4	9
ET095.00	2.1	20	2.9	43	3.4	11	2.3	9
ET097.00	2.2	19	2.9	44	3.7	11	3.0	9
ET099.00	2.2	21	2.7	41	3.1	11	3.6	10
ET100.00	4.3	21	2.7	41	3.1	10	6.3	9
ET100.20	4.2	17	3.4	39	5.6	15	56.1	8
ET102.00	2.2	21	2.5	42	3.6	11	7.5	8
ET103.10	2.7	19	3.1	40	3.4	15	4.9	8
ET103.20	3.0	19	3.0	41	4.0	13	6.4	8
ET104.00	2.4	22	2.6	44	4.9	9	13.4	8

Looking at the graph three stations ET 63, 69, and 91 show geomean scores > 14 with rain amounts of between .5 and 1 inch. All three stations are located in curr45ent restricted areas. Eleven stations show elevated geomean scores with rain > 1". Only two of the stations ET 47 and 79 are classified as open and approved and their respective P90 scores are 15 and 25. All other stations are located in current restricted areas.

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

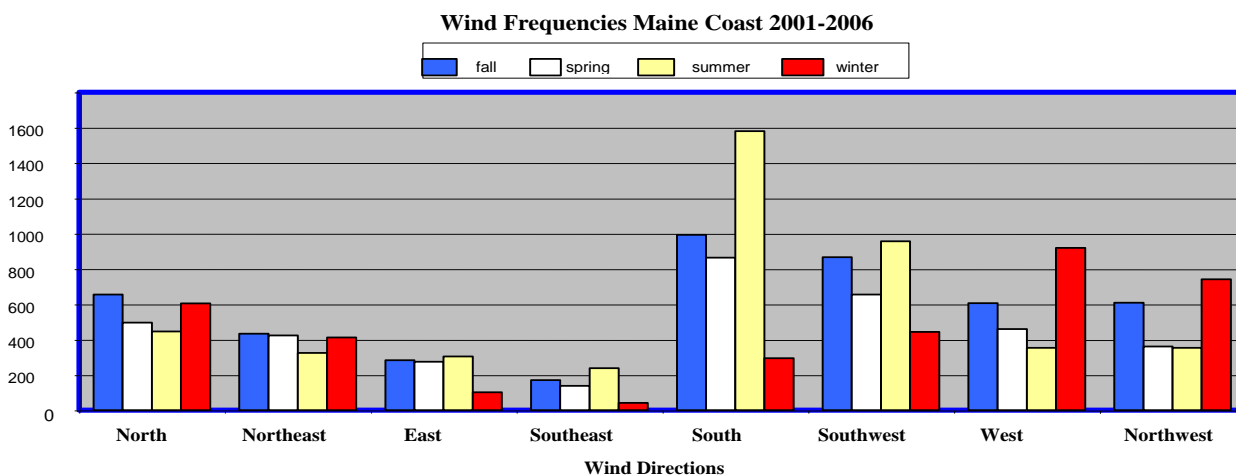


associated with a hurricane or severe northeaster and can reach 125 knots. Sustained winds of 100 knots occur about every 50 years on average; gusts are usually about 30 percent higher.

Coastal winds are complex since they are influenced by the topography. Over land speeds are reduced, however, channels and headlands can redirect the wind and even increase the speed by funneling the wind. In general, winds have southerly components in summer and northerly ones in winter. In sheltered waters near Rockland, Portland, and Brunswick, there are a large percentage of calms, particularly during the morning hours. When the existing circulation is weak and there is a difference between land and water temperatures, a land-sea breeze circulation may be set up. As the land heats faster than the water, a sea breeze is established during the day; this onshore flow may reach 15 knots or more. At night, the land cools more rapidly, often resulting in a weak breeze off the land. In many locations, the sea breeze serves to reinforce the prevailing summer wind. Analysis of GOMOOS data (2001-2006) show winter winds along coastal Maine are typically from the west-northwest during clear periods and from the northeast during storms. In the spring, summer and fall, predominant winds are from the south-southwest. West, northwest and north winds are common during fall and winter. Although less frequent, winds from the northeast, north and northwest directions are typically stronger than winds from the south. In the summer, winds tend to be on shore due to heated, rising air over land and cooler ocean air flowing into the void.



