Merepoint Boat Launching Facility
Merepoint, Brunswick, Maine

Water Quality Impacts Assessment

Prepared by

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1. Introduction

The Maine Department of Inland Fisheries and Wildlife is proposing to construct an all-tide boat launching facility at the southeastern end of Merepoint Neck, Merepoint Bay, northern Casco Bay, Brunswick, Cumberland County, Maine (Figure 1). The proposal calls for the construction of a dual lane launch ramp approximately 110 ft. long and 48 ft. wide, bisected longitudinally by an associated float system consisting of 8 ft. by 20 ft. floats, extending approximately 200 ft. into the water from near the high water mark (Figure 2).

Several reports address the various potential environmental impacts of the proposed project. This report focuses on the potential impacts on water quality resulting from chemical, toxic, and bacteriological contaminants, reduction in dissolved oxygen, and increased turbidity. This report is intended to address whether the proposed project would cause unreasonable impacts to water quality and whether it would meet state water quality standards.

The potential for water quality impacts resulting from chemical, toxic, and bacteriological contaminants can be largely or entirely eliminated as a matter of policy and regulation and are addressed in such context in this report.

The potential for and extent of water quality impairment resulting from possible reduction in dissolved oxygen and increased turbidity, however, cannot be eliminated simply as a matter of policy since these impacts are inherently and inextricably associated with the launching and removal of vessels at launching facilities. The potential impacts on dissolved oxygen and turbidity have therefore been addressed through a study specifically designed to measure such impacts at two facilities of substantially similar design having similar surrounding conditions.

Figure 1. Site Location - (Source: NOAA/NOS Chart 13290, *Casco Bay*, 32nd Ed., Oct. 22/94)

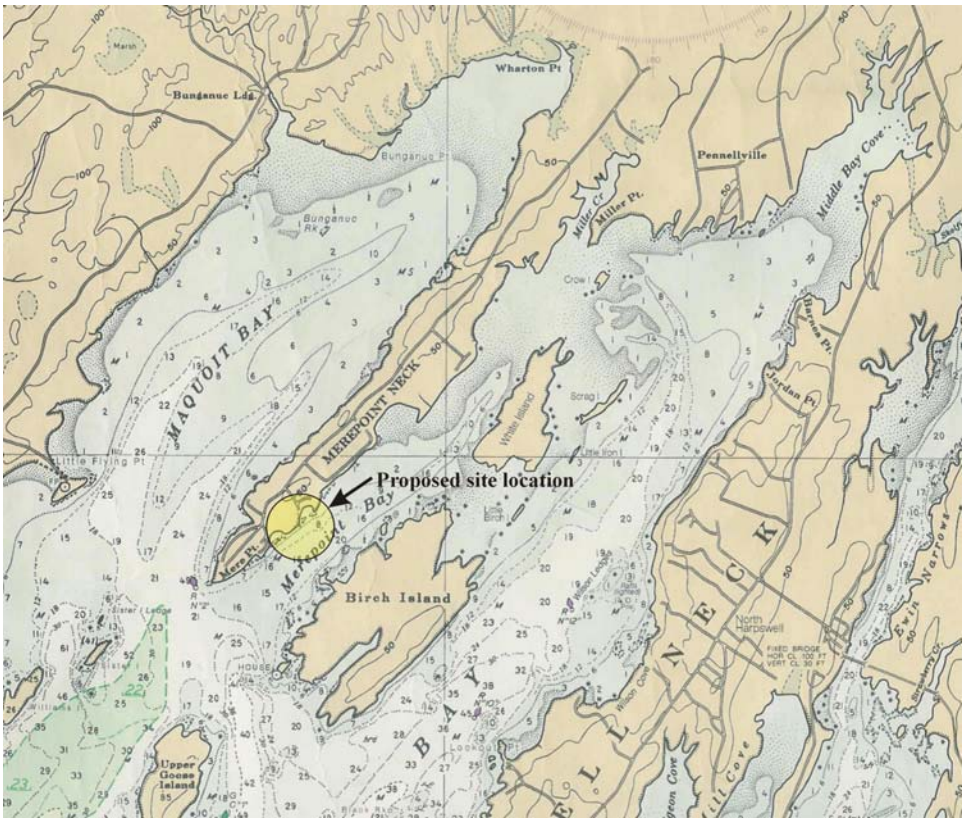
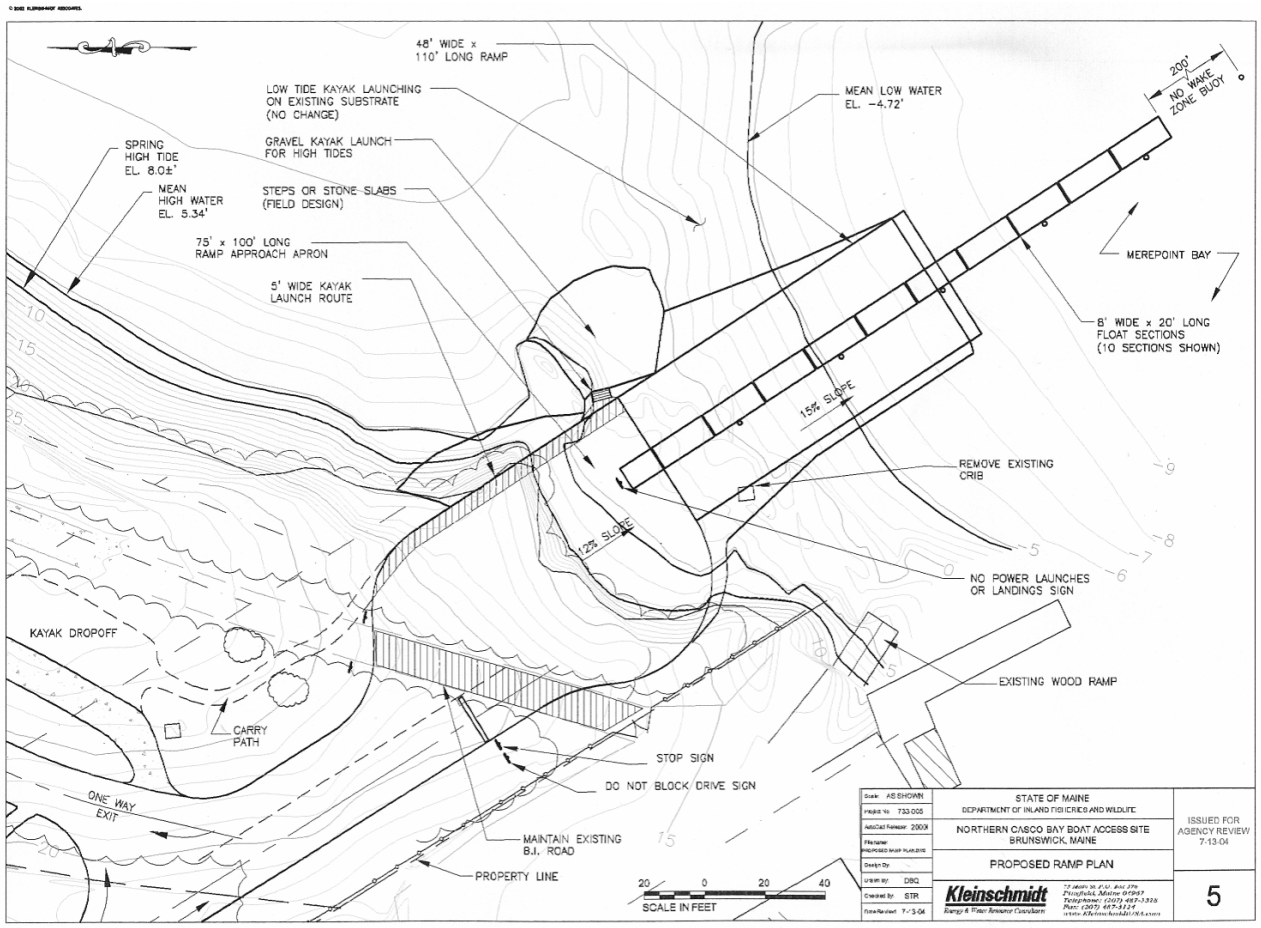


Figure 2. Launching ramp details - (Source: Kleinschmidt, 07-13-03)



2. Potential Impacts

2.1. Chemical contaminants

2.1.1. Fuel and oil

Degradation of water quality resulting from the spillage and discharge of oils and fuels is often a concern associated with commercial and recreational boating. Indeed, the discharge of oils and fuel to surface waters is specifically prohibited under the Clean Water Act §311(b)(3)&(4) [1].

Accidental discharge of oils and fuels by commercial and recreational vessels occurs most frequently during refueling. No refueling facilities are proposed for the Merepoint Boat Launch facility; thus, relatively little risk of accidental discharge exists.

Although these measures are certainly beneficial and advisable, it is further recommended that all refueling of vessels, transfer of fuel or oil, and possession of open fuel and oil containers be prohibited on the premises, except under emergency circumstances, *e.g.* refueling of emergency vehicles and vessels during search and rescue operations. Imposing such restrictions on the handling of fuels and oils will effectively eliminate the risk of accidental spillage and discharge and the attendant potential impacts to water quality.

2.1.2. Toxic materials

Two commercial vessel services companies, Smith Boatyard and Paul's Marina, are located north of the proposed site, but given the distance between these and the proposed site, it is unlikely that any discharges from these operations have affected the proposed site. The Birch Island Association wharf, ramp and boat storage area is immediately adjacent to the proposed site. This facility, however, serves principally as a dinghy and skiff tie-up for residents of Birch Island and the level of activity is generally light. In view of the historical and current use of the site and surrounding area, it is reasonable to assume that no source of toxic substance contamination of significance has ever existed at the site or within its vicinity and no specific testing for existing toxic substances is warranted.

Although no toxic substances are likely to exist at the site at present, the introduction of toxic levels of heavy metals, particularly copper, into the sediments in the immediate vicinity of the ramps could be a matter of concern if the application of antifouling paints at the time of launching or the washing of vessel bottoms at the time of hauling, particularly if using pressure washers, were permitted on the premises, especially on the ramps immediately adjacent to the water.

Anticipating the potential impacts of such activities, no washing of boat bottoms should be permitted on the premises; the prohibition of washing the bottom of boats at hauling effectively eliminates the risk of introducing "end-of-season" bottom paint chips and oxides into the surrounding waters. However, the practice of applying "touch up" bottom paint immediately before launching, specifically to those areas of the hull resting on trailer rollers, poses a risk of introduction of fresh, wet antifouling paint into marine waters, either through leaching of recently applied paint or spillage. Consequently, in addition to the prohibition on washing boat bottoms, it is further recommended that the application of antifouling paint and possession of open containers of antifouling paints be prohibited on the premises at all times.

The application of bleach, *e.g.* hypochlorite (trade name Clorox®), is a common alternative to washing and is often used to kill and/or loosen fouling organisms on hulls prior to washing. In concentrated form, hypochlorite can kill or damage marine flora and fauna on contact, but because it reacts quickly with organic material, in relatively low concentrations, it is rapidly neutralized in organically loaded water as often found in upper estuaries and embayments, such as Merepoint Bay.

In view of this, and in the interest of encouraging compliance with the prohibition on hull washing that addresses a more serious and potentially cumulative, long-term contamination risk, it may be advisable to allow the application, preferably by low-pressure spray, *e.g.* garden sprayer, of mild to moderate strength hypochlorite solution to hulls immediately after hauling, so long as such application takes place at sufficient distance from the ramps, aprons, or any other conveyance to the water, to avoid direct, undiluted contact with marine waters.

2.2. Bacteriological contamination

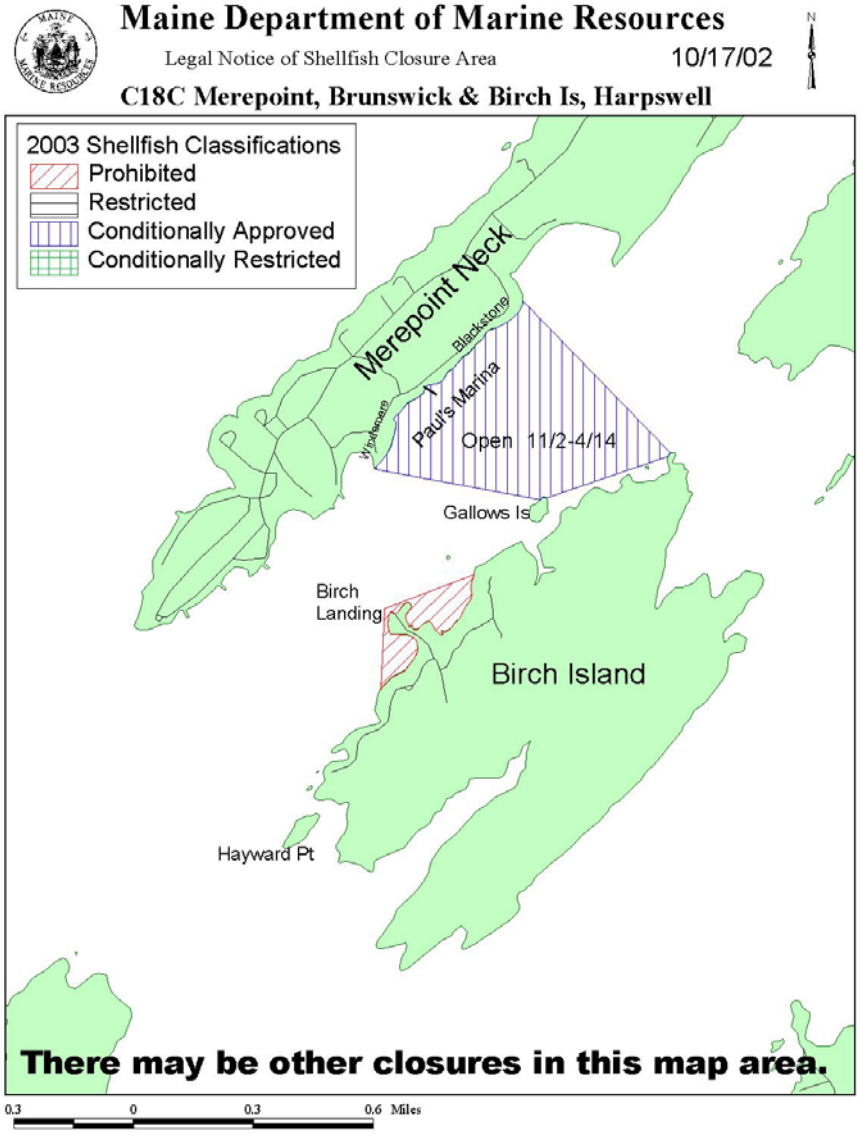
2.2.1. Fecal Coliform

The National Shellfish Sanitation Program's (NSSP) Model Ordinance (1999 Revision)[2], which sets forth the protocol for the classification of shellfish growing to protect public health, defines a marina as being "any water area with a structure (docks, basin, floating docks, etc.) which is:

(a) Used for docking or otherwise mooring vessels; and
(b) Constructed to provide temporary or permanent docking space for more than ten boats."

Accordingly, the Maine Department of Marine Resources (DMR), the state agency charged with the responsibility of implementing the NSSP in Maine, has classified the mooring field adjacent to Paul's Marina just north of the proposed site in Merepoint Bay as Conditionally Approved between November 1 and April 14 of each year and as Prohibited, i.e. no harvesting allowed, between April 15 and October 31 of each year; the closure area along Merepoint Neck extends from Blackstone Point at the north to Windemere Point to the south, the point of land just north of the proposed site (refer to Figure 3).

Figure 3. Maine Department of Marine Resources Merepoint Neck shellfish closure map



The area adjacent to the proposed project site is currently classified as Open/Approved, that is, there are no restrictions on the harvesting of shellfish from this area. The small cove just north of the proposed site may contain commercial, but at least recreational quantities of harvestable soft-shell clams, *Mya arenaria*, and two diggers were observed along the shoreline, but not actually digging, during the on-site survey period of June 14-16, 2004; the shoreline south of the small cove, including the area proposed for the launching ramp, consists primarily of bedrock outcrops with little soft-shell clam habitat.

The Maine DMR's interpretation of "Used for docking or otherwise mooring vessels; and constructed to provide temporary or permanent docking space for more than ten boats" is that the ten boats must be located at the site either permanently or semi-permanently and that they be fitted with thru-hull fittings (if unable to determine the existence of a thru-hull fitting and the boat is of sufficient size to be equipped with a head, the DMR assumes the vessel to have a head and to be fitted with a thru-hull fitting -pers comm. Laura Livingston, DMR Water Quality). Since no vessels will be allowed to moor permanently or semi-permanently at or in the vicinity of the site, the proposed project does not meet the Maine DMR's definition of "marina" and the area will not be automatically closed, even seasonally, to shellfish harvesting. However, routine water quality sampling will continue at the established water quality sampling stations and potential sources of fecal coliform contamination therefore need to be addressed.

The concern for public health focuses principally on fecal coliform bacteria contamination as an indicator of potential presence of human waste and, hence, potential presence of human pathogens. Protection against human pathogens depends on the adequacy of sanitary facilities provided at the site. The current plan calls for the installation of two vault (holding tank) ADA-compliant toilets at the facility, the holding tanks to be pumped "as needed". These proposed sanitary facilities are the same design as those that currently exist at the Brunswick Sawyer Park boat launch facility on the New Meadows River, although the latter is only a single vault; the sanitary facilities at the Brunswick Bike Path along the Androscoggin River are two-vault, identical to those proposed for the Merepoint site. According to Thomas Farrell, Parks and Recreation Director for the Town of Brunswick, the Sawyer Park and Brunswick Bike Path sanitary facilities only require pumping once per year, despite the Bike Path's serving thousands of visitors per year, and have never reached capacity. Therefore, provided adequate, periodic inspections and pumping, these proposed sanitary facilities should not pose a risk of fecal coliform bacteria contamination of the surrounding waters.

Fecal coliform bacteria are found in the excrement of all mammals, not just humans, and birds; although protection against pathogens of human origin is the primary objective of NSSP water quality monitoring, the tests currently used by the NSSP to quantify bacteria in water are not capable of differentiating between human and non-human coliform bacteria, thus potential non-human sources of fecal coliform bacteria also need to be considered. Two potential non-human sources associated with the proposed boat launch are avian, specifically sea gulls, and pets, primarily dogs.

Fecal coliform contamination of shellfish growing areas by avian sources has already been documented in parts of Maquoit Bay, Brunswick on the west side of Merepoint Neck (CBEP, 2003). Although the source of the fecal coliform bacteria in this case is likely geese, a concentration of sea gulls at a single location could result in similarly elevated bacteria counts. Sea gulls could be attracted to the site either by bait or discarded food. Bait for commercial fishing is unlikely to be handled at the proposed site, but if large quantities of bait could arrive at the site, containers holding bait should be covered to discourage attraction of gulls. Bait used in recreational fishing would likely be of sufficiently small quantity so as to pose little attraction, but discarding unused bait on the premises or in the immediately surrounding waters should be discouraged. Consideration might also be given to the incorporation of deterrents, such as the display of fake predators, into the project design.

