9.0 ATTACHMENT 9 - SITE CONDITION REPORT

A Natural Resources Report has been developed that addresses wetlands, streams, vernal pools, wildlife, fisheries, and benthos. Portions of the Natural Resources Report are included here but the report can be found in its entirety in **Attachment 12**.

9.1 Wetlands, Vernal pools and Streams

9.1.1 Methods

Review of wetlands and streams on site were conducted on May 3 and 4, July 24, and August 27 and 28, 2018, with an additional survey conducted on the easement to Perkins Road on May 1, 2019. Review of vernal pools also took place during the survey on May 3 and 4 with a return visit on May 18. Survey dates of each parcel can be found in **Figure 9-1**.

Wetland boundaries were delineated according to the 1987 U.S. Army Corps of Engineers Wetland Delineation Manual and Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0), which utilizes the three parameter approach (i.e., evaluating the site for the presence of hydric soils, hydrophytic vegetation and wetland hydrology) for identifying wetlands and determining their jurisdictional limits. Wetland boundaries were surveyed at the time of delineation using a Trimble® Global Positioning System (GPS) unit capable of sub-meter accuracy and post-processed against known base stations. These GPS points were translated into a detailed map depicting jurisdictional boundaries using Normandeau's geographic information system (GIS) software.

Vernal pool surveys were performed using Maine Department of Inland Fisheries and Wildlife (MDIFW) guidelines which call for a ground survey of all potentially impacted areas and adjacent lands. Any potential pools are visited a minimum of two times during the vernal pool survey window, which occurred from approximately mid-April to early May 2018. Each potential pool was examined thoroughly for the presence of vernal pool indicator species, including wood frog (*Lithobates sylvaticus*), spotted salamander (*Abystoma maculatum*), and blue-spotted salamander (*Abystoma laterale*) egg masses, or the presence of fairy shrimp in any life stage.

Data sheets were completed for all resources identified, including documentation of physical stream characteristics and a functions and values assessment for all wetlands using the Army Corps of Engineers Highway Methodology[1]. The wetlands were also classified by cover type according to the classification system developed by Cowardin et al.[2]

9.1.2 Results

<u>Wetlands</u>

A total of 17 wetlands were identified on site (**Figure 9-1**). Of these, nine wetlands meet the criteria for freshwater wetlands of special significance (WOSS) under the Natural Resources Protection Act (NRPA): W7, W8, W9, W10, W11, W12, W16, W17, and W18. Areas of these wetlands within 25-feet of the banks of their associated streams will necessarily carry a higher regulatory burden under NRPA. Additionally, wetlands W10, and W12 are located within

[1] The Highway Methodology Workbook, Supplement, NAEEP-360-1-30a, September 1999
[2] Cowardin, L.M., V. Carter, F.C. Golet, E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. FWS/OBS-79/31. U.S. Fish and Wildlife Service: Washington, D.C.

250 feet of a coastal wetland. The remaining eight wetlands do not meet such criteria. **Table 9-1** contains a summary of a functional assessment of identified wetlands.