Figure 5: Wind Direction Frequencies Maine Coast 2001-2006



River Discharges

This area is not impacted by any river discharges, only smaller creeks and streams. Stream flow in downeast 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).

Salinity

Salinity generally tends to be lowest in the spring, due to spring rains and snowmelt/runoff and in late fall from rainfall. Summer and early autumn show the highest values of salinity, due to the relatively low stream flows at this time of year. Salinity data, taken from routine (random/prescheduled) ambient monitoring data from sites near the mouths of rivers or streams approximate the stream flow patterns and influence of fresh water inputs on the growing area. However, partial salinity stratification can occur during times of heavy rainfall and runoff. It is well recognized that freshwater influence from runoff can contribute to elevated bacterial loading near shore. Queries of the sample data in Area ET for average salinity by month (2003-2015) shows sample sites with their average salinities broken down by month.

Table 6: Average Salinity by Month

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ET005.00	30	29	31	29	30	29	30	30	31	31	32	
ET007.00	30	29	28	33	29	26	30	30	30	29	29	29
ET008.00	28	30	25	23	25	26	28	30	29	32	28	27
ET008.30	30	31	31	30	29	30	30	32	31	30	30	31
ET009.00		32	30	32	30	30	31	31	31	32	31	31
ET011.00		31	31	31	29	29	31	31	32	32	32	30
ET012.00		30	28	27	29	28	30	31	31	31	30	30
ET013.00		30	20	24	27	27	30	31	29	25	25	29
ET017.00		29	29	29	29	30	31	31	31	29	30	30
ET020.00		28	29	27	29	30	30	31	31	31	27	30



Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ET023.00	26	29	23	26	29	30	30	30	30	32	30	25
ET025.00		29	18	30	29	28	30	31	31	30	31	30
ET026.00	30	30	29	26	29	29	30	31	31	30	31	28
ET027.00		30	25	30	30	29	30	31	31	29	30	30
ET029.00		30	28	26	30	29	30	31	31	30	30	28
ET031.50		28	28	28	29	29	30	31	31	29	30	
ET032.00		28	29	25	29	30	31	31	31	32	30	30
ET033.50	28	30	25	26	28	30	31	31	32	32	30	28
ET036.00		29	26	24	29	28	30	31	31	29	29	26
ET037.00		27	27	24	28	27	30	31	30	29	28	34
ET039.00	25	22	22	21	25	26	27	32	29	31	27	26
ET044.00		21	15	20	22	23	26	30	28	25	22	27
ET045.00		25	19	22	25	25	29	27	30	28	25	14
ET046.00		19	25	22	25	28	29	30	31	30	25	
ET047.00		27	26	21	28	27	29	30	31	26	27	30
ET050.00		27	9	24	24	18	28	18	31	32	29	32
ET053.00				29	29	30	29	30	30	30	28	27
ET054.00	29	29	26	26	26	28	29	30	30	28	27	25
ET057.00	22	26	26	21	17	24	26	29	20	24	20	22
ET057.20	20	13	16	13	14	23	29	21	28	22	24	18
ET059.00	12	16	27	17	26	25	23	29	29	30	22	0
ET060.00	4	1	13	5	12	17	16	22	21	23	16	0
ET063.00		13	12	7	16	21	18	24	21	26	6	
ET064.00		15	22	12	15	25	24	22	25	29	18	
ET066.50	28	23	24	22	23	27	28	30	27	26	24	21
ET068.00	26	22	25	21	25	28	27	29	27	27	25	22
ET069.00	28	19	20	23	24	27	29	31	30	28	26	26
ET070.00	28	25	28	24	24	28	28	30	28	26	25	26
ET071.00	30	24	28	25	25	28	27	29	29	27	26	28
ET073.00	30	29	26	28	28	30	30	30	30	31	30	27
ET074.00	29	30	29	29	29	30	30	31	30	31	30	28
ET077.00	22	22	22	22	24	28	29	29	29	26	29	22
ET079.00	15	19	17	30	24	30	27	31	29	31	25	27
ET080.00		19	12	18	19	27	27	30	27	23	27	26
ET085.00	4	22	22	20	21	28	25	31	29	29	23	23
ET088.00		30	25	25	26	29	30	27	32	29	30	27
ET090.00	26	27	27	27	28	30	29	30	30	31	29	31
ET091.00	22	28	24	25	21	28	27	32	29	28	28	8
ET095.00	30	31	29	29	28	29	29	31	30	31	26	28
ET097.00		30	30	29	29	30	30	31	31	30	30	28



Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ET099.00	30	31	31	27	30	30	30	31	31	31	31	
ET100.00	30	31	31	29	30	29	31	31	32	31	30	30
ET100.20	30	30	32	29	27	28	30	31	31	29	31	28
ET102.00	28	30	31	29	30	30	31	31	31	31	31	30
ET103.10	30	30	31	29	30	30	31	31	31	31	31	
ET103.20	28	30	31	29	30	29	30	31	31	31	30	30
ET104.00	28	30	31	30	30	30	31	31	32	32	31	

Seasonal Effects on FC Concentrations

To examine the effects that seasons may have on fecal coliform levels in Growing Area ET the historical fecal coliform data of the ambient sites were grouped according to season:

Winter was defined as December, January, and February

Spring was defined as March, April, and May

Summer was defined as June, July, and August

Fall was defined as September, October, and November

This analysis includes fecal coliform results collected from 2003 to 2015 (Table 7). The collection dates were queried to conform to the seasonal groupings discussed above. Any adverse flood data was excluded. Next the geomean for each station per season was calculated and then graphed. Each station needed a minimum of 4 samples for each season before a geomean was calculated. Stations with geomean scores > 14 were considered adversely affected during that seasonal period.

Table 7: Seasonal Geomean Scores (2003-2015)

Station	Winter GM	Winter cnt.	Spring GM	Spring Cnt.	Summer GM	Summer Cnt.	Fall GM	Fall Cnt.
ET005.00	2.40	4	3.27	19	5.42	21	4.62	18
ET007.00	2.07	4	2.46	24	4.13	28	5.43	26
ET008.00	4.90	10	3.79	23	10.96	28	11.42	26
ET008.30	3.04	11	2.67	18	5.97	24	7.38	22
ET009.00	3.77	6	2.31	23	4.02	26	5.89	23
ET011.00	2.60	7	3.63	24	5.56	26	7.16	24
ET012.00	2.02	6	2.56	22	3.78	26	5.21	22
ET013.00	2.04	5	2.62	22	3.77	27	7.86	22
ET017.00	2.75	5	2.15	24	3.55	27	4.42	22
ET020.00	2.11	4	2.14	23	3.42	24	5.27	27
ET023.00	2.07	4	2.59	23	3.91	25	5.05	25
ET025.00	2.04	5	3.30	22	3.52	25	3.59	25
ET026.00	2.04	5	2.45	22	2.30	26	3.27	22
ET027.00	2.03	6	2.42	23	3.09	26	3.25	22
ET029.00	2.07	5	2.39	22	2.59	25	3.44	24
ET031.50			1.91	12	2.11	15	2.89	12