Pets may ultimately pose the highest risk of fecal coliform bacteria contamination if allowed to defecate directly into or near the water. Even small quantities of feces can be problematic if these become incorporated into wrack seaweed along the upper shoreline where the moist, warm conditions in the wrack can serve as an incubator (Weiskel *et al.,* 1996; pers. comm. Mercuria Cumbo, DMR). Boaters should therefore be discouraged, perhaps even prohibited, from allowing pets to defecate anywhere along the shoreline and should be required to remove any feces as pet owners are in other public places. Additionally, consideration might be given to establishing a pet walking area designed and maintained to prevent, or at least reduce, fecal contamination of the adjacent waters.

2.3. Dissolved oxygen and turbidity impacts

Dissolved oxygen and turbidity are factors to consider for any proposal in the marine environment since reduction of oxygen in the water and increased turbidity can adversely affect aquatic plants and animals. The Maine DEP Water Classification[3] system sets forth the water quality standards that must be met in each body of water based on its classification. The waters in the vicinity of the proposed site are classified SB. Accordingly, dissolved oxygen saturation must be 85% or greater.

Although it is unlikely that the activities associated with the proposed boat launching facility will have any substantive effect on dissolved oxygen, some reduction in dissolved oxygen saturation may occur as a result of increased turbidity and resuspension of bottom sediments, particularly if the resuspended sediments contain decomposing organic material with an elevated biological oxygen demand.

Unfortunately, unlike the chemical and bacteriological concerns addressed above, increased turbidity and any associated reduction in dissolved oxygen cannot be entirely avoided as matters of policy because they are inherent to the launching/hauling process, if only during certain periods of the tide. Therefore, in order to estimate and predict the degree and duration of increased turbidity and any associated effect on dissolved oxygen, an experimental study was developed and carried out to quantify such impacts at existing facilities of similar design, sediment composition, and usage.

2.3.1. Study design

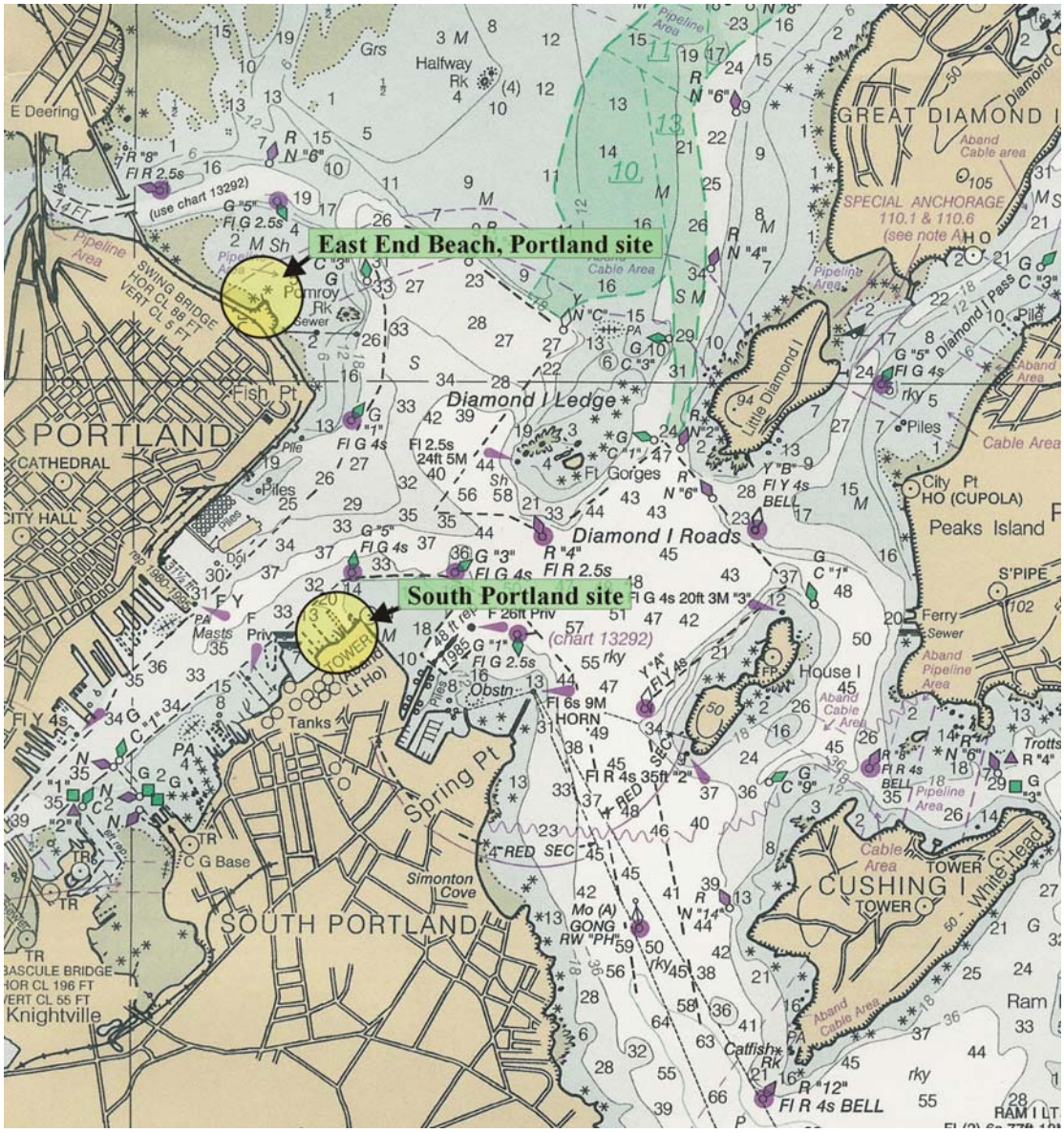
Two existing launching facilities were selected for the study: 1) Bug Light, South Portland, Maine and 2) East End Beach, Portland, Maine, shown in Figure 4. These two facilities were selected because of their location in Casco Bay and consequently being subject to the same tide amplitudes as the proposed site at Merepoint; bottom sediments at both sites, particularly the East End Beach facility, are also similar to those found at Merepoint. Sampling was also carried out at the Merepoint site to develop ambient, baseline data for the site.

The dates for the study, July 3-7, 2004 were selected to provide data during maximum usage since the July 4th weekend is traditionally one of the heaviest, if not the heaviest, boat launching/hauling days of the year. Coincidental astronomically low tides at 0616 (-1.51 ft.) and 1823 (-0.11 ft.) on July 3rd, and at 0710 (-1.49 ft.) and 1920 (-0.08) on July 4th served to create a near-worst-case impact scenario. Ambient, baseline sampling at Merepoint was conducted on July 6th-7th.

Dissolved oxygen (mg/L) and turbidity (NTU) data were collected using two Yellow Springs Instruments (YSI) Model 6920 and one Model 6600 data logging sondes, each equipped with pressure/ depth, temperature/salinity, dissolved oxygen, and turbidity sensors. All units were programmed for the same time and the data collection interval was set at 5 minutes. All instruments were calibrated simultaneously using the same standards to ensure complete comparability of results. Current velocity and direction data were collected using a Sensordata SD-6000 recording current meter programmed for the same time of day and data collection interval as the YSI sondes.

The YSI 6600 sonde was suspended directly beneath the end of the float located between the two launching ramps, thus representing the center of the site and the presumed point of maximum impact. The two YSI 6920 sondes were suspended just below the surface from 12-inch diameter mooring balls anchored by a tether attached to a 20 lb. weight, one 30 meters upcurrent of the center float, the other 30 meters downcurrent. The current meter was set approximately 30 meters off the end of the center float to avoid the effects of vessel prop-wash. At the Merepoint site only a single YSI sonde was deployed along with the current meter, the entire assembly suspended from a single buoy attached to a single-point anchor.

Figure 4. Location of dissolved oxygen and turbidity study sites (Source: NOAA/NOS Chart 13292, *Portland Harbor and Vicinity*, 35th Ed., Mar. 4/00)



At the South Portland site, all instruments were deployed within a 10-minute period at or about 0600 and were allowed to record through 1845; at Portland, the instruments were deployed at 0630 and were retrieved at 1700 due to deteriorating weather and lack of boating activity. Instruments at the proposed Merepoint site were deployed at 1500 on July 6th and recovered at 1700 on July 7th to allow collection of full tide cycle data. All data collected for the data collection period was downloaded upon retrieval and the instruments reset for deployment the following day.

3. Measurements and Results

Results of the various parametric measurements at individual sites are summarized in this section on a site-by-site basis; detailed results of SD6000 current meter and YSI 6600 and 6920 turbidity and dissolved oxygen measurements for each site are included under Appendix I.

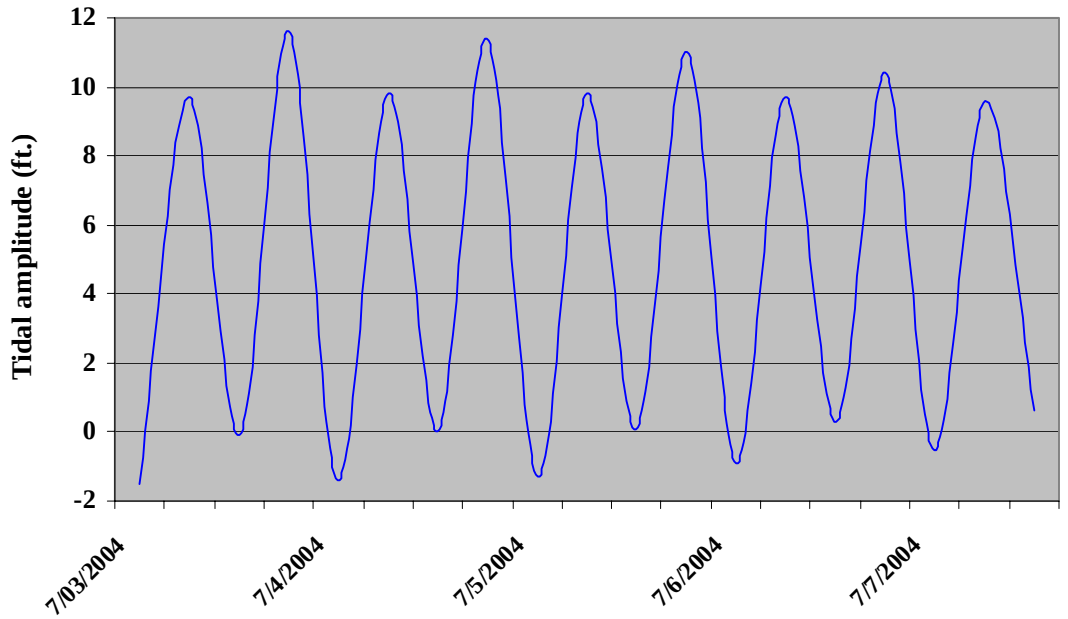
3.1. Tide and amplitude

The dates, times and tide stages for the study period of July 3-7, 2004 for Casco Bay (Portland prediction station) [4] are in Table 2 below and the tide amplitude is shown graphically in Figure 5. The Portland prediction station is close to the two study sites and the differences in both time and amplitude between this station and the proposed Merepoint site are negligible and insignificant with respect to this study. Note: 3-5 July 2004 represents an astronomically large amplitude period (highlight/bold).

Table 1. Tide predictions for Casco Bay, Maine July 3-7, 2004 (Portland prediction station)

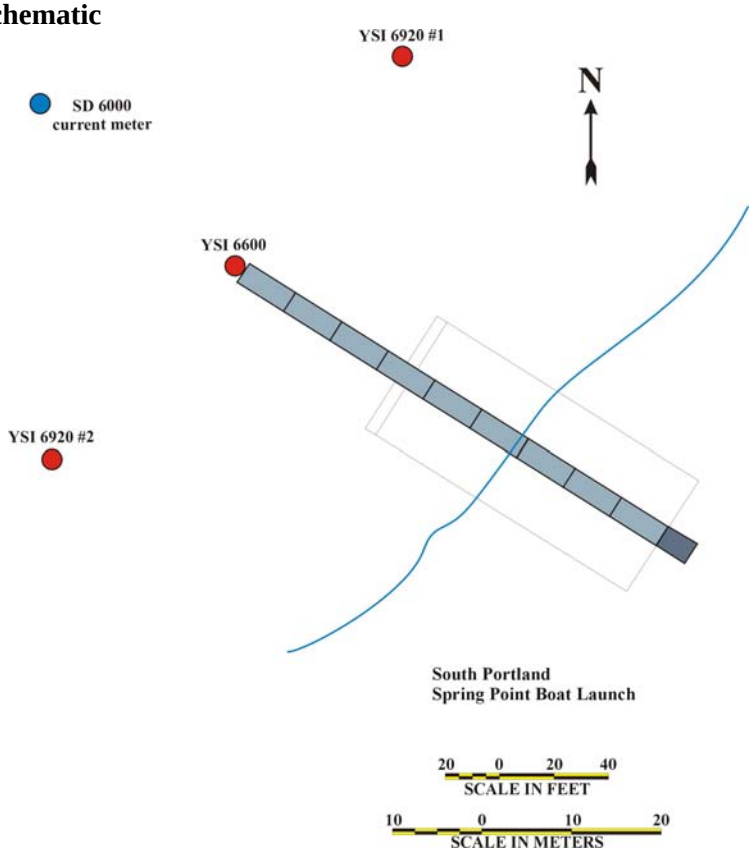
Date		HW		LW		HW		LW
7/3/2004			**0616**	**-1.5**	1232	9.7	1823	-0.1
7/4/2004	0040	11.6	**0711**	**-1.4**	1327	9.8	1920	0.0
7/5/2004	0136	11.4	**0805**	**-1.3**	1422	9.8	2017	0.1
7/6/2004	0233	11.0	0859	-0.9	1517	9.7	2115	0.3
7/7/2004	0330	10.4	0952	-0.5	1612	9.6	2215	0.6

Figure 5. Tide amplitude for Casco Bay, Maine July 3-7, 2004 (Portland prediction station)

