Stantec

Memo

To:	Eric Ham and Kristen Chamberlain Maine Department of Transportation	From:	Paul Sokoloff Topsham, ME Office
File:	Sears Island Diver-based Lobster and Urchin Density Survey	Date:	April 9, 2024

Reference: Lobster and Urchin Dive Survey for the Proposed Sears Island Offshore Wind Terminal – December 2023 Survey Results

The purpose of this Diver-based Lobster and Urchin Density Survey memo is to present resource data for commercially important species collected to support a National Environmental Policy Act Environmental Impact Statement and state and federal permitting for a proposed Offshore Wind Port and Wind Turbine Launch Site (Project). The Project is being developed by the Maine Department of Transportation and they are evaluating the western shoreline of Sears Island to serve as a potential Project site. Based on the June 2023 conceptual Project design, the Sears Island site may require approximately 30 acres of intertidal and subtidal fill (Figure 1). On December 6 and 7, 2023, Stantec completed dive surveys to estimate the density of American lobsters (*Homarus americanus*) and green sea urchins (*Strongylocentrotus droebachiensis*) present at the Sears Island Project Area (Figure 1). The lobster and urchin survey data will be used in consultations with the Maine Department of Marine Resources to determine potential mitigation requirements and if a relocation effort should be completed for lobsters and urchins in and/or adjacent to the Project Area prior to any in-water work. On past Maine projects, the Maine Department of Marine Resources relocation lobster density threshold has been 0.1 lobster per meter^2 to determine if a lobster relocation effort is required. Stantec is not aware of a past project impacting green sea urchin habitat where a relocation effort was required. In addition to the lobster survey results provided herein, Stantec has included a summary of lobster life history specific to water temperature expected during the time of year work window for tidal waters (November 8 to April 9).[1]

LOBSTER LIFE HISTORY AND TEMPERATURE LITERATURE REVIEW

Daily activity level and seasonal movements of the American lobster are influenced by seasonal shifts in water column temperature (McLeese and Wilder 1958, Factor 1995, Crossin et al. 1998, Jury 1999, Goldstein and Watson 2015, Wang et al. 2016). Studies have shown that the lobster prefers water temperature of approximately 16°C to 17°C (Crossin et al. 1998, Watson et al. 1999) and that their movement is directly related to water temperature. Seasonal movement occurs when water temperature drops below 10°C, and when water temperature is below 5°C, there is decreased to no movement of lobsters (Factor 1995, Jury 1999). The walking rate of lobsters increases linearly between 2°C and 10°C, with activity being water temperature-dependent below 10°C and independent of water temperature between 10°C and 20°C (Factor 1995, Jury 1999). The probability of catching lobsters is dependent on individuals encountering traps; therefore, decreases in water temperature can be correlated to reduced catchability (Campbell and Stasko 1986, Factor 1995, Jury 1999, Jury and Watson 2013, Wang et al. 2016). Two studies have investigated the link between water temperature and catchability. One found that the highest catch per unit effort in the Great Bay Estuary of New Hampshire was in areas with water temperature between 12°C and 18°C (Jury and Watson 2013). A second study conducted in the St. Croix River estuary (between Maine and New Brunswick) found a significant decrease in catchability below 8°C (McLeese and Wilder 1958).

[1] Department of the Army General Permit for the State of Maine. https://www.nae.usace.army.mil/Portals/74/docs/regulatory/StateGeneralPermits/ME/2020-2025-MaineGeneralPermits.pdf