Station	Winter GM	Winter cnt.	Spring GM	Spring Cnt.	Summer GM	Summer Cnt.	Fall GM	Fall Cnt.
ET032.00	2.07	4	2.67	25	4.53	25	4.56	24
ET033.50	2.16	11	2.73	27	5.53	26	4.67	27
ET036.00	2.04	5	2.45	23	5.98	27	2.47	22
ET037.00			2.36	22	4.74	25	5.22	21
ET039.00	2.95	17	3.04	28	8.19	27	4.84	28
ET044.00	2.33	5	2.81	23	6.64	27	4.62	22
ET045.00	2.29	5	2.24	24	3.32	27	4.88	21
ET046.00			1.90	8	3.69	11	3.82	7
ET047.00	2.04	5	2.38	22	6.54	28	5.74	22
ET050.00			3.96	17	12.15	17	6.98	16
ET053.00	2.35	4	2.26	14	2.68	21	5.13	13
ET054.00	2.12	7	2.33	23	3.14	26	3.45	21
ET057.00	3.75	17	3.21	28	7.53	29	7.77	24
ET057.20	3.87	17	3.75	29	8.74	28	10.56	24
ET059.00	3.93	6	3.70	20	10.00	28	5.57	23
ET060.00	5.23	5	4.62	21	18.60	28	14.26	23
ET063.00			4.01	13	18.64	26	20.67	18
ET064.00			4.45	14	16.23	25	9.15	18
ET066.50	2.83	5	4.39	23	7.54	27	5.19	23
ET068.00	2.45	7	2.90	19	4.34	28	6.38	24
ET069.00	2.14	6	4.52	18	5.70	25	5.87	23
ET070.00	2.44	7	3.13	21	6.08	26	6.14	23
ET071.00	2.17	7	3.25	21	3.75	27	5.68	22
ET073.00	2.65	5	2.67	17	3.70	19	6.32	18
ET074.00	2.83	8	2.90	20	2.64	28	3.84	21
ET077.00	4.03	7	3.11	21	4.65	28	3.79	22
ET079.00	3.21	5	3.81	20	8.66	28	4.61	24
ET080.00			3.55	15	6.24	20	6.60	17
ET085.00	2.48	4	3.50	21	6.85	29	7.89	23
ET088.00	2.98	3	2.38	21	3.96	29	5.54	24
ET090.00	2.75	6	3.31	15	2.64	27	3.74	28
ET091.00	2.29	5	5.52	18	6.12	30	5.79	24
ET095.00	1.90	4	2.31	24	2.52	30	3.55	24
ET097.00	2.02	7	2.49	22	2.56	30	3.96	23
ET099.00	1.90	5	2.55	24	2.76	26	3.01	26
ET100.00	2.31	6	2.64	23	2.81	26	3.32	24
ET100.20	2.83	5	3.38	23	6.13	25	7.82	24
ET102.00	2.14	7	2.52	23	3.16	26	3.14	24
ET103.10	1.90	3	2.47	24	3.56	28	4.04	25
ET103.20	2.40	5	2.64	21	3.66	28	4.17	26



Station	Winter GM	Winter cnt.	Spring GM	Spring Cnt.	Summer GM	Summer Cnt.	Fall GM	Fall Cnt.
ET104.00	2.07	5	2.23	22	3.39	29	4.46	25

As evidenced by the data station ET 60, 63 and 64 were affected during the summer season and station ET 63 was also impacted during the fall season. This fits with an increase in human habitation during the summer months as well as increased waterfowl activity during the late summer and fall period. All three stations are currently classified as restricted.

Discussion of Hydrographic and Meteorological Characteristics

The most important aspects of hydrographic and meteorology and its influence on pollutant transport in growing area ET is the impact of rainfall events >1.0" in 72 hours with resultant upland runoff from both point and non-point sources. Rainfall is heaviest in February-June and September-November and snowmelt in the late spring adds to the runoff, releasing any frozen feces from wild and domestic animals or failing septic systems. Streams and ditches funnel this runoff to the saltwater. Even during low salinity and higher tides the unacceptable fecal scores begin in June and go into December. Sample stations near significant fresh water inflow sources are many times in restricted areas due to non-point runoff from stream impacts.

Station ET 44 shows geomean scores > 14 on low ebb tide stages while stations 59, 60, 63, and 64 show elevated geomean on the Ebb tide stage. All these stations are located near the heads of drainages and these elevated scores on the ebb tide stages would indicate an issue with non-point runoff from the associated upland drainages. Currently station ET 44 is serves as the boundary station of pollution area 57 (A1) and has a P90 score of 18.4. Stations 59, 60, 63 and 64 are located in area 56 (B3) and are all classified as restricted. Tides along the coast are significant enough in the volume of water moving between ebbing and flooding that pollution dispersion is rapid. Any elevated fecal testing results are more likely a localized pollution source instead of tidal transport issues.

Water Quality Review

There are presently twelve (51) active water sampling sites in Growing Area ET along with three new Z stations. They are collected from near-shore sites on Sample runs 17,18,18 and 20. Sample sites are established to monitor known or potential pollution sources and on the margins of established closures. It is recognized that access, icing and safety considerations prevent some stations being sampled on scheduled dates. Currently all station in Growing Area ET meet their current NSSP classification standard.