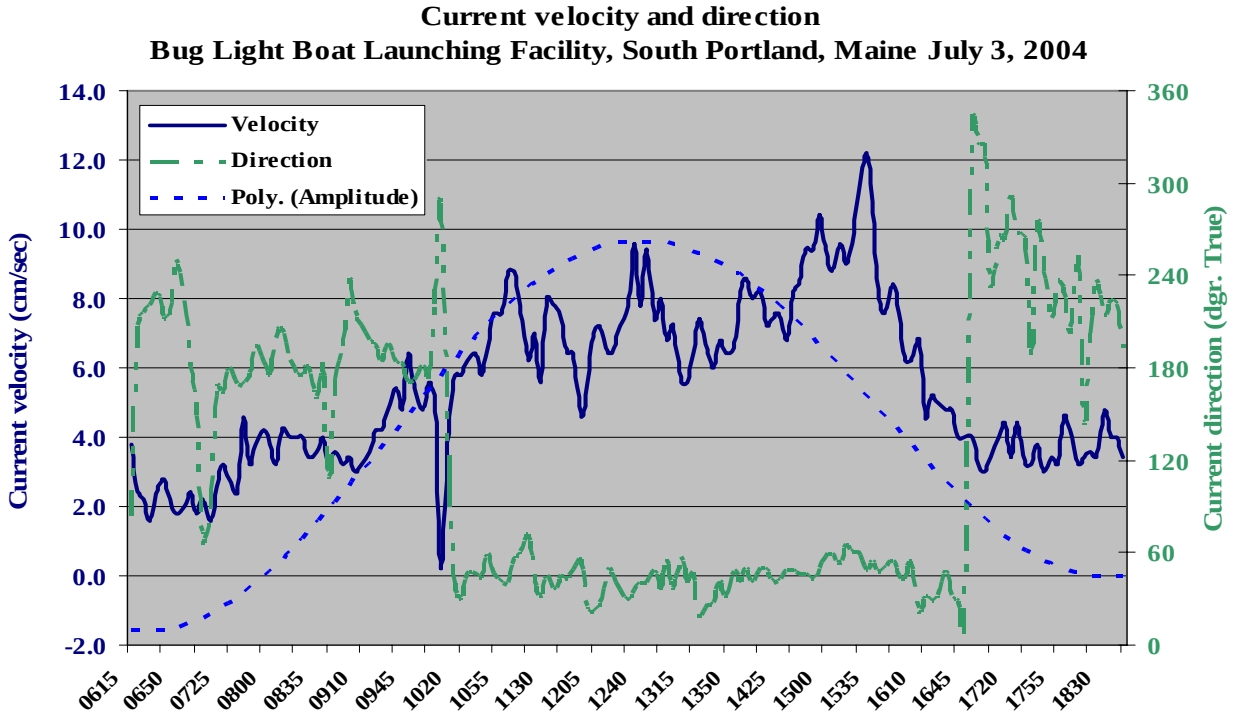


3.2. Bug Light Boat Launching Facility, South Portland

3.2.1. Site schematic

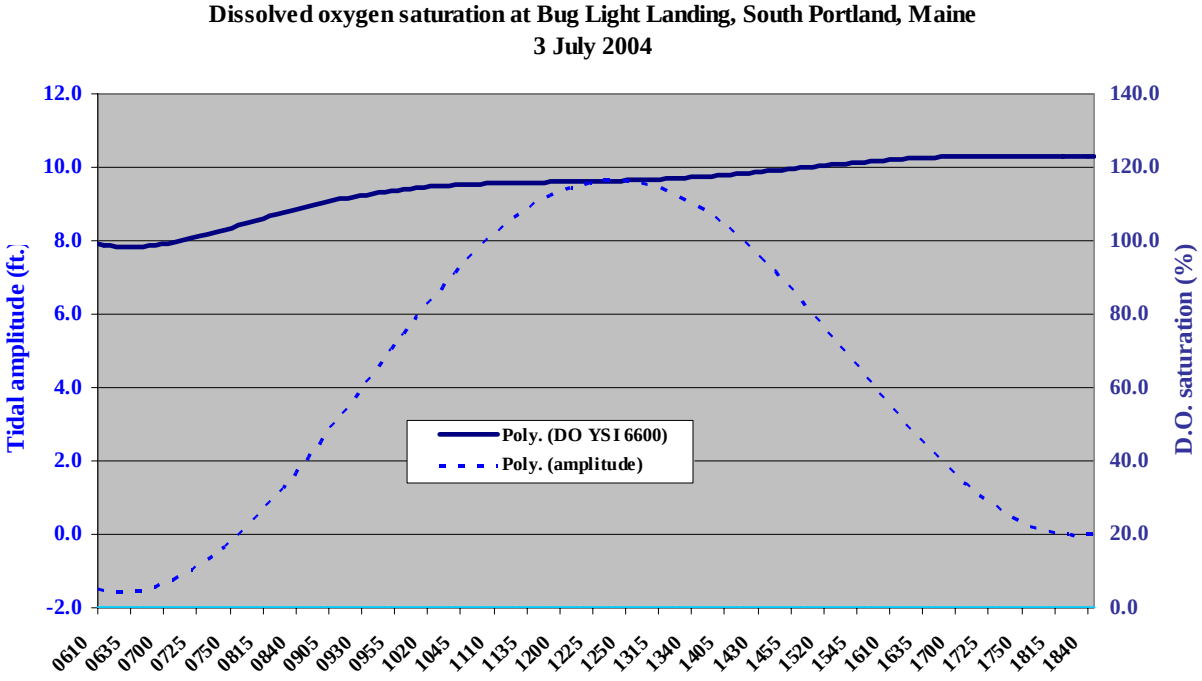


3.2.2. Current velocity and direction

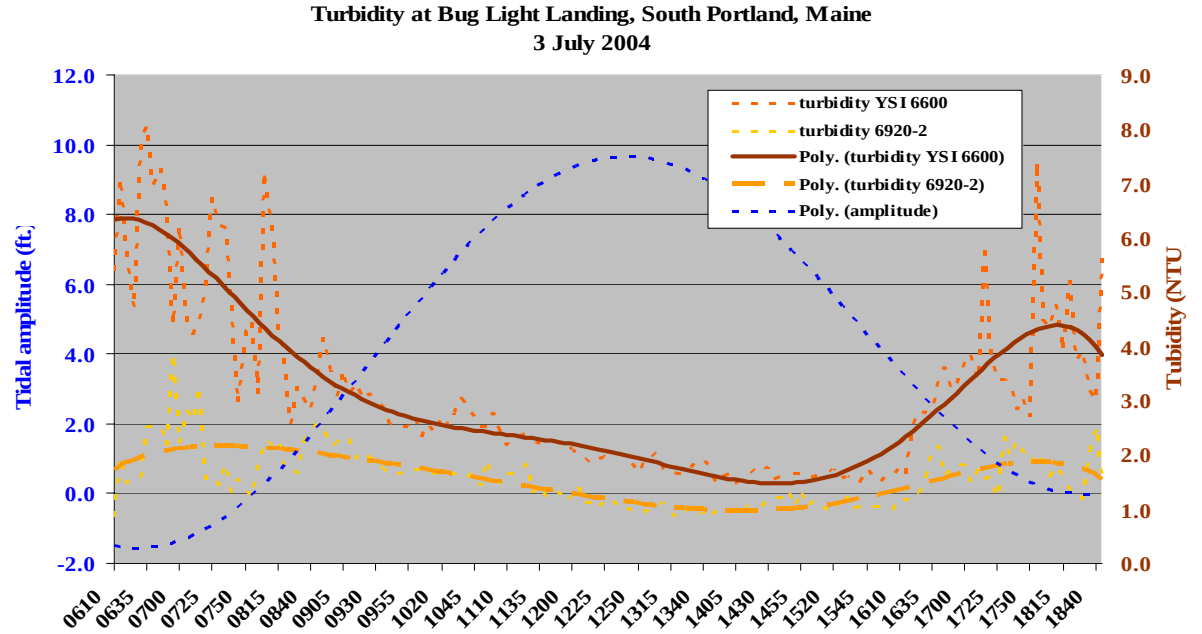


3.2.3. Dissolved oxygen and Turbidity

In the graph below the dashed blue line represents the tidal amplitude during the measurement period and the solid dark blue line the dissolved oxygen percent saturation at the center of the site (end of float system).



In the graph below the dashed blue line represents the tidal amplitude during the measurement period, the dashed orange (readings) and solid dark brown (trend) lines the turbidity at the center of the site (end of float system), and the yellow (readings) and solid tan (trend) lines the turbidity at 30m (100 ft.) alternately downcurrent and upcurrent on flood and ebb tide, respectively.



3.2.4. Summary and Observations

Bathymetrically, the Bug Light launching facility site has a steeper grade to the bottom than the proposed site at Merepoint and depth at the end of the float system is therefore greater at all stages of the tide. At the tide amplitude minimum of 3 July 2004, the end of the ramps on both sides of the central float walkway were exposed such that the tires of trailers had to be dropped off the end of the ramp in order to either launch or load; the sea floor is sufficiently hard beyond the end of the ramp to support a loaded trailer.

Current direction is generally westerly on the flood and easterly on the ebb with current velocity generally slow, increasing on the ebb, reaching a maximum toward the end of the ebb tide. Water flowing past the site during the first four hours of sampling water was moving from the outer Portland Harbor channel into the Fore River, for the next six hours from the Fore River toward the outer channel, then reversing into the Fore River for the final two hours. Water temperature and current velocity mean, maximum and minimum are tabulated below. Some eddy effect occurs during the flood, likely as a consequence of the remnants of stone piers or wharf bases that project perpendicularly from the shore on either side of the launching facility; this is evident from the erratic changes in current direction observed at 0735 and again at 0855.

	Temperature ^{O}C	Velocity (cm/sec)
Mean	**14.7**	**5.5**
Max	**15.8**	**12.2**
Min	**13.3**	**0.2**

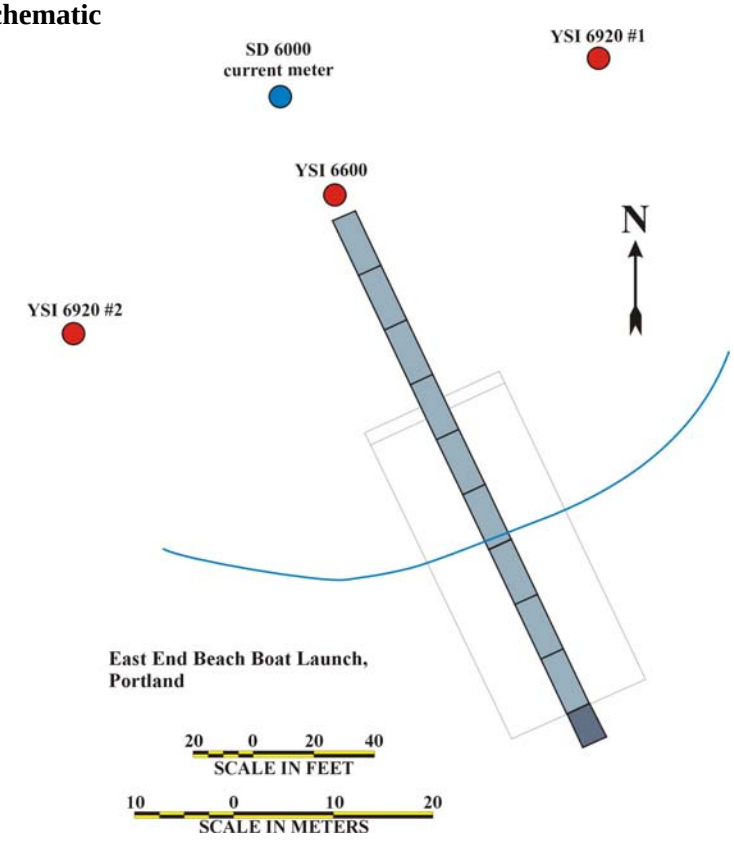
Turbidity at the center of the site was consistently greater than upcurrent or downcurrent of the site, but turbidity levels at both sampling locations remained low (<10 NTU) throughout the sampling period, despite high launching/hauling activity. Dissolved oxygen saturation showed a typical early morning minimum (94.2%), increasing steadily during the day as a result of photosynthesis and aeration resulting from wave action, the latter at times leading to supersaturation (125%); with a mean of 114.6% and a minimum of 94.2%, the saturation level never approached the state water quality minimum standard of 85% saturation for class SB water, much less the 70% saturation minimum standard for class SC, the classification for Portland Harbor.

			Turbidity			Dissolved oxygen		
			Center	East	West	Center	East	West
Time	**Tide (m)**	**Tide (ft)**	**YSI 6600**	**6920-1**	**6920-2**	**YSI 6600**	**6920-1**	**6920-2**
Mean	**1.3**	**4.3**	**3.1**	**No Data**	**1.6**	**114.6**	**No Data**	**Anomalously**
Max	**2.9**	**9.5**	**8.1**		**3.9**	**125.0**		**high readings**
Min	**-0.4**	**-1.3**	**1.5**		**0.8**	**94.2**		

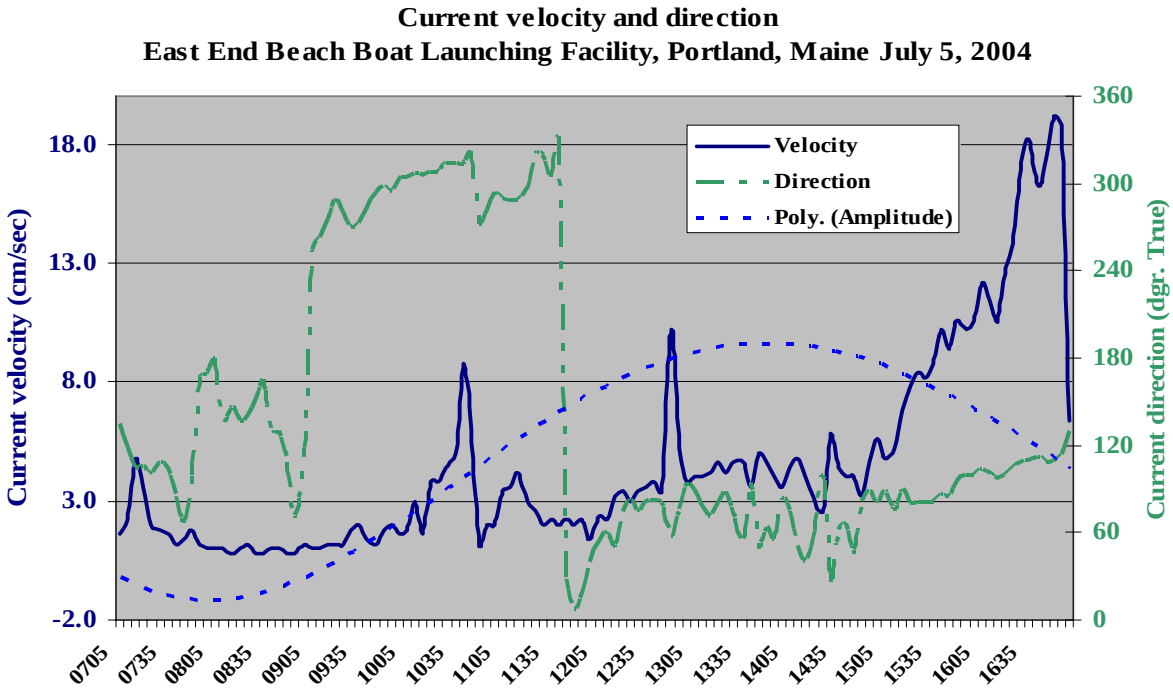
The site is outside of the Portland Harbor "No Wake" zone and is subject to near constant wake impacts from wakes of varying size, ranging up to 2.5-3 ft., generated by the multitude of vessels transiting through Portland Harbor, including everything from sea kayaks and sailing vessels, producing nearly no wake at all, to ferries, tugboats, commercial fishing vessels, cargo ships, and tankers, producing moderate to heavy wakes, all observed at one time or another during the course of the sampling period. The spikes observed in the turbidity graphs during the early morning low-flood tide and afternoon low water periods are predominantly the result of wake impacts from channel traffic rather than wake or propeller wash turbidity originating at the launching facility itself.

3.3. East End Beach Boat Launching Facility, Portland

3.3.1. Site schematic

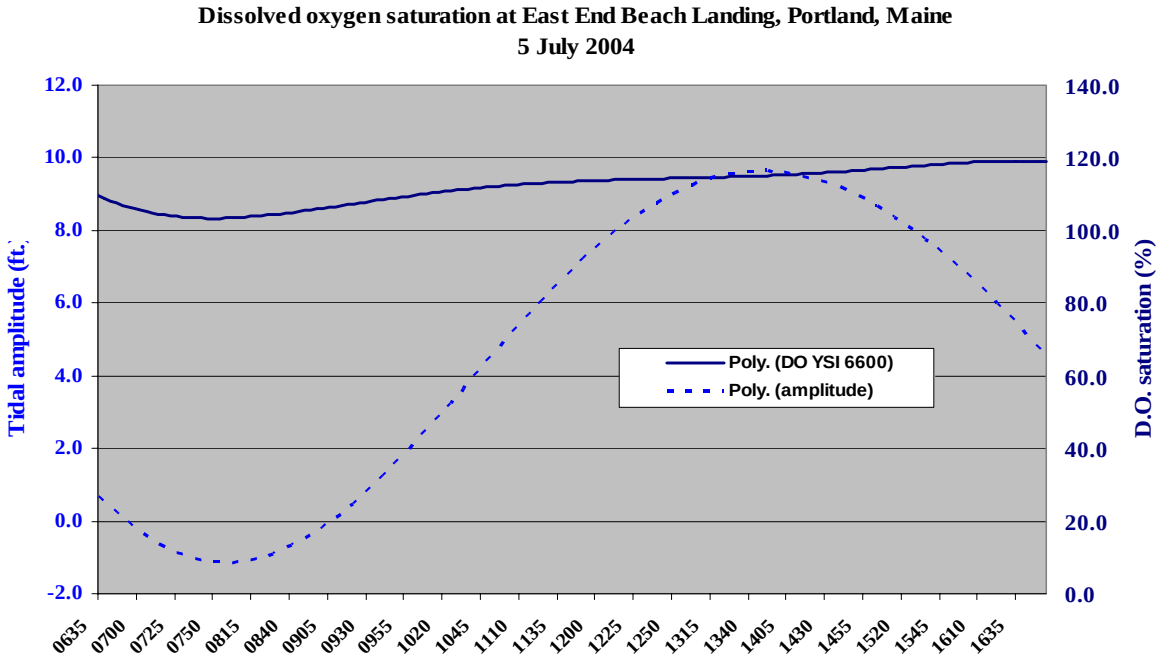


3.3.2. Current velocity and direction

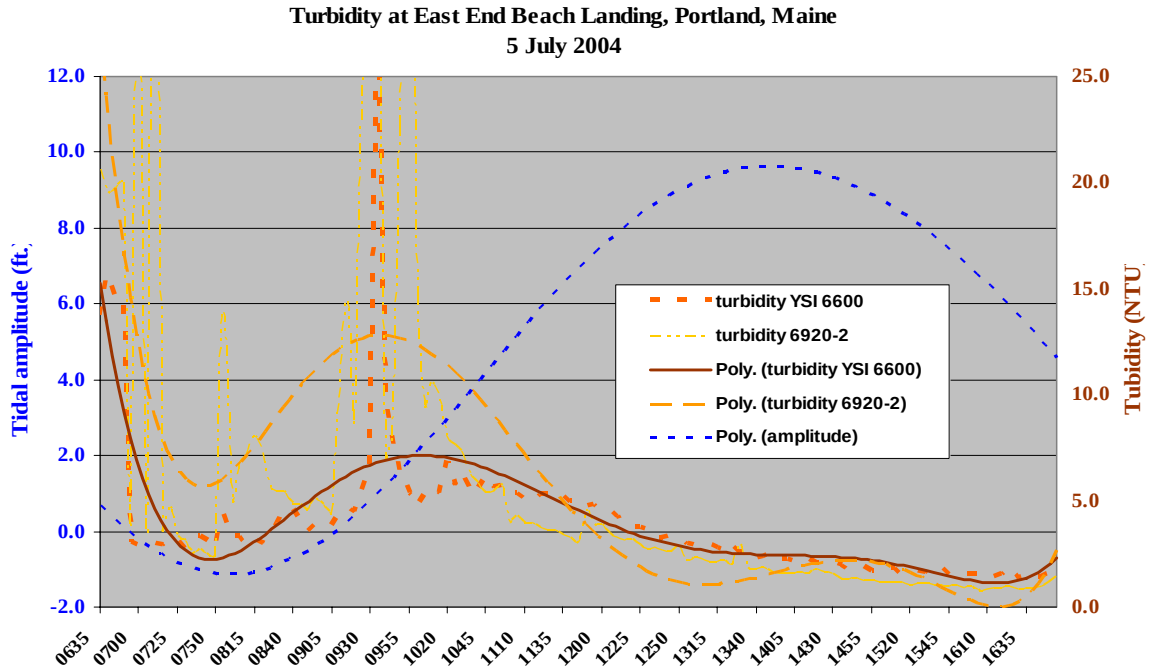


3.3.3. Dissolved oxygen and Turbidity

In the graph below the dashed blue line represents the tidal amplitude during the measurement period and the solid dark blue line the dissolved oxygen percent saturation at the center of the site (end of float system).



In the graph below the dashed blue line represents the tidal amplitude during the measurement period, the dashed orange (readings) and solid dark brown (trend) lines the turbidity at the center of the site (end of float system), and the yellow (readings) and solid tan (trend) lines the turbidity at 30m (100 ft.) alternately upcurrent and downcurrent on ebb and flood tide, respectively.



3.3.4. Summary and Observations

Sediment composition at the East End Beach launching facility is soft silt, similar to that at the Merepoint site, but the slope of the bottom is much shallower than at the proposed site at Merepoint, with a water depth of <2 ft. at low water extending well beyond the end of the float system and into the mooring field. Mussel and extensive kelp beds exist in the vicinity of the site.

At the tide amplitude minimum (-1.3 ft.) on 5 July 2004, the end of the ramps on both sides of the central float walkway were exposed and depth at the end of the floating walkway was approximately 1.5 ft.; the sediment beyond the end of the ramps is soft and has been excavated over time as a result of power launching and loading to the extend that "pools", deeper than the surrounding sea floor, have been created immediately adjacent to the ramp ends.

Current direction is generally west-northwesterly on the flood and east-southeasterly on the ebb with current velocity generally slow, increasing on the ebb, then increasing sharply toward the end of ebb tide (the apparent southerly flow during the early portion of data collection at start of flood at dead low water is an artifact caused by the current meter laying on bottom due to astronomically low tide from dead low water to the first 1.5-2 hours of flood).

	Temperature ^{O}C	Velocity (cm/sec)
Mean	**14.8**	**4.6**
Max	**16.5**	**19.2**
Min	**13.5**	**0.8**

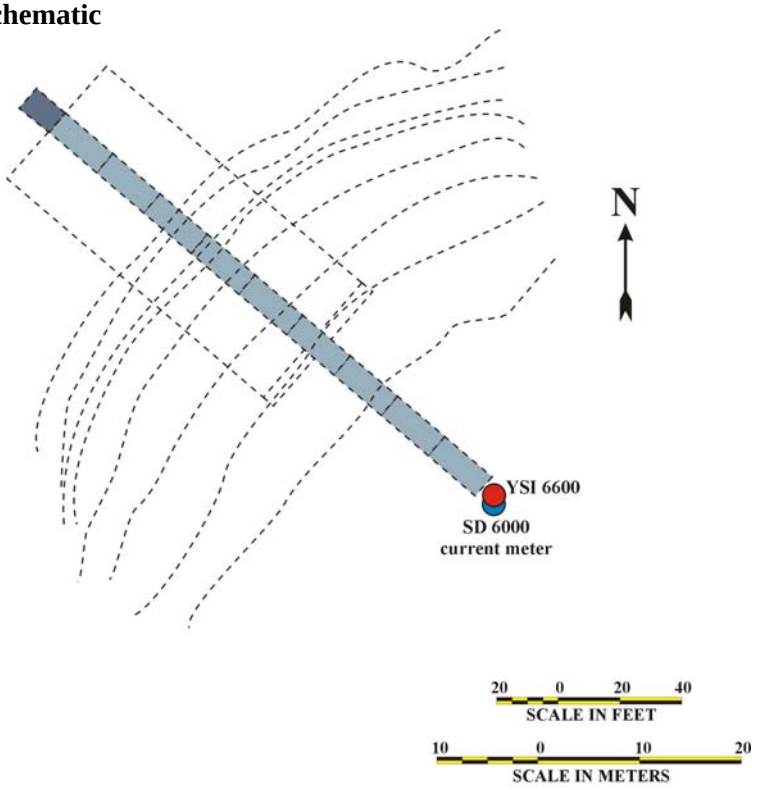
Turbidity at the center of the site was generally lower than downcurrent of the site from low water through flood tide and the same as upcurrent on the ebb; with exception of the spikes early in the recording period and between 0930 and 1030, turbidity levels are low with means <6 NTU; as with the artifacts created with in the current meter data, the spikes seen during the first hour of recording are due to the shallow depth and the agitation of the sediment by the data logger touching the bottom at dead low water. Additionally, two vessels attempted to approach the float at or just after low water, became mired in the bottom, and caused very high turbidity when churning the muddy bottom in an attempt to extricate their vessels from the bottom; the spike shortly after the turn of tide are likely attributable to these vessels.