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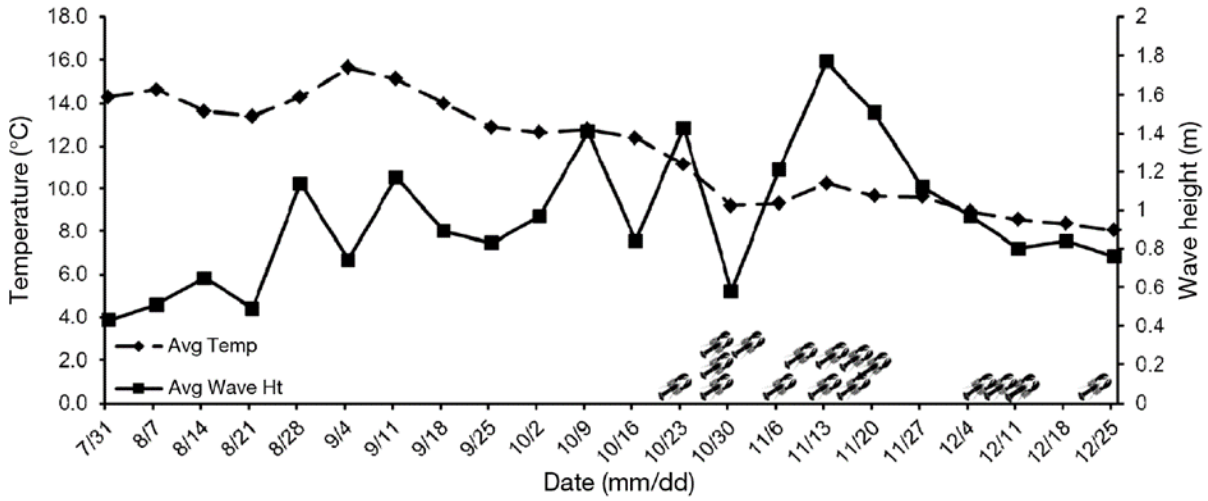
Falling water temperature and storm events create a challenging and stressful environment for lobsters located in inshore areas (Ennis 1984, Goldstein and Watson 2015). Seasonal offshore lobster movement due to decreases in water temperature or increases in storm activity have been documented in the northern part of their range (Cooper and Uzmann 1971, Ennis 1984, Campbell and Stasko 1986, Factor 1995, Goldstein and Watson 2015). Water temperature ranging below 8°C to10°C appears to trigger the offshore migration of adult lobsters (Cooper and Uzmann 1971, Factor 1995, Goldstein and Watson 2015). The migration of lobsters to deeper water has been documented to be age dependent, with adult lobsters moving greater distances and juvenile and adolescent lobsters sometimes remaining in shallower coastal waters even as water temperature decreases (Factor 1995). Migration timing may be affected by sex in addition to age, with adult female lobsters beginning an offshore seasonal migration earlier than male lobsters due to the need for a consistent water temperature above 3.4°C for egg development (Campbell and Stasko 1986).

Goldstein and Watson (2015) observed the offshore movement of lobsters in the Piscataqua River starting in mid-October when significant decreases in water temperature were observed (Figure 2). The water temperature remained relatively constant prior to the observation of offshore movement; however, in mid-October, a decrease in water temperature was observed, with water temperature dropping from 14.1°C to 10.3 ±0.5°C. Of the 16 tagged lobsters that were observed migrating offshore, the majority (75%) left the estuary between October 22 and November 21, with a mean departure date of November 1 (Goldstein and Watson 2015).



Weekly water temperature and wave height in the fall of 2006 for the period before and during the offshore movements of tagged lobsters. Lobster symbols indicate when individual lobsters initiated offshore movements. Most (75%, n = 16) of the lobsters left the area between October 22 and November 21, with a mean date of departure of November 1 (range = 295−315 days) (Goldstein and Watson 2015).

Figure 2. Water temperature and wave height associated with offshore movements of lobsters in the Piscataqua River (Goldstein and Watson 2015).

Publicly available water temperature estimates for Searsport Harbor are based on the daily sea surface temperature satellite readings from NOAA.[2] Historic temperature summary charts are also available based on these satellite readings, including monthly sea temperatures from 2013 to 2023 (Figure 3). As indicated in Figure 3, mean sea temperature drops below 10°C in November and below 5°C in January, and mean sea temperatures again increase above 5°C in April/May. Based on the research cited above and the local sea temperature data, seasonal movement of lobster would be expected to occur out of Searsport Harbor in late October and November. By January and into April, any remaining lobsters in Searsport Harbor would exhibit limited mobility and thus reduced catchability. This period of low lobster abundance and catchability corresponds with the potential in-water work window for the Project.