Table 8Current P90 Area ET most recent 30 samples

Station	Class	Count	MFCCount	GM	SDV	MAX	P90
ET007.00	A	30	30	3.2	0.38	24	10.1
ET008.00	R	30	30	7.5	0.62	240	47.6
ET008.30	A	30	30	4.7	0.54	380	23.7
ET009.00	A	30	0	4	0.26	23	9
ET011.00	R	30	30	9.1	0.83	440	108
ET012.00	A	30	30	3.6	0.6	1700	21.9
ET013.00	A	30	30	3.8	0.59	360	22.5



Station	Class	Count	MFCCount	GM	SDV	MAX	P90
ET017.00	A	30	30	2.8	0.37	72	8.6
ET020.00	A	30	0	5.3	0.47	93	21.7
ET023.00	A	30	30	3.8	0.56	600	20
ET025.00	A	30	30	3.3	0.36	20	9.7
ET026.00	A	30	30	2.2	0.18	10	3.8
ET027.00	A	30	30	2.4	0.24	18	5.1
ET029.00	A	30	30	3.1	0.41	62	10.4
ET031.50	A	30	30	2.3	0.2	10	4.3
ET032.00	A	30	30	3	0.48	280	12.5
ET033.50	A	30	30	2.6	0.28	14	6.1
ET036.00	A	30	30	2.7	0.32	48	7
ET039.00	CA	30	30	3	0.41	48	10.4
ET044.00	A	30	30	4.7	0.45	56	18.4
ET045.00	A	30	30	2.8	0.3	18	7
ET047.00	A	30	30	3.8	0.47	66	15.6
ET054.00	A	30	30	2.3	0.27	35	5.1
ET056.90	A	30	30	4.3	0.43	36	15.9
ET057.00	CA	30	30	4.3	0.48	54	18.1
ET057.20	CA	30	30	3.5	0.45	94	13.3
ET059.00	R	30	30	5.9	0.48	54	25.1
ET060.00	R	30	30	8.4	0.47	50	34
ET063.00	R	30	30	12.4	0.78	1500	126
ET064.00	R	30	30	7.7	0.53	240	37.1
ET066.50	R	30	30	4.2	0.46	25	16.4
ET068.00	A	30	30	3.4	0.53	1040	16.8
ET069.00	R	30	30	4.5	0.67	420	33.3
ET070.00	A	30	30	4.8	0.51	110	21.9
ET071.00	A	30	30	4.3	0.64	420	28.7
ET074.00	A	30	30	2.7	0.36	86	7.8
ET077.00	A	30	30	3.8	0.51	200	17.5
ET079.00	A	30	30	5.4	0.51	76	25.3
ET085.00	A	30	30	4.8	0.55	240	24.8
ET088.00	A	30	30	3.1	0.42	70	10.8
ET090.00	A	30	30	3.3	0.51	250	15.2
ET091.00	R	30	30	6.1	0.75	880	57.7
ET095.00	A	30	30	2.4	0.37	78	7.3
ET097.00	A	30	30	2.4	0.32	68	6.2
ET099.00	A	30	30	2.1	0.13	5.5	3.2
ET100.00	A	30	30	2.4	0.2	10	4.5
ET100.20	R	30	30	3.8	0.65	480	27



Station	Class	Count	MFCCount	GM	SDV	MAX	P90
ET102.00	A	30	30	2	0.14	8	3.1
ET103.10	A	30	30	2.2	0.17	8	3.6
ET103.20	A	30	30	2.4	0.21	8	4.6
ET104.00	A	30	30	2.5	0.29	22	6

Water Quality Discussion and Classification Determination

P90 trending shows specific stations with marked increases in values in 2013-2015 and some stations with a marked decrease. Positive percent change equals an improvement in water quality and a negative percent change indicates a decline in water quality. Those stations that exhibited a decrease of 20% or more are highlighted in red.