Dissolved oxygen saturation again showed a typical early morning minimum, increasing steadily during the day as a result of photosynthesis, eventually leading to supersaturation (119%) toward the end of the day; with a mean of 112.0% and a minimum of 99.2%, the saturation level never approached the state water quality minimum standard of 85% saturation for class SB water, much less the 70% saturation minimum standard for class SC, the classification for Portland Harbor.

			Turbidity			Dissolved oxygen		
			Center	East	West	Center	East	West
	Tide (m)	Tide (ft)	YSI 6600	6920-1	6920-2	YSI 6600	6920-1	6920-2
Mean	**1.5**	**5.0**	**4.1**		**5.8**	**112.0**	**No data**	**Anomalously**
Max	**2.9**	**9.5**	**27.1**		**48.1**	**119.3**		**high readings**
Min	**-0.4**	**-1.3**	**1.4**		**0.7**	**99.2**		

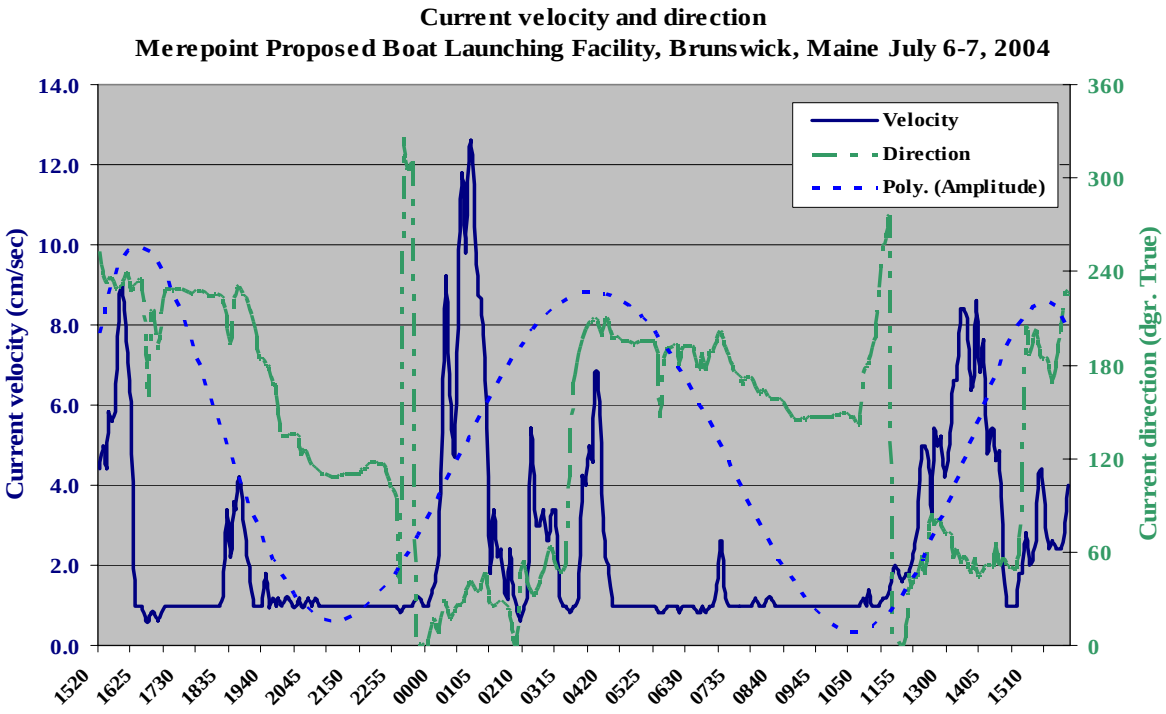
3.4. Merepoint Proposed Boat Launching Facility, Brunswick

3.4.1. Site schematic



Proposed Merepoint Boat Launch, Brunswick

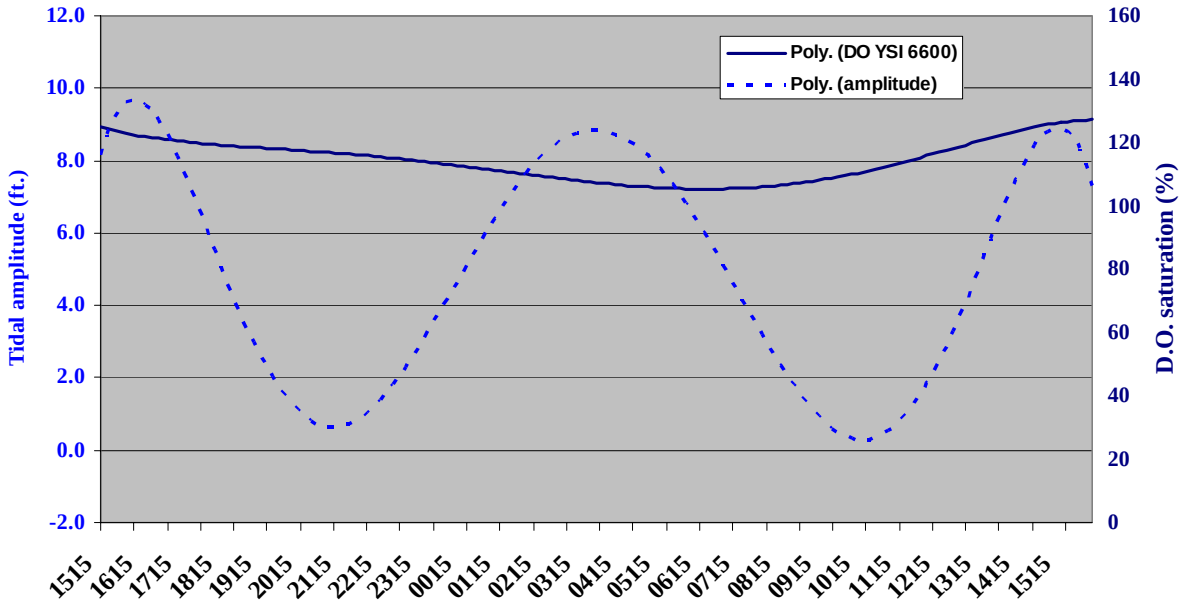
3.4.2. Current velocity and direction



3.4.3. Dissolved oxygen and Turbidity

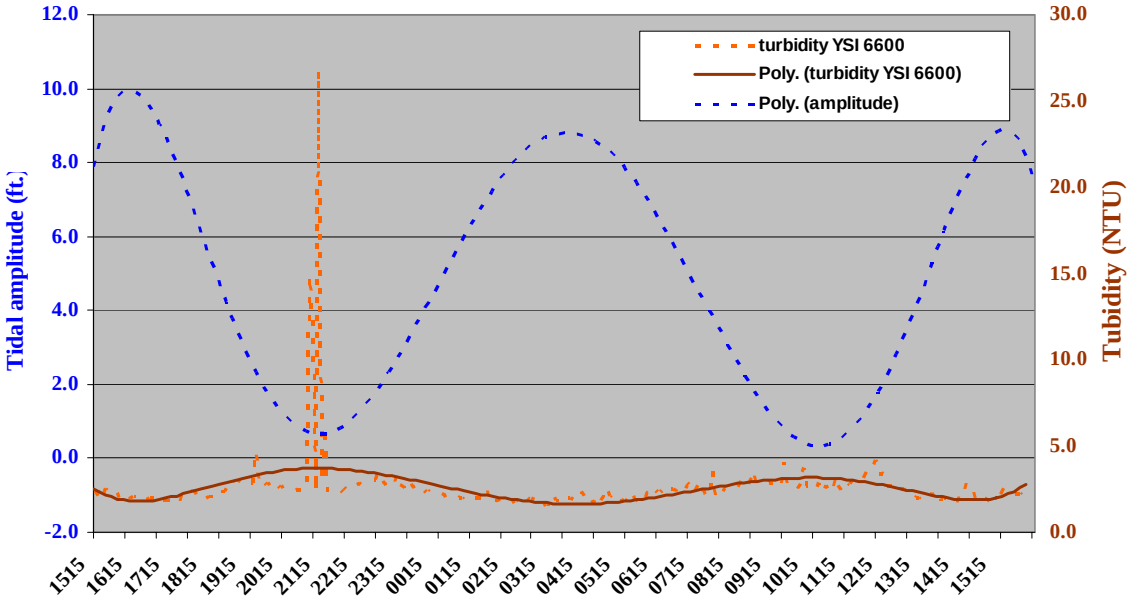
In the graph below the dashed blue line represents the tidal amplitude during the measurement period and the solid dark blue line the dissolved oxygen percent saturation at the center of the site (end of float system).

Dissolved oxygen saturation at Proposed Merepoint Boat Launch Facility, Brunswick
6-7 July 2004



In the graph below the dashed blue line represents the tidal amplitude during the measurement period and the solid dark brown line the turbidity at the center of the site (end of float system); no turbidity measurements at 30m (100 ft.) were necessary at this site.

Turbidity at Proposed Merepoint Boat Launch Facility, Brunswick
6-7 July 2004



3.4.4. Summary and Observations

Sediments at the proposed Merepoint boat launching site are soft, similar to those at East End Beach, Portland. As planned, depth at the end of the proposed ramp will be approximately -3 ft. on a normal tide and -1.5 ft. on an astronomically low tide; at the end of the floating walkway, depth should be approximately -6 ft. on a normal tide and -4.5 ft. on an astronomically low tide, considerably deeper than the 1.5 ft. observed at the East End Beach facility on July 6th and more similar to depths at the Bug Light facility.

Current direction is generally east-northeasterly during flood tide and west-southwesterly during ebb (anomalous readings at or near low water are due to the current meter/YSI 6600 assembly touching bottom). Current velocity throughout the tide cycle are generally slow (2.4 cm/sec mean), occasionally interrupted by periods of slightly faster velocity (6-12 cm/sec). These velocities are consistent with the soft, depositional sediment composition of the site.

	Temperature ^{O}C	Velocity (cm/sec)
Mean	**15.9**	**2.4**
Max	**18.0**	**12.6**
Min	**13.6**	**0.6**

Turbidity is low throughout the tide cycle, averaging 2.5 NTU. The sharp spike in turbidity (26.7 NTU) coinciding with dead low water is an artifact of the current meter/YSI 6600 assembly touching bottom. Dissolved oxygen saturation remained above 100%, well above the state water quality minimum standard of 85% saturation for class SB water, throughout the period, reaching a supersaturation peak of ≈130% around 1530 each day, likely the result of photosynthesis in the area rather than aeration by wave action given the calm wind conditions and relatively small wakes affecting the area during data collection.

			Turbidity	Dissolved oxygen
			Center	Center
	Tide (m)	Tide (ft)	YSI 6600	YSI 6600
Mean	**1.5**	**5.0**	**2.5**	**114.3**
Max	**2.9**	**9.5**	**26.7**	**134.0**
Min	**0.1**	**0.3**	**1.5**	**101.8**

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4. Launching/hauling activity over course of day

Launching and hauling activity can vary greatly during the day depending on the type of water activity involved. Generally, serious sport fishermen tend to leave early in the morning, *i.e.* 6:30-7:00 AM and return in late afternoon, *i.e.* 4:30-5:00 PM; family picnickers and sightseers tend to leave later in the morning, *i.e.* 9:00-11:00 AM, and return either slightly earlier or about the same time as sport fishermen (pers. comm.. Steve Walker, Natural Resources Planner, Town of Brunswick). Although boating activity takes place throughout the summer, highest activity is concentrated on the weekends.

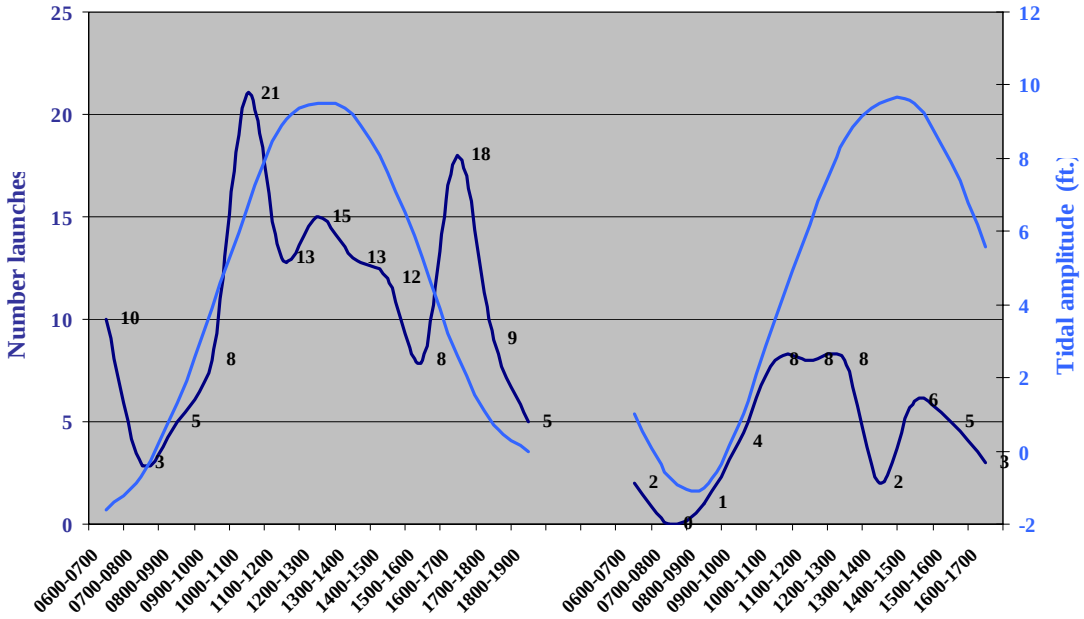
To better understand and quantify the hourly boat launching/hauling activity, the number of boat launchings and hauls were recorded for each hourly interval over the course of each data collection day from the time of instrument deployment through instrument retrieval; the results are presented in Table 2 below and graphically in Figure 6. on the following page.

Table 2. Boat launchings/loadings per hour interval at Bug Light, South Portland and East End Beach, Portland

Hour interval	Bug Light 07/03/04	East End 07/05/04
0600-0700	10	2
0700-0800	3	0
0800-0900	5	1
0900-1000	8	4
1000-1100	21	8
1100-1200	13	8
1200-1300	15	8
1300-1400	13	2
1400-1500	12	6
1500-1600	8	5
1600-1700	18	3
1700-1800	9	----
1800-1900	5	----
Total	**140**	**47**

The numbers for each hourly interval represent a combination of launchings, loadings, and landings to pick up or drop off passengers; the latter resulted in neither a launch nor loading, but all approaches and departures from the facilities were counted as "events" since potential disturbance to the bottom sediments exists in all cases.

Figure 6. Boat launch/hauls per hour interval and stage of tide Bug Light, So. Portland and East End Beach, Portland, Maine 07/03-05/2004



The vast majority of events at the Bug Light facility between 0600 and 1400 on 3 July 2004 were launching, representing 84 of the 88 launching/loading events during those hours; between 1400 and 1900 the events were more evenly split at 22 launchings and 30 loadings. It should be noted that the Bug Light facility has parking capacity for at least 70 cars and trailers immediately adjacent to the ramps, with an additional capacity of 30+ along Madison Street, the approach street to the facility, where the City allows parking. Additionally, the July 4th weekend was chosen as a worst-case scenario representing peak usage; however, because of the City of Portland fireworks display planned for the evening of July 4th, many of the vessel owners who launched on July 3rd requested overnight parking permits at the facility; therefore, the discrepancy between the number of vessels launched in the morning and returning in the evening may be anomalous and consequently not necessarily representative of the norm.

Interestingly, since Bug Light is a true all-tide launching facility, activity appears to be related more to time of day rather than stage of tide, and the level of activity per hourly interval observed on July 3 corroborates the previously reported busy periods cited above. Additionally, many of the vessels launching in the 1100-1200 and 1200-1300 could have launched earlier, but were delayed due to ramp use restrictions. The Bug Light facility does have two ramps, but the eastern ramp is designated only for launching, the western ramp only for loading; this rule was respected throughout the day even when the launching ramp was occupied and the loading ramp was free; allowing launchings on the loading ramp during the busiest period would likely have increased the launching rate and reduced the launching period, which would likely have resulted in an hourly activity distribution more closely resembling the projection. Based on the observations, a rate of 20-21 launchings and loadings per hour per ramp appears to be a maximum.

No "power-loading" was observed during the observation period; arriving vessels tended to land at the far end of the float walkway and were pulled alongside the walkway to the ramp and awaiting trailer. Similarly, boats launched immediately adjacent to the walkway and were walked to the end of the walkway before engines were started; no signs encouraged, much less required, this behavior. This was undoubtedly done more out of courtesy to others waiting to launch rather than concern for disturbance to bottom sediments.

The study at the East End Beach, Portland facility was originally scheduled for July 4th, the anticipated peak usage day of the year. However, although the City of Portland did not impose any restriction on usage of the launching ramps at the facility due to the planned July 4th fireworks display at the site that evening, a restriction was imposed on parking of all vehicles, including trailers, anywhere on the site, effectively bringing all use to a halt; the study was therefore conducted the following day, July 5th.

The situation at the East End Beach facility is quite different compared to that at the Bug Light facility since the East End Beach landing is not a true all-tide facility, at least not during astronomically high amplitude periods such as that experienced on July 3-5, 2004; activity at the facility is consequently tide-dependent rather than hour dependent. Indeed, only three vessels were launched at or near low water between 0600 and 0900, one 20 ft. boat (rowed to deeper water) and two small skiffs and most of the activity centered around mid-flood tide between 1100 and 1300. Including these, there were 21 launchings and 10 loadings for a total of 31 events between 0600 and 1300; between 1300 and 1700 there were 4 launchings and 12 loadings for a total of 16 events, or 47 total events for the day. The study was stopped two hours early due to threatening weather; all launching and hauling activity also ceased for the same reason.