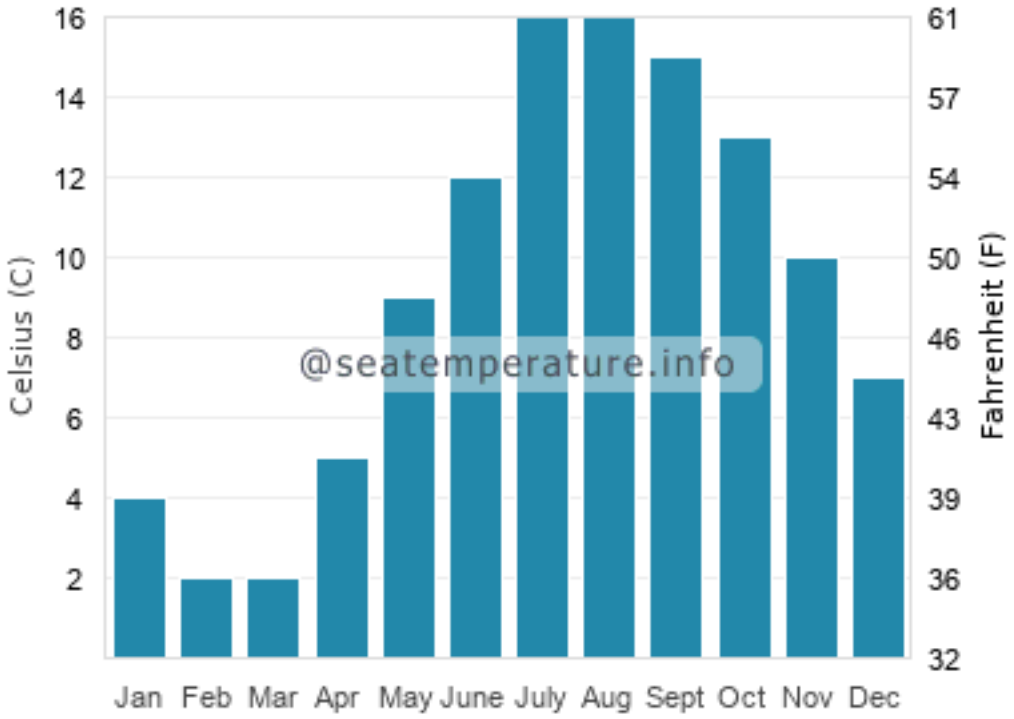


Figure 3: Mean Sea Temperature for Searsport Harbor (2013–2023)

LOBSTER AND URCHIN SURVEY METHODOLOGY

Diver-based lobster and urchin surveys were conducted in early December, to estimate the density of lobsters and urchins during the allowable in-water work window. Based on the homogeneity of substrate types and the lack of boulder and cobble habitat beyond the shallow subtidal, three transects were surveyed by divers at Sears Island (Figures 4 and 5). The transect length and spacing was chosen to characterize representative habitats across the Project Area; however, since actual impact areas are still being determined a 200-foot

[2] seatemperature.net accessed March 2024

buffer around proposed impacts was included (Survey Area). Video data documenting lobster and urchin density and benthic conditions in the Survey Area were collected with a GoPro® camera.[3]

Divers recorded the number of observed lobsters, lobster burrows, and urchins within one meter of either side of the transect. The density of observed lobsters, lobster burrows, and urchins was calculated for each transect based on the square meters surveyed (e.g. number urchins/ (length of the transect in meters x 2)). In addition, the following information was noted by divers:

1. General sediment type (i.e., silt, mud, sand, and shell).
2. Notable biological observations (i.e., shellfish or algal beds, crabs, and fish fauna).

LOBSTER AND URCHIN SURVEY RESULTS

The lobster and urchin surveys were completed in the Sears Island Survey Area on December 6 and 7, 2023. Figure 4 depicts the lobster and urchin transects and the survey boundaries. Table 1 contains the survey results. No lobsters were observed in the Sears Island Survey Area. Divers observed lobster burrows that were not visibly occupied on the three transects during the survey.