Table 9: Area ET P90 trends

Station	Class	2013 P90	2014 P90	2015P90	% Change
ET007.00	A	20.5	11.1	10.1	103
ET008.00	R	46.2	40.5	47.6	-3
ET008.30	A	43.5	31.5	23.7	84
ET009.00	A	18.2	15.3	9	102
ET011.00	R	30.5	53	108	-72
ET012.00	A	8.1	21.9	21.9	-63
ET013.00	A	16	12.9	22.5	-29
ET017.00	A	13.4	13	8.6	56
ET020.00	A	16.3	13.2	21.7	-25
ET023.00	A	18.3	15.5	20	-9
ET025.00	A	10.9	9.5	9.7	12
ET026.00	A	6.8	3.8	3.8	79
ET027.00	A	7.1	3.8	5.1	39
ET029.00	A	7.8	9.5	10.4	-25
ET031.50	A	3.5	3.5	4.3	-19
ET032.00	A	9.8	10.4	12.5	-22
ET033.50	A	4.3	4.8	6.1	-30
ET036.00	A	10.6	11.3	7	51
ET039.00	CA	8.9	9.9	10.4	-14
ET044.00	A	14.6	16.1	18.4	-21
ET045.00	A	9.2	6.5	7	31
ET047.00	A	27.7	11.9	15.6	78
ET054.00	A	7.1	3.6	5.1	39
ET056.90	A	11.3	14.4	15.9	-29
ET057.00	CA	26.3	17.8	18.1	45
ET057.20	CA	32.3	33.5	13.3	143
ET059.00	R	34.4	26.8	25.1	37



Station	Class	2013 P90	2014 P90	2015P90	% Change
ET060.00	R	45.3	35.8	34	33
ET063.00	R	113.4	104.3	126	-10
ET064.00	R	67.6	36.7	37.1	82
ET066.50	R	27.6	16.4	16.4	68
ET068.00	A	31.8	18	16.8	89
ET069.00	R	46.8	44.2	33.3	41
ET070.00	A	24	18.2	21.9	10
ET071.00	A	19.2	20.8	28.7	-33
ET074.00	A	9.7	8.5	7.8	24
ET077.00	A	21.8	17.4	17.5	25
ET079.00	A	30.8	22.9	25.3	22
ET085.00	A	22.3	20.3	24.8	-10
ET088.00	A	19	13.3	10.8	76
ET090.00	A	11.3	12.8	15.2	-26
ET091.00	R	58.2	52.7	57.7	1
ET095.00	A	7.5	7.3	7.3	3
ET097.00	A	7.1	6.2	6.2	15
ET099.00	A	5	3.3	3.2	56
ET100.00	A	3.5	4	4.5	-22
ET100.20	R	56.9	29.5	27	111
ET102.00	A	8.2	3.1	3.1	165
ET103.10	A	6.4	5.9	3.6	78
ET103.20	A	5.6	6.7	4.6	22
ET104.00	A	18.3	6	6	205

Growing area ET has shown an overall improvement in water quality over the last three years with only 11 out of 51 stations showing a decrease of 20 percent or more.

Conclusions

Growing Area ET has environmental and human impacts similar to the remainder of the Maine coast east of Penobscot Bay. Coastal community development is expanding with homes and businesses near the mainland shores and on islands. This development increases the potential pollution risks to the traditional shellfish harvesting areas. Pollution sources have adequate prohibited zones large enough to dilute the fecal loading to < 14 CFU/100 ml. of the receiving waters. Pollution loading is most likely originating on the near shore land and impacting the harvesting areas and ocean waters by non-point wide-spread runoff from streams and ditches. Environmental factors and seasonal periods have the greatest pollution impacts on the growing area. There are no present plans to change surveying and sampling schedules in the future. This area is properly classified. There are no changes to classification required in Growing Area EQ at this time.

Recommendation for Future Work

1. Add station ET 59, 60, 63, and 64 to the adverse rain sampling runs.
2. Continue sampling streams draining to this growing area.

References

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U.S. Food and Drug Administration (2001). Applied Concepts in Sanitation Surveys of Shellfish Growing Areas: Course #FD2042 (Training Manual), Volumes I and II.

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

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.

MFCNT = the number of samples evaluated with the MTec method (included in the total Count column)

GEO_MEAN = 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

APPD_STD = the 90th percentile, at or below which the station would meet approved criteria in the absence of pollution sources or poisonous and deleterious substances.

RESTR_STD = the 90th percentile, at or below which the station would meet restricted criteria.