Similar to behavior observed at Bug Light on July 3rd, launched vessels were generally walked down the walkway to take on passengers and before starting engines, particularly vessels larger than 18-20 ft. Only two "power loadings" were observed, both at or near high water, and neither had any effect on turbidity in the vicinity of the ramps. Again, as observed on July 3rd at Bug Light, boaters were respectful of other users and assisted others with launching and loading when necessary. East End Beach is a posted "No Wake" zone and the zone was consistently respected by all vessels.

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5. Discussion

The purpose of the proposed facility is to provide a launching and hauling capability irrespective of tide stage, otherwise referred to as an all-tide ramp. Based on direct observation during sampling conducted on June 14-16, 2004 and the results of the study of the effects of boat launching/hauling activities on dissolved oxygen and turbidity reported here, little, if any, effect on dissolved oxygen and turbidity occurs during most of the approximately 12-hour tide cycle; however, some increase in turbidity can be expected when vessels are either launched or hauled between 1-2 hours before and 1-2 hours after low water, particularly during astronomically large-amplitude tide periods.

Since the majority of boat launching and hauling activity occurs at relatively specific times during the day and tide stages shift daily by approximately one hour, the coincidence of low tide and peak hours of ramp usage are predictable. To determine the frequency of coincidental low water and peak usage events during the boating season, an analysis was performed of the times of low water and peak usage hours for the three-month period between Memorial Day and Labor Day, the traditional beginning and ending dates of the summer season in Maine. As the analysis results in Table 3 on the following page show, the number of occasions when maximum effect will occur is relatively limited. Furthermore, the number of occasions when these periods of greatest impact, *i.e.* coincidence of low water and peak usage hours, occur on weekends, traditionally the most intensive boating days of the week, are extremely limited.

As currently designed, the launching ramp will extend out to a point where water depth is approximately 3 feet below the mean low water mark. Propeller depth for most vessels expected to be using the facility (18-24 ft. range) is approximately 1.5 to 2.0 feet. Assuming a propeller influence (disturbance) depth of 1.5 ft. below the prop at headway speed (just moving forward), soft sediments beyond the end of the ramp in water depths of -3 to -3.5 feet or shallower would be expected to be disturbed. Accordingly, any tide with an amplitude at or less than mean resulting in a *positive* tide (low tide above mean low water) would have little effect; tides with amplitudes greater than mean resulting in a *negative* tide (low tide below mean low water) would have increasing levels of effect with increasing amplitude.

There are a total of 379 tides during the Memorial Day to Labor Day official summer period in 2004. A comparison between the anticipated peak summertime usage hours of 8:00-11:00 AM and 3:30-6:30 PM and the predicted negative low water events during this period yields the number of occasions when turbidity is most likely to be increased. The light yellow highlighted cells in Table 3 represent the predicted negative low tides for the entire period; these tides total 45 or approximately 12% of the tides during the period. The orange highlighted cells represent the predicted negative low tides that fall within the expected peak usage hours; these total 16 or approximately 4% of the tides during the period. The dark orange represent the predicted negative low tides that fall within the expected peak usage hours on high-use weekend days; these total 4 or approximately 1% of the tides during the period.

The number of negative low tides and the amplitude of the tides will vary slightly from year to year as a result of astronomical conditions but, despite these slight inter-annual differences, it is clear that the number of occasions on which turbidity effects would be expected is extremely small.

It should be noted that the conclusion of limited effect on turbidity assumes that vessels will be moving only at headway speed, defined in Maine law as "the minimum speed necessary to maintain steerage and control of the watercraft while the watercraft is moving", that is, in forward gear with just sufficient power to move forward in the water. It further assumes that loading of vessels will be only by winching vessels onto trailers and that "power loading", running a vessel onto a trailer under power, should be strictly prohibited, at least during the more sensitive period within 1-2 hour either side of low water.

Table 3. Negative low water events for the Memorial Day through Labor Day period, 2004

Date	Day	Time	Height	Time	Height	Time	Height	Time	Height
6/1/2004	Tue	03:52AM	-0.4	10:03AM	9.5	04:02PM	0.1	10:18PM	11.1
6/2/2004	Wed	04:45AM	-1.0	10:58AM	9.7	04:53PM	-0.1	11:08PM	11.5
6/3/2004	Thu	05:38AM	-1.4	11:52AM	9.9	05:45PM	-0.1		
6/4/2004	Fri	12:00AM	11.7	06:32AM	-1.6	12:47PM	9.9	06:39PM	-0.1
6/5/2004	Sat	12:54AM	11.7	07:26AM	-1.5	01:43PM	9.8	07:35PM	0.1
6/6/2004	Sun	01:50AM	11.4	08:22AM	-1.3	02:41PM	9.6	08:33PM	0.3
6/7/2004	Mon	02:49AM	11.0	09:20AM	-0.9	03:40PM	9.5	09:34PM	0.6
6/8/2004	Tue	03:50AM	10.5	10:19AM	-0.5	04:41PM	9.4	10:38PM	0.8
6/9/2004	Wed	04:53AM	10.0	11:18AM	-0.1	05:41PM	9.3	11:44PM	1.0
6/30/2004	Wed	03:29AM	-0.5	09:40AM	9.2	03:35PM	0.3	09:54PM	11.2
7/1/2004	Thu	04:27AM	-1.0	10:40AM	9.4	04:32PM	0.1	10:50PM	11.5
7/2/2004	Fri	05:23AM	-1.3	11:37AM	9.6	05:29PM	0.0	11:46PM	11.6
7/3/2004	Sat	06:18AM	-1.5	12:34PM	9.7	06:25PM	-0.1		
7/4/2004	Sun	12:42AM	11.6	07:13AM	-1.4	01:29PM	9.8	07:22PM	0.0
7/5/2004	Mon	01:38AM	11.4	08:07AM	-1.3	02:24PM	9.8	08:19PM	0.1
7/6/2004	Tue	02:35AM	11.0	09:01AM	-0.9	03:19PM	9.7	09:17PM	0.3
7/7/2004	Wed	03:32AM	10.4	09:54AM	-0.5	04:14PM	9.6	10:17PM	0.6
7/29/2004	Thu	03:12AM	-0.4	09:25AM	8.9	03:19PM	0.5	09:39PM	10.9
7/30/2004	Fri	04:13AM	-0.8	10:27AM	9.2	04:19PM	0.2	10:38PM	11.2
7/31/2004	Sat	05:10AM	-1.1	11:25AM	9.5	05:17PM	0.0	11:36PM	11.4
8/1/2004	Sun	06:04AM	-1.3	12:19PM	9.8	06:13PM	-0.2		
8/2/2004	Mon	12:30AM	11.3	06:56AM	-1.3	01:11PM	9.9	07:07PM	-0.3
8/3/2004	Tue	01:24AM	11.1	07:46AM	-1.1	02:01PM	10.0	08:01PM	-0.2
8/4/2004	Wed	02:16AM	10.7	08:35AM	-0.7	02:51PM	9.9	08:55PM	0.0
8/5/2004	Thu	03:08AM	10.1	09:23AM	-0.2	03:40PM	9.8	09:49PM	0.3
8/27/2004	Fri	03:02AM	-0.2	09:17AM	8.8	03:11PM	0.6	09:31PM	10.6
8/28/2004	Sat	04:02AM	-0.5	10:17AM	9.2	04:12PM	0.2	10:31PM	10.8
8/29/2004	Sun	04:57AM	-0.8	11:11AM	9.6	05:08PM	-0.2	11:26PM	11.0
8/30/2004	Mon	05:47AM	-0.9	12:01PM	10.0	06:01PM	-0.4		
8/31/2004	Tue	12:17AM	11.0	06:35AM	-0.9	12:48PM	10.1	06:51PM	-0.5
9/1/2004	Wed	01:06AM	10.7	07:20AM	-0.7	01:33PM	10.2	07:40PM	-0.4
9/2/2004	Thu	01:53AM	10.3	08:04AM	-0.3	02:17PM	10.0	08:28PM	-0.1

Total negative low tides	**14**	**17**	**7**	**7**
Total negative low tides during peak usage hours		**9**	**7**	
Total negative low tides during peak weekend usage		**1**	**3**	
Total disturbance period in hours assuming 2 hrs/tide		**2**	**6**	

Although very infrequent, tides may be sufficiently low to require trailers to drop off the end of ramp as, currently designed, in order to launch. On these occasions, the depth below the vessel may be insufficient to allow an outboard to be fully lowered during backing and clearly insufficient to avoid substantial resuspension of bottom sediments and the consequent increase in turbidity. On such occasions boaters should be encouraged, perhaps required, to launch the boat while tended by line from the float so that the boat can be moved to the end of the float before the engine is dropped and propeller engaged, behavior already exhibited voluntarily by boaters elsewhere, as reported here. Water depth at the end of the float on a mean tide should be approximately -7 ft., thus approximately -5 to -5.5 ft. on a strong negative tide, which would still offer ample distance between the bottom of the propeller and the soft-sediment bottom.

Additionally, since the eelgrass at the very end of the ramp will likely be substantially impacted and is already part of the calculated impact zone, consideration might be given to the installation of additional concrete ramp slabs to sufficiently extend the ramp to gain an additional 1 ft. of water depth over the ramp, or roughly 30 ft. of additional length. Such a change would admittedly increase the area of permanent ramp coverage, however the sacrifice of an additional 1,500 sq. ft. of permanently covered bottom, but again area already considered in the impact assessment, may serve to further reduce, perhaps even largely eliminate, the potential impacts of increased turbidity.

5. Conclusions

Based on the proposed project design, plan of operation [that includes substantial Town of Brunswick staff presence (pers. comm.. Tom Farrell)], and the implementation of the recommendations proposed in this report, it is reasonable to expect that the proposed project will have little chemical, toxic, or bacteriological effect on the quality of the water or sediment adjacent to or surrounding the site.

Based on the sampling results and observations made during the study of boat landings on July 3rd through July 5th reported here, little, if any, effect on dissolved oxygen and turbidity during most of the approximately 12-hour tide cycle is anticipated. Some temporary increase in turbidity can be expected when vessels are either launched or hauled between 1-2 hours before and 1-2 hours after low water, particularly during astronomically large-amplitude tide periods. However, the number of occasions when low water coincides with the hours of peak launching and hauling activity during the boating season is limited; the number of occasions when these coincide on weekends, when greatest usage is expected, is even fewer. Therefore, even though some limited, if not negligible, temporary impacts can be associated with launching and hauling activity, the incidence and duration of these impacts will be limited and will ultimately prove insignificant when compared to the frequency and duration of naturally occurring increased turbidity events due to storm water runoff and/or storm-generated waves.

Since usage of the facility will be primarily for recreational boating and fishing purposes, most of the concern is focused on the summer boating period. Nevertheless, boat launching and hauling can be expected to occur throughout much of the remainder of the year, except for the two- to three-month period in winter when Merepoint Bay is often frozen. Given the location of the proposed facility and its proximity to large, productive shellfish growing areas, much of the non-summer activity will likely be associated with clam harvesting. Since clams are harvested during low water, most harvesters leave for the flats approximately 2-3 hours before low water, that is, at mid-ebb tide, and return 2-3 hours after low water, that is, at mid-flood tide. Consequently, water depth over the ramp during the peak clamming-related launching/hauling period will be more than sufficient to avoid disturbance to the bottom and there should be little, if any, effect on turbidity or dissolved oxygen.

Similarly, commercial boat haulers launch and haul when ample water depth exists at the ramp, that is, usually between mid-flood tide through mid-ebb tide, or two to three hours either side of high water. Therefore, as in the case of commercial shellfish harvesters, most of the commercial launching and hauling activity will occur outside of the vulnerability period and, again, there should be little, if any, effect on turbidity or dissolved oxygen.

Based on our review of the proposed site, the proposed project plan, and observations made at existing facilities in the Casco Bay area of substantially similar design and conditions, we conclude that the proposed project should not cause unreasonable impacts to water quality or cause detrimental changes in the resident biological community; by implementing and enforcing the recommendations detailed in this report, we are confident that the facility will meet state water quality standards for Class SB designated waters as set forth in 38 M.R.S.A. §465-B. Standards for the classification of estuarine and marine waters.[5]

6. Summary of recommendations

Educational and signage measures can be used to avoid or reduce the possible impacts of fuel and oil spillage, however, it is further recommended that all refueling of vessels, transfer of fuel or oil, and possession of open fuel and oil containers be prohibited on the premises, except under emergency circumstances, *e.g.* refueling of emergency vehicles and vessels during search and rescue operations. Imposing such restrictions on the handling of fuels and oils will effectively eliminate the risk of accidental spillage and discharge and the attendant potential impacts to water quality.

To reduce the possibility of chemical and toxic contamination, we also recommended imposing a prohibition on the washing boat bottoms on the premises; additionally, it is further recommended that the application of antifouling paint and possession of open containers of antifouling paints be prohibited on the premises at all times.

To avoid potential fecal coliform contamination resulting from pets, boaters and visitors should be discouraged, perhaps even prohibited, from allowing pets to defecate anywhere along the shoreline and pet owners should be required to remove any feces, as they are in other public places. Additionally, consideration might be given to establishing a pet walking area designed and maintained to prevent, or at least reduce, fecal contamination of the adjacent waters.

By law, only headway speed will be allowed within the immediate vicinity of the ramp and floats; loading of vessels should only be by winching vessels onto trailers and the running a vessel onto a trailer under power, referred to as "power loading", should be strictly prohibited, at least during the more sensitive period within 1-2 hours either side of low water.

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World Wide Web links:

[1] http://www.epa.gov/oilspill/cwakeys.htm

[2] http://vm.cfsan.fda.gov/~ear/nsspotoc.html

[3] http://www.maine.gov/dep/blwq/docmonitoring/classification/

[4] http://co-ops.nos.noaa.gov/cgi-bin/get_pred.cgi?year=2004&stn=2652+Portland

[5] http://janus.state.me.us/legis/statutes/38/title38sec465-B.html

See also:

Sources of marine bacteria contamination

http://www.sciencedaily.com/releases/1999/12/991206071651.htm

http://www.co.thurston.wa.us/shellfish/pdf/Final%20DNA%20Report%2002.pdf

Appendix I

Boat Landings Turbidity and Dissolved Oxygen Impact Study July 3-7 Detailed Data

Bug Light, South Portland, Maine – Current velocity/direction

From file: SPRTLAND

Meas	Temp	Curr	Dir	Date	Time
1	14.4	3.8	101	7/3/2004	0615
2	14.2	2.4	224	7/3/2004	0620
3	14.2	2.2	233	7/3/2004	0625
4	14.2	1.6	237	7/3/2004	0630
5	14.1	2.6	246	7/3/2004	0635
6	14.1	2.8	229	7/3/2004	0640
7	14.1	2.2	231	7/3/2004	0645
8	14.2	1.8	267	7/3/2004	0650
9	14.2	2.0	241	7/3/2004	0655
10	14.2	2.4	198	7/3/2004	0700
11	14.2	1.8	174	7/3/2004	0705
12	14.2	2.2	85	7/3/2004	0710
13	14.3	1.6	110	7/3/2004	0715
14	14.3	2.6	185	7/3/2004	0720
15	14.4	3.2	181	7/3/2004	0725
16	14.4	2.8	197	7/3/2004	0730
17	14.4	2.4	186	7/3/2004	0735
18	14.4	4.6	186	7/3/2004	0740
19	14.4	3.2	191	7/3/2004	0745
20	14.4	3.8	211	7/3/2004	0750
21	14.4	4.2	201	7/3/2004	0755
22	14.4	3.8	192	7/3/2004	0800
23	14.3	3.2	216	7/3/2004	0805
24	14.3	4.2	223	7/3/2004	0810
25	14.3	4.0	202	7/3/2004	0815
26	14.3	4.0	194	7/3/2004	0820
27	14.4	4.0	192	7/3/2004	0825
28	14.6	3.4	198	7/3/2004	0830
29	14.6	3.6	177	7/3/2004	0835
30	14.5	4.0	200	7/3/2004	0840
31	14.6	3.2	125	7/3/2004	0845
32	14.6	3.6	190	7/3/2004	0850
33	14.6	3.2	211	7/3/2004	0855
34	14.6	3.4	255	7/3/2004	0900
35	14.7	3.0	234	7/3/2004	0905
36	14.8	3.2	224	7/3/2004	0910
37	14.8	3.6	215	7/3/2004	0915
38	15.0	4.2	211	7/3/2004	0920
39	15.0	4.2	200	7/3/2004	0925
40	15.2	4.8	212	7/3/2004	0930
41	15.5	5.4	200	7/3/2004	0935
42	15.3	4.8	199	7/3/2004	0940
43	15.5	6.4	187	7/3/2004	0945
44	15.2	5.4	189	7/3/2004	0950
45	15.2	4.8	198	7/3/2004	0955
46	15.1	5.6	191	7/3/2004	1000

Meas	Temp	Curr	Dir	Date	Time
47	15.2	5.2	238	7/3/2004	1005
48	15.2	0.2	304	7/3/2004	1010
49	15.1	4.6	123	7/3/2004	1015
50	15.1	5.8	52	7/3/2004	1020
51	15.2	5.8	47	7/3/2004	1025
52	15.2	6.2	63	7/3/2004	1030
53	15.1	6.4	63	7/3/2004	1035
54	15.1	5.8	61	7/3/2004	1040
55	15.1	6.6	76	7/3/2004	1045
56	14.8	7.6	63	7/3/2004	1050
57	14.7	7.6	57	7/3/2004	1055
58	14.6	8.8	57	7/3/2004	1100
59	14.6	8.8	73	7/3/2004	1105
60	14.3	7.8	76	7/3/2004	1110
61	14.6	6.2	89	7/3/2004	1115
62	14.6	7.0	59	7/3/2004	1120
63	14.3	5.6	48	7/3/2004	1125
64	14.1	8.0	62	7/3/2004	1130
65	14.4	7.8	52	7/3/2004	1135
66	14.1	7.4	62	7/3/2004	1140
67	14.1	6.4	60	7/3/2004	1145
68	14.0	6.4	65	7/3/2004	1150
69	13.9	4.6	72	7/3/2004	1155
70	13.9	5.6	40	7/3/2004	1200
71	13.9	7.0	38	7/3/2004	1205
72	13.9	7.2	42	7/3/2004	1210
73	14.2	6.4	66	7/3/2004	1215
74	14.2	6.6	61	7/3/2004	1220
75	14.1	7.2	53	7/3/2004	1225
76	14.1	7.8	45	7/3/2004	1230
77	14.1	9.6	53	7/3/2004	1235
78	14.0	7.8	57	7/3/2004	1240
79	14.1	9.4	57	7/3/2004	1245
80	13.9	7.4	65	7/3/2004	1250
81	13.9	8.0	52	7/3/2004	1255
82	14.0	6.8	73	7/3/2004	1300
83	13.5	7.2	53	7/3/2004	1305
84	13.3	5.6	74	7/3/2004	1310
85	13.8	5.6	57	7/3/2004	1315
86	14.5	6.4	63	7/3/2004	1320
87	14.2	7.4	36	7/3/2004	1325
88	14.3	6.4	43	7/3/2004	1330
89	14.1	6.0	44	7/3/2004	1335
90	14.1	6.8	58	7/3/2004	1340
91	14.7	6.4	48	7/3/2004	1345
92	14.7	6.6	66	7/3/2004	1350
93	14.8	8.2	57	7/3/2004	1355
94	14.9	8.6	67	7/3/2004	1400