A total of 1,442 urchins were observed in the Sears Island Survey Area. Urchins were only observed on Transect 1 in boulder and cobble habitat, (Table 1; Photo 1). The remaining transects lacked hard bottom urchin habitat. The urchin density (0.53 urchins per square meter) on cobble and boulder substrate in the Survey Area has resulted in heavy browsing pressure on algae in the subtidal, with algae in these areas being primarily limited to crustose coralline algae on cobble and boulders (Photos 2–4).

Figure 5 presents subtidal substrate mapping based on a side-scan sonar survey completed by Steele Associates Marine Consultants, LLC (SAMC 2023). The substrate in the shallow subtidal along Transect 1 is primarily boulder and cobble interspersed with silty sands. This is where the greatest densities of green sea urchin were observed. This rocky substrate extended into the subtidal to around -10 feet mean lower low water before grading to sandy silt in deeper water. Beyond -10 feet mean lower low water the benthic substrates in Sears Island Survey Area were mud, with an area of silty sands located in the northwestern portion of the Survey Area (Figure 5). An area immediately west of transect 2 was identified has having a substrate consisting of primarily sand, gravel, or shell hash based high backscatter received during the side-scan sonar survey. This area was not surveyed for lobsters and urchins based the lack of suitable cobble and boulder habitat.

[3] Lobster and urchin survey video is available upon request.

Reference: Lobster and Urchin Dive Survey for the Proposed Sears Island Offshore Wind Terminal – December 2023 Survey Results

Table 1. December 6 and 7, 2023, Lobster and Urchin Densities, Sears Island.

	Urchins	Unoccupied Burrows	Lobsters	Notes
Transect 1				
Total	1442	3	0	
Per m²	0.53	0.001	0	
Transect 2				
Total	0	3	0	
Per m²	0	0.001	0	
Transect 3				
Total	0	39	0	20 scallops, 9 ghost traps
Per m²	0	0.02	0	

The following other marine species were observed during the 2023 Sears Island dive surveys:

- Acadian hermit crab (*Pagurus acadianus*)
- Blue mussel (*Mytilus edulis*)
- Brown filamentous algae (*Ectocarpus* spp.)
- Burrowing anemone (*Ceriantheopsis austroafricanus*)
- Common periwinkle (*Littorina littorea*) (Photo 5)
- Common slipper shell (*Crepidula fornicata*)
- Crustose coralline algae (*Corallinales*)
- Encrusting bryozoan (*Membranipora membranacea)*
- False Irish moss (*Mastocarpus stellatus*)
- Finger sponge (*Haliclona oculate)*
- Green crab (*Carcinus maenas*)
- Mysid shrimp (*Mysis* sp.)
- Northern rock barnacle (*Semibalanus balanoides*) (Photo 5)
- Rock crab (*Cancer irroratus*)
- Sand shrimp (*Crangon septemspinosa*)
- Sand dollar (*Echinarachnius parma*) (Photo 6)
- Sea scallop *(Placopecten magellanicus*) (Photo 7)
- Sea star (*Asterias rubens*) (Photo 8, photo taken during September 2023 eelgrass survey)
- Sea vase (*Ciona intestinalis*)
- Surf clams (*Spisula solidissima)*
- Unidentified brown filamentous algae
- Unidentified encrusting black tunicate
- Unidentified globular sponges

Reference: Lobster and Urchin Dive Survey for the Proposed Sears Island Offshore Wind Terminal – December 2023 Survey Results

SUMMARY

The following summarizes the lobster literature review and lobster and urchin survey effort at the Sears Island Survey Area:

- Lobster movement and activity are temperature dependent. The allowable in-water work window for tidal waters in Maine (November 8 to April 9) occurs during a period when many lobsters are expected to have moved out of the Sears Island Project Area into deeper offshore waters. Remaining lobsters likely seek refuge in the deeper water associated with the navigation channel. Lobsters that remain in Searsport Harbor exhibit reduced activity and catchability from January to March, when water temperatures are below 5°C. This period of reduced abundance and activity corresponds with the in-water work window.
- No lobsters were observed during the dive surveys at Sears island. The lack of lobsters in the Survey Area during early December is supported by the reviewed literature. Higher lobster densities are expected in this area during the summer and fall.
- The cobble and boulder habitat in the shallow subtidal of the Survey Area supports a high density of green sea urchin.