Meas	Temp	Curr	Dir	Date	Time
95	14.6	8.0	57	7/3/2004	1405
96	14.5	8.2	67	7/3/2004	1410
97	14.6	7.2	65	7/3/2004	1415
98	14.6	7.4	59	7/3/2004	1420
99	14.8	7.6	58	7/3/2004	1425
100	14.6	6.8	66	7/3/2004	1430
101	14.9	8.2	66	7/3/2004	1435
102	14.9	8.4	63	7/3/2004	1440
103	14.8	9.4	63	7/3/2004	1445
104	15.0	9.4	60	7/3/2004	1450
105	15.2	10.4	67	7/3/2004	1455
106	15.1	9.4	74	7/3/2004	1500
107	15.1	8.8	76	7/3/2004	1505
108	15.2	9.6	69	7/3/2004	1510
109	15.1	9.0	82	7/3/2004	1515
110	15.2	9.6	77	7/3/2004	1520
111	15.3	11.0	77	7/3/2004	1525
112	15.2	12.2	65	7/3/2004	1530
113	15.1	10.8	71	7/3/2004	1535
114	15.1	8.0	64	7/3/2004	1540
115	15.2	7.6	67	7/3/2004	1545
116	15.2	8.4	72	7/3/2004	1550
117	15.1	7.6	62	7/3/2004	1555
118	15.2	6.2	60	7/3/2004	1600
119	15.3	6.2	72	7/3/2004	1605
120	15.2	6.8	38	7/3/2004	1610
121	15.1	4.6	49	7/3/2004	1615
122	15.2	5.2	46	7/3/2004	1620
123	15.2	5.0	48	7/3/2004	1625
124	15.2	4.8	65	7/3/2004	1630
125	15.2	4.8	48	7/3/2004	1635
126	15.6	4.0	45	7/3/2004	1640
127	15.4	4.0	24	7/3/2004	1645
128	15.1	4.0	359	7/3/2004	1650
129	15.0	3.2	342	7/3/2004	1655
130	15.2	3.0	343	7/3/2004	1700
131	15.1	3.4	250	7/3/2004	1705
132	15.4	4.0	283	7/3/2004	1710
133	15.1	4.4	280	7/3/2004	1715
134	15.1	3.4	310	7/3/2004	1720
135	15.2	4.4	285	7/3/2004	1725
136	15.2	3.2	281	7/3/2004	1730
137	15.1	3.2	205	7/3/2004	1735
138	15.1	3.8	290	7/3/2004	1740
139	15.1	3.0	265	7/3/2004	1745
140	15.0	3.4	229	7/3/2004	1750

Meas	Temp	Curr	Dir	Date	Time
141	14.9	3.2	254	7/3/2004	1755
142	15.2	4.6	249	7/3/2004	1800
143	15.6	4.2	219	7/3/2004	1805
144	15.5	3.2	270	7/3/2004	1810
145	15.6	3.4	162	7/3/2004	1815
146	15.6	3.6	220	7/3/2004	1820
147	15.3	3.4	254	7/3/2004	1825
148	15.1	4.8	231	7/3/2004	1830
149	15.2	4.0	241	7/3/2004	1835
150	15.0	4.0	238	7/3/2004	1840
151	15.8	3.4	210	7/3/2004	1845
Mean	**14.7**	**5.5**			
Max	**15.8**	**12.2**			
Min	**13.3**	**0.2**			

Bug Light – Dissolved Oxygen/turbidity data

			Turbidity			DO%		
			Center	East	West	Center	East	West
Time	**Tide (m)**	**Tide (ft)**	**YSI 6600**	**6920-1**	**6920-2**	**YSI 6600**	**6920-1**	**6920-2**
0610	-0.4	-1.3	5.4	**No Data**	0.9	100.9	**No Data**	**Anomalously**
0615	-0.3	-1.0	7.1		2.0	99.6		**high readings**
0620	-0.3	-1.0	5.7		1.5	99.7		
0625	-0.3	-1.0	4.7		1.5	99.5		
0630	-0.2	-0.7	7.8		1.5	97.9		
0635	-0.2	-0.7	8.1		2.5	95.7		
0640	-0.2	-0.7	7.0		2.5	97.0		
0645	-0.1	-0.3	7.3		2.5	96.1		
0650	-0.1	-0.3	6.5		2.2	94.2		
0655	0	0.0	4.4		3.9	97.9		
0700	0.0	0.0	6.2		2.2	98.4		
0705	0.1	0.3	4.5		2.8	103.6		
0710	0.1	0.3	4.2		2.6	101.5		
0715	0.2	0.7	4.5		3.3	102.4		
0720	0.2	0.7	5.1		1.5	104.2		
0725	0.3	1.0	6.7		1.6	96.4		
0730	0.4	1.3	6.2		1.4	98.4		
0735	0.4	1.3	6.2		1.8	100.3		
0740	0.5	1.6	4.6		1.3	102.7		
0745	0.6	2.0	2.9		1.5	106.6		
0750	0.7	2.3	4.3		1.4	105.3		
0755	0.7	2.3	4.5		1.2	104.5		
0800	0.8	2.6	3.1		1.8	106.5		
0805	0.8	2.6	7.2		2.3	102.2		

Time	Tide (m)	Tide (ft)	Center YSI 6600	East 6920-1	West 6920-2	Center YSI 6600	East 6920-1	West 6920-2
0810	0.9	3.0	6.2	**No Data**	2.2	102.3	**No Data**	**Anomalously**
0815	1	3.3	4.4		2.3	106.8		**high readings**
0820	1.1	3.6	3.8		1.8	105.5		
0825	1.1	3.6	2.6		1.8	110.1		
0830	1.2	3.9	3.3		1.7	109.1		
0835	1.3	4.3	3.0		2.3	108.3		
0840	1.3	4.3	2.8		2.4	108.5		
0845	1.4	4.6	3.5		2.6	108.0		
0850	1.5	4.9	4.2		2.5	109.9		
0855	1.6	5.3	3.6		2.2	109.5		
0900	1.6	5.3	3.1		2.2	110.0		
0905	1.7	5.6	3.6		2.3	109.7		
0910	1.8	5.9	3.1		2.3	111.0		
0915	1.8	5.9	3.3		1.9	110.1		
0920	1.9	6.2	3.0		2.0	112.6		
0925	2	6.6	3.1		2.0	113.1		
0930	2	6.6	3.0		1.9	113.0		
0935	2.1	6.9	2.9		1.7	113.4		
0940	2.2	7.2	2.6		1.7	113.3		
0945	2.2	7.2	2.5		1.7	113.4		
0950	2.3	7.6	2.5		1.7	113.2		
0955	2.3	7.6	2.5		1.7	113.3		
1000	2.4	7.9	2.7		1.7	113.5		
1005	2.4	7.9	2.3		1.7	113.7		
1010	2.5	8.2	2.6		1.7	113.7		
1015	2.5	8.2	2.4		1.7	115.0		
1020	2.6	8.5	2.7		1.7	115.5		
1025	2.6	8.5	2.5		1.7	115.6		
1030	2.7	8.9	2.8		1.7	115.3		
1035	2.7	8.9	3.1		1.5	114.9		
1040	2.7	8.9	2.9		1.6	114.4		
1045	2.8	9.2	2.7		1.7	115.0		
1050	2.8	9.2	2.5		1.4	115.1		
1055	2.8	9.2	2.5		1.9	114.9		
1100	2.9	9.5	2.8		1.5	115.0		
1105	2.9	9.5	2.4		1.5	114.8		
1110	2.9	9.5	2.2		1.7	115.0		
1115	2.9	9.5	2.3		1.7	115.2		
1120	2.9	9.5	2.3		1.7	115.1		
1125	2.9	9.5	2.4		1.8	115.0		
1130	2.9	9.5	2.3		1.3	115.9		
1135	2.9	9.5	2.2		1.4	115.7		
1140	2.9	9.5	2.3		1.2	116.1		
1145	2.9	9.5	2.3		1.4	116.3		
1150	2.9	9.5	2.2		1.3	115.9		
1155	2.9	9.5	2.2		1.1	116.1		
1200	2.9	9.5	2.1		1.2	115.8		

Time	Tide (m)	Tide (ft)	Center YSI 6600	East 6920-1	West 6920-2	Center YSI 6600	East 6920-1	West 6920-2
1205	2.9	9.5	2.0	**No Data**	1.4	116.1	**No Data**	**Anomalously**
1210	2.9	9.5	1.9		1.1	116.0		**high readings**
1215	2.9	9.5	1.8		1.1	115.9		
1220	2.9	9.5	1.9		1.0	115.8		
1225	2.8	9.2	2.0		1.2	116.1		
1230	2.8	9.2	2.0		1.2	115.8		
1235	2.8	9.2	2.0		1.0	116.2		
1240	2.8	9.2	2.0		1.1	115.7		
1245	2.7	8.9	1.9		1.0	116.5		
1250	2.7	8.9	1.7		1.1	116.4		
1255	2.6	8.5	1.9		0.9	116.3		
1300	2.6	8.5	1.9		1.0	116.2		
1305	2.6	8.5	2.0		1.0	116.0		
1310	2.5	8.2	1.7		1.1	117.5		
1315	2.5	8.2	1.7		0.9	118.0		
1320	2.4	7.9	1.7		0.8	117.8		
1325	2.4	7.9	1.7		0.9	117.7		
1330	2.3	7.6	1.7		1.0	118.3		
1335	2.3	7.6	1.9		0.9	117.8		
1340	2.2	7.2	1.9		0.9	117.5		
1345	2.1	6.9	1.7		0.8	117.8		
1350	2.1	6.9	1.5		1.0	117.8		
1355	2	6.6	1.6		0.9	117.6		
1400	2	6.6	1.7		1.0	118.0		
1405	1.9	6.2	1.5		0.9	117.9		
1410	1.8	5.9	1.5		0.9	118.1		
1415	1.8	5.9	1.6		1.1	118.3		
1420	1.7	5.6	1.7		1.1	118.5		
1425	1.7	5.6	1.7		1.1	118.6		
1430	1.6	5.3	1.8		1.2	118.7		
1435	1.5	4.9	1.5		1.2	118.8		
1440	1.5	4.9	1.6		1.2	118.9		
1445	1.4	4.6	1.6		1.4	119.3		
1450	1.3	4.3	1.7		1.1	119.4		
1455	1.3	4.3	1.7		1.4	119.9		
1500	1.2	3.9	1.6		1.1	120.3		
1505	1.1	3.6	1.6		1.2	120.5		
1510	1.1	3.6	1.7		1.1	120.5		
1515	1	3.3	1.7		0.9	120.6		
1520	0.9	3.0	1.7		1.1	120.9		
1525	0.9	3.0	1.5		1.1	120.7		
1530	0.8	2.6	1.6		1.2	120.9		
1535	0.8	2.6	1.5		1.0	120.5		
1540	0.7	2.3	1.5		1.1	120.8		
1545	0.7	2.3	1.7		1.0	120.9		
1550	0.6	2.0	1.6		1.1	120.3		
1555	0.5	1.6	1.5		1.1	120.4		

Time	Tide (m)	Tide (ft)	Center YSI 6600	East 6920-1	West 6920-2	Center YSI 6600	East 6920-1	West 6920-2
1600	0.5	1.6	1.6	**No Data**	1.1	121.1	**No Data**	**Anomalously**
1605	0.4	1.3	1.6		1.0	121.0		**high readings**
1610	0.4	1.3	1.8		1.2	120.8		
1615	0.3	1.0	1.7		1.2	120.8		
1620	0.3	1.0	2.5		1.2	120.9		
1625	0.3	1.0	2.8		1.3	121.4		
1630	0.2	0.7	2.8		1.6	122.0		
1635	0.2	0.7	2.8		2.1	122.0		
1640	0.2	0.7	3.4		2.2	122.6		
1645	0.1	0.3	3.6		1.6	124.6		
1650	0.1	0.3	3.2		1.8	123.4		
1655	0.1	0.3	3.4		1.8	123.6		
1700	0.1	0.3	3.7		1.8	125.0		
1705	0	0.0	3.9		1.5	124.3		
1710	0	0.0	3.4		1.7	124.2		
1715	0	0.0	5.9		1.5	123.5		
1720	0	0.0	3.9		1.6	123.2		
1725	0	0.0	3.4		1.2	122.7		
1730	0	0.0	3.4		2.3	122.3		
1735	0	0.0	3.3		2.0	123.0		
1740	0	0.0	2.8		2.3	122.7		
1745	0	0.0	3.1		2.0	123.1		
1750	0	0.0	2.7		1.8	122.7		
1755	0	0.0	7.4		2.0	122.9		
1800	0	0.0	4.5		1.8	123.2		
1805	0	0.0	4.4		1.6	122.8		
1810	0	0.0	4.8		1.8	123.0		
1815	0.1	0.3	3.9		1.5	123.4		
1820	0.1	0.3	5.2		1.4	123.5		
1825	0.1	0.3	3.7		1.3	123.0		
1830	0.1	0.3	3.9		1.2	123.0		
1835	0.2	0.7	3.2		2.1	123.1		
1840	0.2	0.7	3.0		2.5	122.9		
1845	0.2	0.7	5.6		1.5	121.6		

Time	Tide (m)	Tide (ft)	Center YSI 6600	East 6920-1	West 6920-2	Center YSI 6600	East 6920-1	West 6920-2
Mean	**1.3**	**4.3**	**3.1**	**No Data**	**1.6**	**114.6**	**No Data**	**Anomalously**
Max	**2.9**	**9.5**	**8.1**		**3.9**	**125.0**		**high readings**
Min	**-0.4**	**-1.3**	**1.5**		**0.8**	**94.2**		

East End Beach, Portland – Current velocity/direction

From file: EEBPRTL

Meas	Temp	Curr	Dir	Date	Time
152	15.9	1.6	151	7/5/2004	0705
153	15.3	2.2	135	7/5/2004	0710
154	15.2	4.8	122	7/5/2004	0715
155	15.3	3.6	123	7/5/2004	0720
156	15.4	2.0	117	7/5/2004	0725
157	15.5	1.8	126	7/5/2004	0730
158	15.6	1.6	121	7/5/2004	0735
159	15.6	1.2	102	7/5/2004	0740
160	15.8	1.4	84	7/5/2004	0745
161	15.8	1.8	117	7/5/2004	0750
162	16.0	1.2	183	7/5/2004	0755
163	15.5	1.0	186	7/5/2004	0800
164	15.8	1.0	196	7/5/2004	0805
165	16.2	1.0	154	7/5/2004	0810
166	15.8	0.8	164	7/5/2004	0815
167	16.3	1.0	154	7/5/2004	0820
168	16.3	1.2	158	7/5/2004	0825
169	16.2	0.8	169	7/5/2004	0830
170	16.1	0.8	181	7/5/2004	0835
171	16.0	1.0	146	7/5/2004	0840
172	16.0	1.0	146	7/5/2004	0845
173	15.5	0.8	126	7/5/2004	0850
174	15.5	0.8	87	7/5/2004	0855
175	15.9	1.2	129	7/5/2004	0900
176	15.4	1.0	271	7/5/2004	0905
177	15.4	1.0	280	7/5/2004	0910
178	15.1	1.2	292	7/5/2004	0915
179	15.0	1.2	306	7/5/2004	0920
180	15.7	1.2	297	7/5/2004	0925
181	14.9	1.8	287	7/5/2004	0930
182	15.1	2.0	289	7/5/2004	0935
183	14.8	1.4	299	7/5/2004	0940
184	14.9	1.2	310	7/5/2004	0945
185	14.9	1.8	315	7/5/2004	0950
186	14.8	2.0	312	7/5/2004	0955
187	14.8	1.6	320	7/5/2004	1000
188	14.8	1.8	321	7/5/2004	1005
189	14.8	3.0	324	7/5/2004	1010
190	14.7	1.6	323	7/5/2004	1015
191	14.7	3.8	325	7/5/2004	1020
192	14.7	3.8	325	7/5/2004	1025
193	14.7	4.4	332	7/5/2004	1030
194	14.6	5.0	332	7/5/2004	1035
195	14.5	8.8	330	7/5/2004	1040
196	16.5	6.0	337	7/5/2004	1045
197	14.7	1.2	291	7/5/2004	1050

Meas	Temp	Curr	Dir	Date	Time
198	14.8	2.0	298	7/5/2004	1055
199	14.9	2.0	310	7/5/2004	1100
200	14.9	3.4	307	7/5/2004	1105
201	14.8	3.6	305	7/5/2004	1110
202	15.0	4.2	305	7/5/2004	1115
203	15.0	3.0	314	7/5/2004	1120
204	15.1	2.6	337	7/5/2004	1125
205	15.0	2.0	336	7/5/2004	1130
206	15.0	2.2	322	7/5/2004	1135
207	15.2	2.0	347	7/5/2004	1140
208	15.5	2.2	45	7/5/2004	1145
209	15.4	2.0	25	7/5/2004	1150
210	15.5	2.2	35	7/5/2004	1155
211	15.8	1.4	56	7/5/2004	1200
212	15.9	2.4	71	7/5/2004	1205
213	15.8	2.2	77	7/5/2004	1210
214	15.8	3.2	67	7/5/2004	1215
215	15.6	3.4	91	7/5/2004	1220
216	15.4	3.0	99	7/5/2004	1225
217	15.2	3.4	91	7/5/2004	1230
218	15.2	3.6	98	7/5/2004	1235
219	15.0	3.8	100	7/5/2004	1240
220	15.1	3.4	97	7/5/2004	1245
221	15.0	10.2	75	7/5/2004	1250
222	15.0	5.2	94	7/5/2004	1255
223	14.9	3.8	111	7/5/2004	1300
224	14.8	4.0	106	7/5/2004	1305
225	14.8	4.0	95	7/5/2004	1310
226	14.8	4.2	89	7/5/2004	1315
227	14.7	4.6	97	7/5/2004	1320
228	14.7	4.2	105	7/5/2004	1325
229	14.6	4.6	90	7/5/2004	1330
230	14.5	4.6	72	7/5/2004	1335
231	14.5	3.6	112	7/5/2004	1340
232	14.4	5.0	68	7/5/2004	1345
233	14.3	4.6	81	7/5/2004	1350
234	14.3	4.0	72	7/5/2004	1355
235	14.2	3.6	101	7/5/2004	1400
236	14.2	4.4	92	7/5/2004	1405
237	14.1	4.8	68	7/5/2004	1410
238	14.0	4.0	58	7/5/2004	1415
239	14.0	3.2	74	7/5/2004	1420
240	13.9	2.6	117	7/5/2004	1425
241	13.9	5.8	44	7/5/2004	1430
242	13.8	4.4	79	7/5/2004	1435
243	13.8	4.0	83	7/5/2004	1440
244	13.8	4.0	63	7/5/2004	1445
245	13.8	3.2	98	7/5/2004	1450
246	13.9	4.6	106	7/5/2004	1455