REFERENCES

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Cooper, R. A., and J. R. Uzmann. 1971. Migrations and growth of deep-sea lobsters, *Homarus americanus*. Science 171: 288–290.

Crossin, G. T., S. A. Al-Ayoub, S. H. Jury, W. H. Howell, and W. H. Watson III. 1998. Behavioral thermoregulation in the American lobster *Homarus americanus*. Journal of Experimental Biology 201: 365–374.

Ennis, G. P. 1984. Small-scale seasonal movements of the American lobster *Homarus americanus*. Transactions of the American Fisheries Society 113: 336–338.

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Jury, S. H., and W. H. Watson III. 2013. Seasonal and sexual differences in the thermal preferences and movements of American lobsters. Canadian Journal of Fisheries and Aquatic Sciences 70: 1650–1657.

Reference: Lobster and Urchin Dive Survey for the Proposed Sears Island Offshore Wind Terminal – December 2023 Survey Results

McLeese, D. W., and D. G. Wilder. 1958. The activity and catchability of the lobster (*Homarus americanus*) in relation to temperature. Journal of the Fisheries Research Board of Canada 15: 1345–1354.

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Watson III, W. H., A. Vetrovs, and W. H. Howell. 1999. Lobster movements in an estuary. Marine Biology 134: 65–75.

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Stantec Consulting Services Inc.

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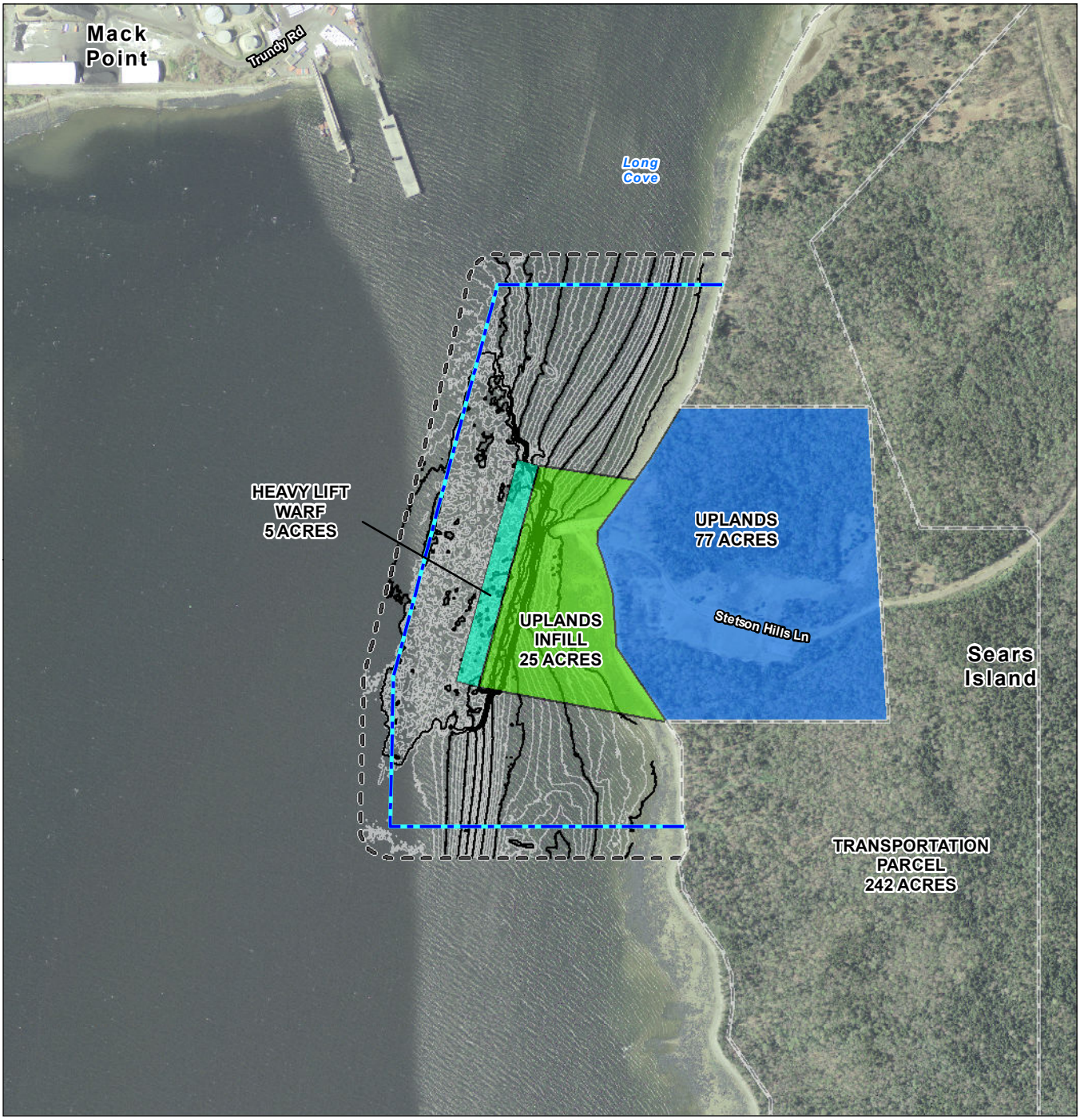
Attachment: Figure 1. Maine Floating Offshore Wind Port Sears Island Alternative, June 2023 Conceptual Design
Figure 4. 2023 Sears Island Lobster and Urchin Survey Transects
Figure 5. 2023 Subtidal Substrates Sears Island
Representative Photographs