Meas	Temp	Curr	Dir	Date	Time
247	13.9	5.6	97	7/5/2004	1500
248	13.8	4.8	106	7/5/2004	1505
249	13.8	5.2	93	7/5/2004	1510
250	13.8	6.8	107	7/5/2004	1515
251	13.7	7.8	97	7/5/2004	1520
252	13.6	8.4	98	7/5/2004	1525
253	13.6	8.2	98	7/5/2004	1530
254	13.6	8.8	98	7/5/2004	1535
255	13.6	10.2	103	7/5/2004	1540
256	13.6	9.4	102	7/5/2004	1545
257	13.5	10.6	112	7/5/2004	1550
258	13.5	10.2	117	7/5/2004	1555
259	13.6	10.6	117	7/5/2004	1600
260	13.6	12.2	121	7/5/2004	1605
261	13.6	11.4	118	7/5/2004	1610
262	13.6	10.6	114	7/5/2004	1615
263	13.5	12.8	117	7/5/2004	1620
264	13.5	13.8	122	7/5/2004	1625
265	13.7	17.2	125	7/5/2004	1630
266	13.7	18.2	127	7/5/2004	1635
267	13.7	16.2	129	7/5/2004	1640
268	13.8	17.4	125	7/5/2004	1645
269	13.9	19.2	127	7/5/2004	1650
270	14.1	18.8	130	7/5/2004	1655
Mean	**14.8**	**4.6**			
Max	**16.5**	**19.2**			
Min	**13.5**	**0.8**			

East End Beach, Portland – Dissolved Oxygen/turbidity data

			Turbidity			DO%		
			Center	East	West	Center	East	West
Time	Tide (m)	Tide (ft)	YSI 6600	6920-1	6920-2	YSI 6600	6920-1	6920-2
0630	-0.3	-1.0	15.0	No Data	----	107.9	No Data	Anomalously
0635	-0.3	-1.0	13.8		20.6	107.9		high readings
0640	-0.3	-1.0	15.6		19.5	107.5		
0645	-0.3	-1.0	14.3		19.7	107.3		
0650	-0.3	-1.0	14.3		20.0	106.9		
0655	-0.3	-1.0	3.1		3.9	109.4		
0700	-0.4	-1.3	2.9		29.9	108.8		
0705	-0.4	-1.3	3.1		3.7	106.7		
0710	-0.4	-1.3	3.0		43.1	105.4		
0715	-0.4	-1.3	2.9		3.7	104.9		
0720	-0.3	-1.0	3.3		4.7	104.0		
0725	-0.3	-1.0	3.2		3.3	103.4		
0730	-0.3	-1.0	2.8		3.1	102.6		

Time	Tide (m)	Tide (ft)	Center YSI 6600	East 6920-1	West 6920-2	Center YSI 6600	East 6920-1	West 6920-2
0735	-0.2	-0.7	3.3	**No Data**	2.5	102.2	**No Data**	**Anomalously**
0740	-0.2	-0.7	3.4		2.7	102.2		**high readings**
0745	-0.2	-0.7	3.1		2.5	102.5		
0750	-0.1	-0.3	2.8		2.4	102.0		
0755	-0.1	-0.3	4.4		13.9	101.9		
0800	0	0.0	3.4		5.1	102.6		
0805	0.0	0.0	3.3		6.7	102.6		
0810	0.1	0.3	2.9		7.2	102.0		
0815	0.1	0.3	3.1		8.1	103.0		
0820	0.2	0.7	3.0		7.3	104.6		
0825	0.2	0.7	3.6		5.6	105.5		
0830	0.3	1.0	3.9		5.4	106.9		
0835	0.4	1.3	4.5		5.4	106.7		
0840	0.4	1.3	4.7		4.8	106.6		
0845	0.5	1.6	3.9		4.8	108.6		
0850	0.6	2.0	3.6		4.6	107.5		
0855	0.7	2.3	3.9		5.1	108.2		
0900	0.7	2.3	3.9		4.7	108.0		
0905	0.8	2.6	3.9		4.4	104.0		
0910	0.8	2.6	4.5		9.9	99.2		
0915	0.9	3.0	4.7		14.4	102.8		
0920	1	3.3	4.5		8.9	104.0		
0925	1.1	3.6	5.5		24.1	110.5		
0930	1.1	3.6	6.6		30.4	107.2		
0935	1.2	3.9	27.1		33.9	108.0		
0940	1.3	4.3	9.9		7.0	105.6		
0945	1.3	4.3	7.6		8.1	107.6		
0950	1.4	4.6	6.3		22.7	107.3		
0955	1.5	4.9	5.4		48.1	113.4		
1000	1.6	5.3	4.8		14.7	113.4		
1005	1.6	5.3	5.3		9.5	112.8		
1010	1.7	5.6	5.6		10.6	112.6		
1015	1.8	5.9	5.4		9.7	111.8		
1020	1.8	5.9	6.9		8.0	111.3		
1025	1.9	6.2	5.7		7.6	110.2		
1030	2	6.6	6.4		7.2	110.8		
1035	2	6.6	5.4		6.3	109.5		
1040	2.1	6.9	5.4		5.9	111.1		
1045	2.2	7.2	6.2		5.4	110.3		
1050	2.2	7.2	5.6		5.4	110.5		
1055	2.3	7.6	5.7		5.8	112.7		
1100	2.3	7.6	5.3		4.0	113.2		
1105	2.4	7.9	5.4		4.3	113.0		
1110	2.4	7.9	5.1		3.9	112.3		
1115	2.5	8.2	5.0		4.0	111.7		
1120	2.5	8.2	5.3		3.7	112.7		
1125	2.6	8.5	5.3		3.6	112.8		

Time	Tide (m)	Tide (ft)	Center YSI 6600	East 6920-1	West 6920-2	Center YSI 6600	East 6920-1	West 6920-2
1130	2.6	8.5	5.2	**No Data**	3.6	113.0	**No Data**	**Anomalously**
1135	2.7	8.9	5.4		3.4	112.2		**high readings**
1140	2.7	8.9	5.0		3.3	112.9		
1145	2.7	8.9	5.0		3.1	113.3		
1150	2.8	9.2	4.8		4.5	113.7		
1155	2.8	9.2	4.8		3.9	113.5		
1200	2.8	9.2	4.5		3.9	113.7		
1205	2.9	9.5	4.5		3.5	113.7		
1210	2.9	9.5	4.3		3.3	114.1		
1215	2.9	9.5	3.9		3.1	114.1		
1220	2.9	9.5	3.7		3.2	114.3		
1225	2.9	9.5	3.7		2.9	114.4		
1230	2.9	9.5	3.7		2.7	114.4		
1235	2.9	9.5	3.4		2.8	113.7		
1240	2.9	9.5	3.3		2.6	114.5		
1245	2.9	9.5	3.3		2.6	114.4		
1250	2.9	9.5	3.4		2.9	114.3		
1255	2.9	9.5	3.0		2.2	114.5		
1300	2.9	9.5	2.9		2.3	114.9		
1305	2.9	9.5	2.9		2.3	114.8		
1310	2.9	9.5	3.0		2.1	115.0		
1315	2.9	9.5	2.8		2.1	114.9		
1320	2.9	9.5	2.6		2.2	114.8		
1325	2.9	9.5	3.0		2.0	115.0		
1330	2.8	9.2	2.6		2.9	115.0		
1335	2.8	9.2	2.6		1.8	114.9		
1340	2.8	9.2	2.3		1.8	114.9		
1345	2.8	9.2	2.4		1.8	114.4		
1350	2.7	8.9	2.6		1.7	114.8		
1355	2.7	8.9	2.3		1.6	115.3		
1400	2.6	8.5	2.3		1.5	115.0		
1405	2.6	8.5	2.1		1.5	115.4		
1410	2.6	8.5	2.3		1.7	115.3		
1415	2.5	8.2	2.3		1.6	115.3		
1420	2.5	8.2	2.0		1.8	115.8		
1425	2.4	7.9	2.0		1.7	115.8		
1430	2.4	7.9	2.2		1.6	116.0		
1435	2.3	7.6	2.0		1.3	116.1		
1440	2.3	7.6	1.8		1.3	116.3		
1445	2.2	7.2	1.9		1.4	116.5		
1450	2.1	6.9	1.9		1.2	116.6		
1455	2.1	6.9	1.7		1.2	116.9		
1500	2	6.6	1.8		1.2	116.1		
1505	2	6.6	1.9		1.2	116.7		
1510	1.9	6.2	1.8		1.2	116.8		
1515	1.8	5.9	1.6		1.2	117.3		
1520	1.8	5.9	1.8		1.1	117.4		

Time	Tide (m)	Tide (ft)	Center YSI 6600	East 6920-1	West 6920-2	Center YSI 6600	East 6920-1	West 6920-2
1525	1.7	5.6	1.7	**No Data**	1.1	117.6	**No Data**	**Anomalously**
1530	1.7	5.6	1.7		1.1	117.9		**high readings**
1535	1.6	5.3	1.9		1.1	117.6		
1540	1.5	4.9	1.9		1.0	117.8		
1545	1.5	4.9	1.5		0.9	117.8		
1550	1.4	4.6	1.6		1.0	118.5		
1555	1.3	4.3	1.6		0.9	118.6		
1600	1.3	4.3	1.5		0.9	118.8		
1605	1.2	3.9	1.6		0.7	118.9		
1610	1.1	3.6	1.6		0.8	119.1		
1615	1.1	3.6	1.4		0.9	119.1		
1620	1	3.3	1.5		0.9	119.3		
1625	0.9	3.0	1.9		0.9	119.3		
1630	0.9	3.0	1.4		0.8	119.1		
1635	0.8	2.6	1.7		0.9	119.0		
1640	0.8	2.6	1.5		0.9	118.9		
1645	0.7	2.3	1.4		0.9	118.9		
1650	0.7	2.3	1.5		1.2	118.8		
1655	0.6	2.0	1.5		1.4	118.9		
1700	0.5	1.6	1.8		1.9	116.9		

	Tide (m)	Tide (ft)	Center YSI 6600	South 6920-1	North 6920-2	Center YSI 6600	South 6920-1	North 6920-2
Mean	**1.5**	**5.0**	**4.1**	**No Data**	**5.8**	**112.0**	**No Data**	**Anomalously**
Max	**2.9**	**9.5**	**27.1**		**48.1**	**119.3**		**high readings**
Min	**-0.4**	**-1.3**	**1.4**		**0.7**	**99.2**		

Merepoint site, Brunswick, Maine – Current velocity/direction

From file: MRPTCRNT

Meas	Temp	Curr	Dir	Date	Time
273	16.2	4.4	270	7/6/2004	1520
274	15.8	5.0	254	7/6/2004	1525
275	15.6	4.4	249	7/6/2004	1530
276	15.5	5.8	251	7/6/2004	1535
277	15.4	5.6	253	7/6/2004	1540
278	15.5	6.0	246	7/6/2004	1545
279	15.9	8.6	247	7/6/2004	1550
280	15.7	9.0	248	7/6/2004	1555
281	15.6	7.6	256	7/6/2004	1600
282	15.6	6.6	251	7/6/2004	1605
283	15.1	5.8	244	7/6/2004	1610
284	14.9	1.0	248	7/6/2004	1615
285	14.8	1.0	250	7/6/2004	1620
286	14.8	1.0	252	7/6/2004	1625
287	14.8	0.6	209	7/6/2004	1630
288	14.7	0.6	177	7/6/2004	1635
289	14.7	0.8	231	7/6/2004	1640
290	14.7	0.8	231	7/6/2004	1645
291	14.7	0.6	207	7/6/2004	1650
292	14.7	0.8	231	7/6/2004	1655
293	14.7	1.0	246	7/6/2004	1700
294	14.7	1.0	246	7/6/2004	1705
295	14.8	1.0	245	7/6/2004	1710
296	14.8	1.0	245	7/6/2004	1715
297	14.8	1.0	246	7/6/2004	1720
298	14.8	1.0	246	7/6/2004	1725
299	14.8	1.0	245	7/6/2004	1730
300	14.9	1.0	244	7/6/2004	1735
301	14.8	1.0	243	7/6/2004	1740
302	15.6	1.0	243	7/6/2004	1745
303	16.1	1.0	245	7/6/2004	1750
304	16.6	1.0	245	7/6/2004	1755
305	16.2	1.0	244	7/6/2004	1800
306	16.3	1.0	242	7/6/2004	1805
307	17.5	1.0	242	7/6/2004	1810
308	17.3	1.0	242	7/6/2004	1815
309	17.5	1.0	243	7/6/2004	1820
310	17.5	1.0	242	7/6/2004	1825
311	17.8	1.4	240	7/6/2004	1830
312	18.0	3.4	225	7/6/2004	1835
313	17.9	2.2	210	7/6/2004	1840
314	17.8	3.6	235	7/6/2004	1845
315	17.6	3.4	242	7/6/2004	1850
316	17.3	4.2	248	7/6/2004	1855
317	17.2	3.4	242	7/6/2004	1900

Meas	Temp	Curr	Dir	Date	Time
318	17.2	2.4	239	7/6/2004	1905
319	17.1	1.8	232	7/6/2004	1910
320	17.1	1.0	225	7/6/2004	1915
321	17.0	1.0	215	7/6/2004	1920
322	17.0	1.0	201	7/6/2004	1925
323	17.0	1.0	202	7/6/2004	1930
324	17.0	1.8	196	7/6/2004	1935
325	17.0	1.0	195	7/6/2004	1940
326	16.9	1.2	184	7/6/2004	1945
327	16.9	1.0	184	7/6/2004	1950
328	16.9	1.2	169	7/6/2004	1955
329	16.9	1.0	151	7/6/2004	2000
330	16.9	1.2	151	7/6/2004	2005
331	16.9	1.2	151	7/6/2004	2010
332	16.9	1.0	152	7/6/2004	2015
333	16.9	1.0	152	7/6/2004	2020
334	16.9	1.2	150	7/6/2004	2025
335	16.9	1.0	139	7/6/2004	2030
336	16.9	1.0	143	7/6/2004	2035
337	17.0	1.2	138	7/6/2004	2040
338	17.0	1.0	132	7/6/2004	2045
339	17.0	1.2	130	7/6/2004	2050
340	17.0	1.0	128	7/6/2004	2055
341	17.0	1.0	127	7/6/2004	2100
342	17.1	1.0	127	7/6/2004	2105
343	17.1	1.0	126	7/6/2004	2110
344	17.1	1.0	125	7/6/2004	2115
345	17.1	1.0	125	7/6/2004	2120
346	17.2	1.0	125	7/6/2004	2125
347	17.2	1.0	126	7/6/2004	2130
348	17.2	1.0	126	7/6/2004	2135
349	17.2	1.0	127	7/6/2004	2140
350	17.3	1.0	127	7/6/2004	2145
351	17.3	1.0	127	7/6/2004	2150
352	17.3	1.0	127	7/6/2004	2155
353	17.4	1.0	127	7/6/2004	2200
354	17.5	1.0	130	7/6/2004	2205
355	17.5	1.0	130	7/6/2004	2210
356	17.4	1.0	135	7/6/2004	2215
357	17.3	1.0	135	7/6/2004	2220
358	17.3	1.0	134	7/6/2004	2225
359	17.3	1.0	133	7/6/2004	2230
360	17.3	1.0	134	7/6/2004	2235
361	17.3	1.0	130	7/6/2004	2240
362	17.3	1.0	120	7/6/2004	2245
363	17.1	1.0	117	7/6/2004	2250
364	17.0	1.0	111	7/6/2004	2255

Meas	Temp	Curr	Dir	Date	Time
365	17.0	0.8	62	7/6/2004	2300
366	17.1	1.0	342	7/6/2004	2305
367	16.8	1.0	329	7/6/2004	2310
368	16.7	1.0	321	7/6/2004	2315
369	15.5	1.0	327	7/6/2004	2320
370	14.6	1.2	6	7/6/2004	2325
371	14.5	1.2	18	7/6/2004	2330
372	14.5	1.0	17	7/6/2004	2335
373	15.9	1.0	5	7/6/2004	2340
374	16.8	1.0	17	7/6/2004	2345
375	15.9	1.4	34	7/6/2004	2350
376	16.0	1.6	31	7/6/2004	2355
377	15.8	2.6	24	7/6/2004	0000
378	15.1	6.2	45	7/7/2004	0005
379	14.8	9.2	45	7/7/2004	0010
380	14.5	7.8	38	7/7/2004	0015
381	14.7	5.8	34	7/7/2004	0020
382	15.3	4.8	40	7/7/2004	0025
383	15.6	9.0	43	7/7/2004	0030
384	15.1	11.8	43	7/7/2004	0035
385	15.1	9.8	50	7/7/2004	0040
386	14.9	11.2	54	7/7/2004	0045
387	15.0	12.6	58	7/7/2004	0050
388	15.0	11.0	54	7/7/2004	0055
389	14.8	8.8	51	7/7/2004	0100
390	14.9	8.6	54	7/7/2004	0105
391	15.1	6.6	64	7/7/2004	0110
392	15.0	4.2	48	7/7/2004	0115
393	15.2	1.8	43	7/7/2004	0120
394	15.1	3.4	42	7/7/2004	0125
395	15.1	2.2	43	7/7/2004	0130
396	15.2	2.4	45	7/7/2004	0135
397	15.1	1.4	43	7/7/2004	0140
398	15.1	1.2	41	7/7/2004	0145
399	15.4	2.4	39	7/7/2004	0150
400	15.4	1.4	23	7/7/2004	0155
401	15.1	1.0	15	7/7/2004	0200
402	15.5	0.6	60	7/7/2004	0205
403	15.5	1.0	72	7/7/2004	0210
404	15.5	1.2	57	7/7/2004	0215
405	15.8	5.4	52	7/7/2004	0220
406	15.9	5.0	50	7/7/2004	0225
407	15.6	3.0	50	7/7/2004	0230
408	15.5	3.0	59	7/7/2004	0235
409	15.4	3.4	64	7/7/2004	0240
410	15.4	2.6	74	7/7/2004	0245
411	15.5	3.0	80	7/7/2004	0250