Legend

- 200 ft Buffer
- Potential Intertidal and Subtidal Project Footprint
- Uplands (77 acres)
- Uplands Infill (25 acres)
- Heavy Lift Warf (5acres)
- Transportation Parcel (242 acres)

0 1,000 Feet

(At original document size of 8.5x11)
1" = 1,000'

N

Notes

1. Coordinate System: NAD 1983 StatePlane Maine East FIPS 1801 Feet
2. Vertical Datum: Mean Lower Low Water (MLLW).
3. Data Sources:MEDOT, Stantec
4. Background: Maine Orthoimagery Regional, 2015

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Project Location
Searsport, Maine

Prepared by PWB on 2024-04-11
TR Review by KWH on 2024-04-11
IR Review by PS on 2024-04-11

Client/Project
Maine Department of Transportation

195602718

Figure No.
1

DRAFT

Title
Sears Island Conceptual Design

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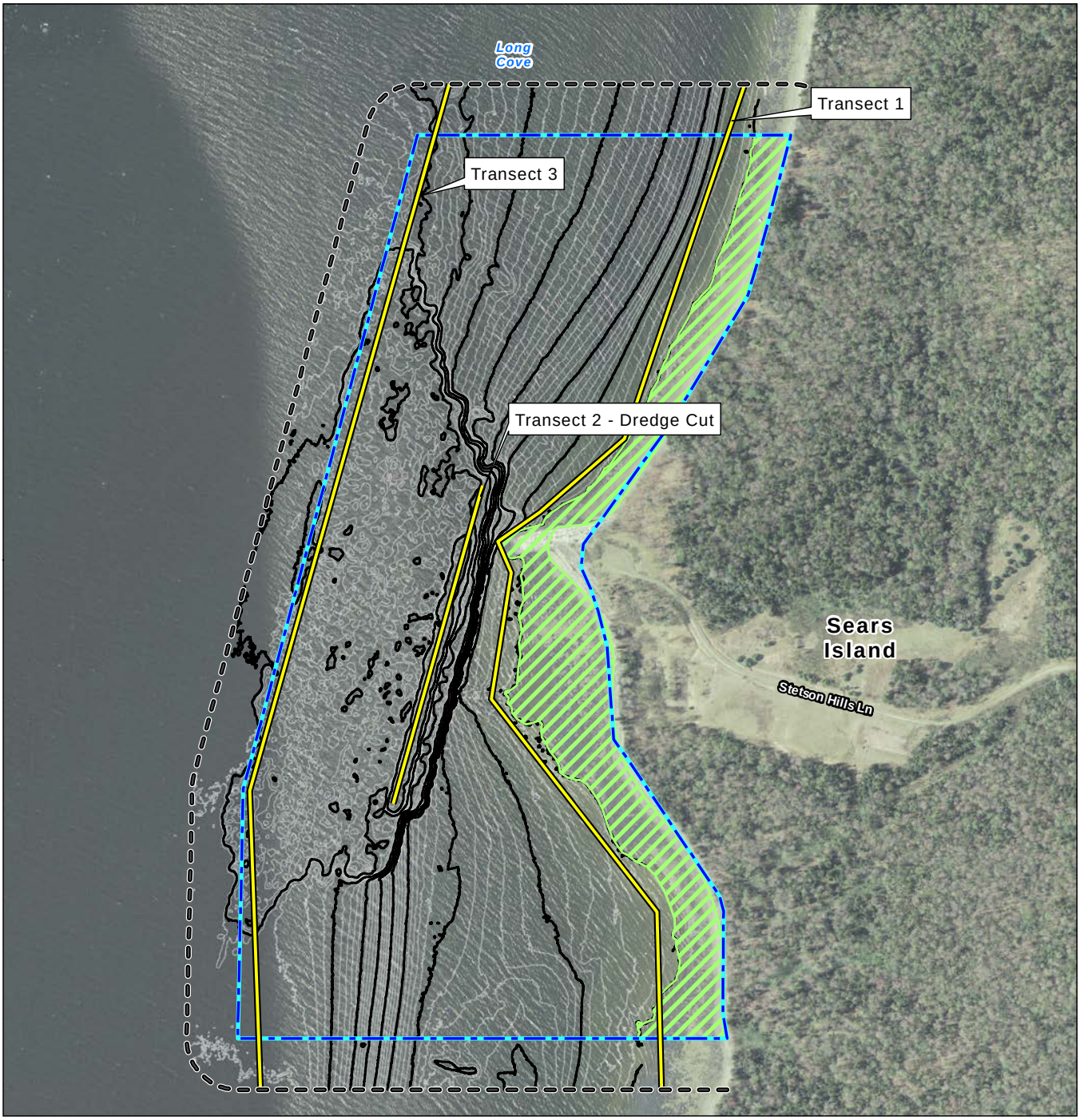

Legend

- Bathymetry Contour 1ft
- Bathymetry Contour 5ft
- 200 ft Buffer
- Lobster and Urchin Dive Transects
- Potential Project Footprint
- Approximate Intertidal Area (583,000 SQ. FT. /13.4 Acres)

0 600 Feet

(At original document size of 8.5x11)
1" = 600'

N

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Project Location
Searsport, Maine

Prepared by PWB on 2024-04-02
TR Review by KWH on 2024-04-02
IR Review by PS on 2024-04-02

Client/Project
Maine Department of Transportation

195602718

Figure No.
6

Title
2023 Sears Island Lobster and Urchin Survey Transects

Notes
1. Coordinate System: NAD 1983 StatePlane Maine East FIPS 1801 Feet
2. Vertical Datum: Mean Lower Low Water (MLLW).
3. Data Sources:MEDOT, Stantec
4. Background: Maine Orthoimagery Regional, 2015

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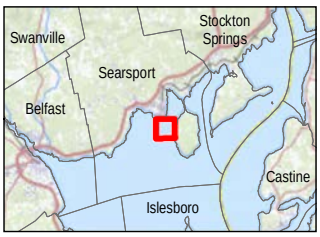

Notes

1. Coordinate System: NAD 1983 StatePlane Maine East FIPS 1801 Feet

2. Data Sources: Steele Associates Marine Consultants, LLC, Hydrographic and Marine Geophysical Site Characterization Surveys Mack Point and Sears Island Searsport, ME Report.