Meas	Temp	Curr	Dir	Date	Time
412	15.5	3.4	80	7/7/2004	0255
413	15.6	3.4	68	7/7/2004	0300
414	15.5	1.4	64	7/7/2004	0305
415	15.5	1.0	64	7/7/2004	0310
416	15.4	1.0	69	7/7/2004	0315
417	15.4	0.8	142	7/7/2004	0320
418	15.4	1.0	178	7/7/2004	0325
419	15.5	1.0	191	7/7/2004	0330
420	15.6	1.2	205	7/7/2004	0335
421	15.5	4.2	213	7/7/2004	0340
422	15.3	4.0	220	7/7/2004	0345
423	15.4	5.0	224	7/7/2004	0350
424	15.4	4.6	225	7/7/2004	0355
425	14.4	6.8	227	7/7/2004	0400
426	14.5	6.8	225	7/7/2004	0405
427	14.1	4.4	215	7/7/2004	0410
428	14.0	2.2	227	7/7/2004	0415
429	13.8	2.0	225	7/7/2004	0420
430	13.8	1.0	213	7/7/2004	0425
431	13.8	1.0	215	7/7/2004	0430
432	13.6	1.0	214	7/7/2004	0435
433	13.6	1.0	212	7/7/2004	0440
434	13.6	1.0	212	7/7/2004	0445
435	13.6	1.0	212	7/7/2004	0450
436	13.8	1.0	211	7/7/2004	0455
437	13.8	1.0	210	7/7/2004	0500
438	13.8	1.0	211	7/7/2004	0505
439	13.8	1.0	212	7/7/2004	0510
440	13.8	1.0	212	7/7/2004	0515
441	13.8	1.0	212	7/7/2004	0520
442	13.8	1.0	212	7/7/2004	0525
443	13.8	1.0	212	7/7/2004	0530
444	13.8	0.8	199	7/7/2004	0535
445	13.8	0.8	163	7/7/2004	0540
446	13.8	0.8	197	7/7/2004	0545
447	13.8	1.0	208	7/7/2004	0550
448	14.0	1.0	208	7/7/2004	0555
449	15.0	1.0	209	7/7/2004	0600
450	15.0	1.0	210	7/7/2004	0605
451	15.5	0.8	197	7/7/2004	0610
452	15.8	1.0	209	7/7/2004	0615
453	15.9	1.0	209	7/7/2004	0620
454	16.0	1.0	209	7/7/2004	0625
455	16.2	1.0	208	7/7/2004	0630
456	16.2	0.8	195	7/7/2004	0635
457	16.3	0.8	194	7/7/2004	0640
458	16.3	1.0	205	7/7/2004	0645
459	16.3	0.8	193	7/7/2004	0650

Meas	Temp	Curr	Dir	Date	Time
460	16.2	1.0	206	7/7/2004	0655
461	16.2	1.0	205	7/7/2004	0700
462	16.3	1.4	213	7/7/2004	0705
463	16.4	2.6	219	7/7/2004	0710
464	16.4	2.6	217	7/7/2004	0715
465	16.4	1.2	208	7/7/2004	0720
466	16.4	1.0	203	7/7/2004	0725
467	16.4	1.0	194	7/7/2004	0730
468	16.4	1.0	191	7/7/2004	0735
469	16.4	1.0	189	7/7/2004	0740
470	16.4	1.0	184	7/7/2004	0745
471	16.4	1.0	188	7/7/2004	0750
472	16.4	1.0	189	7/7/2004	0755
473	16.2	1.0	188	7/7/2004	0800
474	15.9	1.2	183	7/7/2004	0805
475	15.9	1.0	179	7/7/2004	0810
476	15.8	1.0	181	7/7/2004	0815
477	15.7	1.0	181	7/7/2004	0820
478	15.6	1.2	177	7/7/2004	0825
479	15.7	1.2	175	7/7/2004	0830
480	15.6	1.0	175	7/7/2004	0835
481	15.6	1.0	176	7/7/2004	0840
482	15.6	1.0	173	7/7/2004	0845
483	15.7	1.0	170	7/7/2004	0850
484	15.8	1.0	168	7/7/2004	0855
485	15.8	1.0	165	7/7/2004	0900
486	15.8	1.0	162	7/7/2004	0905
487	15.9	1.0	162	7/7/2004	0910
488	15.8	1.0	162	7/7/2004	0915
489	15.9	1.0	163	7/7/2004	0920
490	15.8	1.0	162	7/7/2004	0925
491	15.8	1.0	164	7/7/2004	0930
492	15.8	1.0	164	7/7/2004	0935
493	15.8	1.0	164	7/7/2004	0940
494	15.9	1.0	164	7/7/2004	0945
495	15.9	1.0	164	7/7/2004	0950
496	15.9	1.0	164	7/7/2004	0955
497	16.0	1.0	164	7/7/2004	1000
498	16.0	1.0	164	7/7/2004	1005
499	16.0	1.0	165	7/7/2004	1010
500	16.0	1.0	165	7/7/2004	1015
501	16.0	1.0	166	7/7/2004	1020
502	16.0	1.0	165	7/7/2004	1025
503	16.0	1.0	164	7/7/2004	1030
504	16.1	1.0	164	7/7/2004	1035
505	16.1	1.0	160	7/7/2004	1040
506	16.2	1.0	159	7/7/2004	1045

Meas	Temp	Curr	Dir	Date	Time
507	16.3	1.2	191	7/7/2004	1050
508	16.4	1.0	195	7/7/2004	1055
509	16.3	1.4	198	7/7/2004	1100
510	16.4	1.0	208	7/7/2004	1105
511	16.3	1.0	217	7/7/2004	1110
512	16.3	1.0	247	7/7/2004	1115
513	16.3	1.2	270	7/7/2004	1120
514	16.4	1.2	278	7/7/2004	1125
515	16.4	1.4	293	7/7/2004	1130
516	16.4	1.6	2	7/7/2004	1135
517	16.4	2.0	0	7/7/2004	1140
518	16.3	1.8	19	7/7/2004	1145
519	16.4	1.6	14	7/7/2004	1150
520	16.3	1.8	26	7/7/2004	1155
521	16.4	1.8	62	7/7/2004	1200
522	16.3	2.0	54	7/7/2004	1205
523	16.3	2.4	61	7/7/2004	1210
524	16.5	3.2	61	7/7/2004	1215
525	16.5	5.0	75	7/7/2004	1220
526	16.6	5.0	62	7/7/2004	1225
527	16.8	4.6	90	7/7/2004	1230
528	16.7	3.2	102	7/7/2004	1235
529	16.6	5.4	94	7/7/2004	1240
530	16.8	5.0	98	7/7/2004	1245
531	16.6	5.2	96	7/7/2004	1250
532	16.3	4.2	88	7/7/2004	1255
533	16.9	4.8	89	7/7/2004	1300
534	16.6	5.8	87	7/7/2004	1305
535	16.3	6.6	73	7/7/2004	1310
536	16.4	6.6	79	7/7/2004	1315
537	16.5	8.4	69	7/7/2004	1320
538	16.5	8.4	75	7/7/2004	1325
539	16.6	8.0	68	7/7/2004	1330
540	16.5	6.4	63	7/7/2004	1335
541	16.5	7.0	74	7/7/2004	1340
542	16.4	8.6	65	7/7/2004	1345
543	16.5	6.8	61	7/7/2004	1350
544	16.6	7.6	66	7/7/2004	1355
545	16.8	4.8	68	7/7/2004	1400
546	17.0	5.4	68	7/7/2004	1405
547	17.0	5.4	67	7/7/2004	1410
548	17.0	4.6	83	7/7/2004	1415
549	16.9	4.8	67	7/7/2004	1420
550	15.1	2.4	74	7/7/2004	1425
551	14.7	1.0	68	7/7/2004	1430
552	14.6	1.0	67	7/7/2004	1435
553	14.6	1.0	66	7/7/2004	1440

Meas	Temp	Curr	Dir	Date	Time
554	14.5	1.0	66	7/7/2004	1445
555	16.8	1.8	80	7/7/2004	1450
556	16.5	1.8	120	7/7/2004	1455
557	16.8	2.8	221	7/7/2004	1500
558	16.8	2.0	203	7/7/2004	1505
559	17.0	2.2	214	7/7/2004	1510
560	17.3	2.8	220	7/7/2004	1515
561	17.1	4.2	213	7/7/2004	1520
562	17.3	4.4	201	7/7/2004	1525
563	17.3	3.2	202	7/7/2004	1530
564	17.2	2.4	198	7/7/2004	1535
565	17.4	2.6	185	7/7/2004	1540
566	17.6	2.4	200	7/7/2004	1545
567	17.6	2.4	218	7/7/2004	1550
568	17.6	2.4	219	7/7/2004	1555
569	17.6	2.8	245	7/7/2004	1600
570	17.6	4.0	242	7/7/2004	1605
Mean	**15.9**	**2.4**			
Max	**18.0**	**12.6**			
Min	**13.6**	**0.6**			

Merepoint site, Brunswick, Maine – Dissolved Oxygen/turbidity data

Time	Tide (m)	Tide (ft)	Turbidity YSI 6600	DO% %
1500	2.8	9.2	3.1	114.4
1505	2.9	9.5	-2.3	119.3
1510			9.7	124.6
1515			2.3	134
1520			2.2	130.1
1525	2.8	9.2	2.2	128.6
1530			1.9	126.6
1535			2.5	124.7
1540			2.3	124
1545			2.4	124
1550			2.4	120.4
1555			2.0	120.2
1600	2.7	8.9	2.2	119.8
1605			2.2	120.8
1610			1.8	117.4
1615			2.0	116.6
1620	2.6	8.5	2.1	116.3
1625			2.1	116.2
1630			2.2	116.5
1635	2.5	8.2	2.0	115.9

Time	Tide (m)	Tide (ft)	Turbidity YSI 6600	DO% %
1640			1.9	116
1645	2.4	7.9	2.0	116
1650			2.0	116.2
1655			1.7	116.4
1700	2.3	7.6	1.8	116.5
1705			1.8	119.2
1710	2.2	7.2	1.8	120.1
1715			1.8	120.6
1720	2.1	6.9	1.8	120.1
1725			1.8	120.1
1730	2.0	6.6	1.6	121.2
1735			2.2	123.4
1740	1.9	6.2	2.3	123.2
1745	1.8	5.9	2.2	124.2
1750			2.2	122.5
1755	1.7	5.6	2.5	123.9
1800			2.1	125.9
1805	1.6	5.3	2.0	125.8
1810			2.0	125
1815	1.5	4.9	2.0	124.8
1820			2.1	125.1
1825	1.4	4.6	2.1	123.9
1830	1.3	4.3	2.4	122.8
1835			2.3	123
1840	1.2	3.9	2.3	126.1
1845			2.3	126.8
1850	1.1	3.6	2.6	122
1855			3.0	117.7
1900	1.0	3.3	2.8	117.5
1905	0.9	3.0	3.0	117.7
1910			2.9	117.5
1915			2.9	116.8
1920	0.8	2.6	2.9	117.1
1925			2.8	117.5
1930	0.7	2.3	2.8	117.8
1935			4.7	116.7
1940	0.6	2.0	2.8	116.6
1945			2.8	116.3
1950			2.6	116.4
1955	0.5	1.6	2.8	116.2
2000	0.4	1.3	2.5	116.1
2005			2.6	116.1
2010			2.5	116
2015			2.7	115.8
2020			2.5	115.9
2025	0.3	1.0	2.5	115.7
2030			2.5	116.1

Time	Tide (m)	Tide (ft)	Turbidity YSI 6600	DO% %
2035			2.6	116.1
2040			2.4	116.1
2045			2.5	116.3
2050	0.2	0.7	2.4	115.6
2055			2.7	116.2
2100			14.9	116.5
2105			12.2	117.2
2110			2.4	117.3
2115			26.7	117.4
2120			3.1	117.6
2125			6.1	117.5
2130			2.3	117.5
2135			2.4	117.4
2140			2.2	116.7
2145			2.4	116.1
2150	0.3	1.0	2.3	115.6
2155			2.5	115.3
2200			2.6	114.2
2205			2.7	113.8
2210			2.9	113.8
2215	0.4	1.3	2.9	114.1
2220			2.7	114
2225			2.8	113.4
2230			3.0	113
2235	0.5	1.6	3.1	113.1
2240			2.9	112.7
2245	0.6	2.0	3.0	112.2
2250			3.4	112.2
2255			3.1	112
2300	0.7	2.3	2.8	112.1
2305			2.8	112.4
2310	0.8	2.6	2.9	112.1
2315			2.6	112.1
2320			3.4	112.3
2325	0.9	3.0	2.8	112.8
2330	1.0	3.3	2.6	112.9
2335			3.0	113.5
2340	1.1	3.6	2.9	112.9
2345			2.6	113.2
2350	1.2	3.9	2.6	113.1
2355			2.9	112.1
0000	1.3	4.3	2.5	112.8
0005			2.2	115.3
0010	1.4	4.6	2.4	115.4
0015			2.3	111.1
0020	1.5	4.9	2.2	112.4
0025			2.3	113.4

Time	Tide (m)	Tide (ft)	Turbidity YSI 6600	DO% %
0030	1.6	5.3	2.2	112.5
0035	1.7	5.6	2.2	111.7
0040			1.9	111.9
0045	1.8	5.9	2.1	111.5
0050			2.2	111.5
0055	1.9	6.2	2.2	111.7
0100			2.0	111.6
0105	2.0	6.6	2.0	111.2
0110			1.8	110.9
0115	2.1	6.9	1.9	110.5
0120			2.1	110.9
0125	2.2	7.2	2.0	110.9
0130			2.0	110.8
0135	2.3	7.6	2.0	110.8
0140			1.9	110.2
0145	2.4	7.9	2.5	109.7
0150			1.7	109.9
0155			1.8	110.1
0200	2.5	8.2	1.8	109.5
0205			1.9	109.5
0210	2.6	8.5	1.8	109.1
0215			1.8	109.2
0220			2.0	109.3
0225	2.7	8.9	1.7	111
0230			1.8	111.4
0235			1.6	111.3
0240			1.7	110.3
0245	2.8	9.2	2.0	110.1
0250			1.8	110.7
0255			2.0	110.6
0300			1.8	110.7
0305			1.5	111.6
0310			1.7	111.6
0315			1.5	111.3
0320	2.90	9.5	1.7	111.2
0325			1.7	110.8
0330			2.2	109.2
0335			1.8	107.7
0340	2.80	9.2	1.8	109.3
0345			1.7	110.3
0350			2.1	108.7
0355			2.0	109.6
0400			1.9	109.8
0405			2.0	109.6
0410			1.8	109.9
0415			2.3	109.4
0420	2.70	8.9	2.0	107.3

Time	Tide (m)	Tide (ft)	Turbidity YSI 6600	DO% %
0425			2.1	107.9
0430			2.1	107.7
0435			1.7	107.4
0440	2.60	8.5	2.2	107.4
0445			1.8	107.2
0450	2.50	8.2	2.1	106.9
0455			2.6	106.3
0500			2.1	106
0505	2.40	7.9	2.0	105.9
0510			1.7	106.2
0515	2.30	7.6	1.7	106.9
0520			1.8	106.9
0525			1.9	107
0530	2.20	7.2	1.8	106.7
0535			2.3	106.4
0540	2.10	6.9	1.8	105.8
0545			1.7	105
0550	2.00	6.6	2.1	103.4
0555			1.9	103.9
0600	1.9	6.2	2.2	103.7
0605	1.80	5.9	2.3	103
0610			2.6	103
0615			2.2	102.7
0620	1.7	5.6	2.5	102.4
0625	1.6	5.3	2.2	102.2
0630			2.5	102.1
0635	1.5	4.9	2.5	102
0640	1.4	4.6	2.5	102.1
0645			2.5	102.1
0650	1.3	4.3	2.3	101.9
0655			2.3	101.8
0700	1.2	3.9	2.2	101.8
0705			2.6	102.3
0710			2.8	102.5
0715	1.1	3.6	2.3	102.6
0720	1	3.3	2.6	102.7
0725			2.2	102.8
0730	0.9	3.0	2.5	103
0735			2.0	103.3
0740	0.8	2.6	2.2	102.8
0745			3.6	103.1
0750	0.7	2.3	2.1	102.9
0755			2.3	102.9
0800	0.6	2.0	2.1	103.6
0805			2.5	103.7
0810	0.5	1.6	2.8	103.3
0815			2.9	103.7

Time	Tide (m)	Tide (ft)	Turbidity YSI 6600	DO% %
0820	0.4	1.3	2.7	104.3
0825			2.6	105.5
0830			3.0	106.9
0835	0.3	1.0	3.0	107.7
0840			2.6	107.7
0845			2.9	108
0850	0.2	0.7	3.6	108.3
0855			2.9	108.6
0900			2.8	108.8
0905			3.1	109
0910			3.0	109.4
0915			2.8	109.8
0920	0.1	0.3	2.9	110.2
0925			2.7	110.5
0930			3.1	110.6
0935			2.8	111
0940			4.1	111.3
0945			2.6	111.4
0950			2.8	111.9
0955			2.7	111.9
1000			2.5	112.1
1005			2.8	112.7
1010			3.7	113
1015			2.6	113.2
1020			2.7	112
1025	0.2	0.7	2.7	112.4
1030			2.4	111.9
1035			2.8	113.1
1040			2.3	113.3
1045			2.6	113.4
1050	0.3	1.0	2.3	113.2
1055			2.5	113.5
1100			3.2	113.5
1105	0.4	1.3	2.6	113.7
1110			2.4	113.7
1115			2.8	114.5
1120	0.5	1.6	2.5	115.4
1125			2.8	114.4
1130	0.6	2.0	3.0	115.9
1135			3.1	116.6
1140	0.7	2.3	3.0	116.6
1145			3.0	116.1
1150			3.4	116.3
1155	0.8	2.6	3.4	116.9
1200	0.9	3.0	3.7	117.3
1205			4.2	117.2
1210			4.0	117.4

Time	Tide (m)	Tide (ft)	Turbidity YSI 6600	DO% %
1215	1	3.3	3.3	116.1
1220	1.1	3.6	3.5	117
1225			2.6	116.5
1230	1.2	3.9	2.7	117.1
1235			2.9	117.4
1240	1.3	4.3	2.8	118.9
1245	1.4	4.6	2.5	118.4
1250			2.5	117
1255			2.2	117.9
1300	1.5	4.9	2.3	118.9
1305	1.6	5.3	2.3	118.8
1310			2.0	118.7
1315	1.7	5.6	2.0	119.2
1320			1.8	120.2
1325	1.8	5.9	1.9	120.6
1330			1.9	121.2
1335	1.9	6.2	2.2	121.3
1340	2	6.6	2.0	121.4
1345			2.2	121.6
1350	2.1	6.9	1.8	122.4
1355			2.0	122.7
1400			2.0	123
1405	2.2	7.2	1.8	123.5
1410			1.7	123.4
1415	2.3	7.6	1.7	123.9
1420			2.3	123.9
1425	2.4	7.9	2.2	122.9
1430			2.9	121.6
1435	2.5	8.2	2.6	121
1440			2.6	120.5
1445			1.8	123
1450			1.8	124.7
1455	2.6	8.5	2.0	124.5
1500			2.0	124.7
1505			1.8	125.8
1510	2.7	8.9	1.9	126.1
1515			2.0	127.3
1520			2.1	126
1525			2.1	126.8
1530			2.5	132
1535	2.8	9.2	2.3	129.3
1540			2.3	129.9
1545			2.2	127.4
1550			2.3	126.7
1555			2.2	126.9

Time	Tide (m)	Tide (ft)	Turbidity YSI 6600	DO% %
1600			2.1	126.5
1605			2.3	128.6
Mean	**1.5**	**5.0**	**2.5**	**114.3**
Max	**2.9**	**9.5**	**26.7**	**134.0**
Min	**0.1**	**0.3**	**1.5**	**101.8**