Not to Scale

N

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Project Location
Searsport, Maine

Prepared by PWB on 2024-04-02
TR Review by KWH on 2024-04-02
IR Review by PS on 2024-04-02

Client/Project
195602718
Maine Department of Transportation

Figure No.
3

Title
Side-Scan Backscatter Mosaic and Bottom Types

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April 9, 2024

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Attachments

Reference: Lobster and Urchin Dive Survey for the Proposed Sears Island Offshore Wind Terminal – December 2023 Survey Results

Photo 1. Sandy silt with cobble and gravel substrate at Sears Island. December 2023.

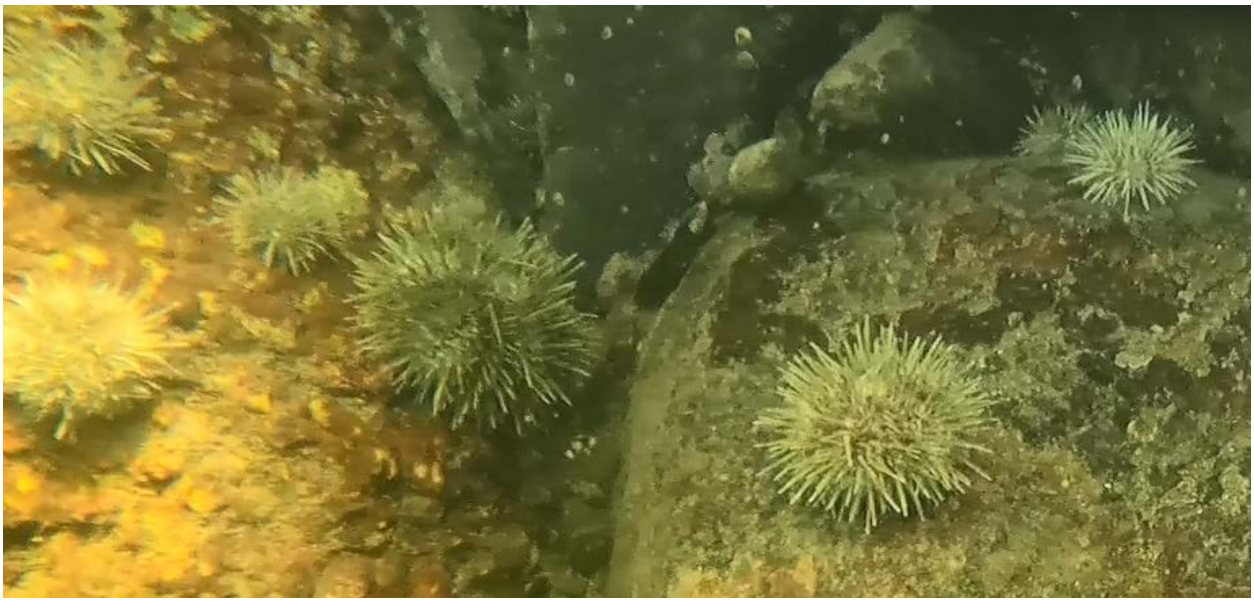

Photo 2. Green sea urchins at Sears Island in boulder and cobble habitat. December 2023.

April 9, 2024

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Reference: Lobster and Urchin Dive Survey for the Proposed Sears Island Offshore Wind Terminal – December 2023 Survey Results

Photo 3. Green sea urchins and crustose coralline algae at Sears Island. December 2023.

Photo 4. Green sea urchins and crustose coralline algae at Sears Island. December 2023.

April 9, 2024

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Reference: Lobster and Urchin Dive Survey for the Proposed Sears Island Offshore Wind Terminal – December 2023 Survey Results

Photo 5. Green sea urchins, common periwinkles, and northern rock barnacles on a boulder in the shallow subtidal at Sears Island. December 2023.

Photo 6. Sand dollars in the sandy silty substrate in the shallow subtidal at Sear Island. December 2023.

April 9, 2024

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Reference: Lobster and Urchin Dive Survey for the Proposed Sears Island Offshore Wind Terminal – December 2023 Survey Results

Photo 7. Sea scallop in the subtidal at Sears Island. December 2023.

Photo 8. Sea star in the shallow subtidal at Sears Island. Photo taken during September 2023 eelgrass survey.