Palustrine Wetlands

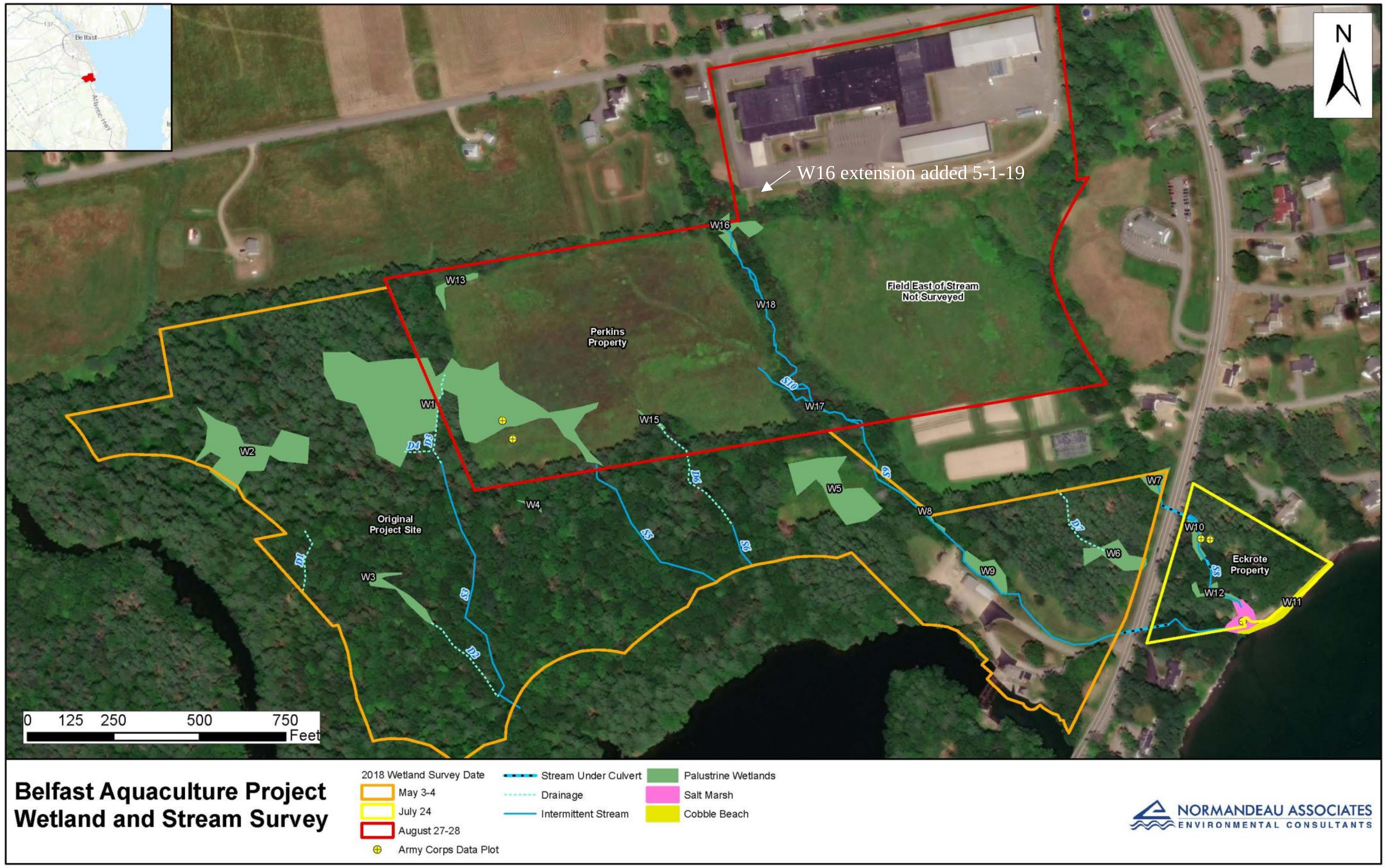
Wetlands W1, W2, and W3 are forested wetlands dominated by a mixture of deciduous and coniferous species, including red maple (*Acer rubrum*), white pine (*Pinus strobus*), hemlock (*Tsuga canadensis*), and red spruce (*Picea rubens*). Species such as the pine, spruce, and hemlock are not typically regarded as wetland species, however it is acknowledged that these species are known to be found in wetlands in the northeastern region. This site is largely composed of fine textured soils that restrict the infiltration of water and creating wetland environments. This is exemplified by the roots of the white pine, red spruce, and hemlock in wetlands W1 and W2, which are at or near the surface of the soil. This limited rooting depth in response to a high water table is known as a morphological adaptation of upland plants to wetland soil and is sufficient to meet wetland vegetation criteria for the purpose of wetland delineations. Additionally, the understory in these wetlands consisted of wetland species such as cinnamon fern (*Osmundastrum cinnamomeum*) and sensitive fern (*Onoclea sensibilis*). A large amount of the non-native invasive shrub glossy false buckthorn (*Frangula alnus*) was present throughout W1, limiting the value of this wetland. Wetland W1 also extends into the adjacent hayfield on the Perkins Avenue parcel. This portion of the wetland is dominated by bluejoint (*Calamagrostis canadensis*) with numerous other common weedy field species present, including red clover (*Trifolium pretense*) and cow vetch (*Viccia cracca*).

Wetland W4 is an isolated depression in an oak dominated forest. There is evidence of standing water, and the understory is generally sparse and dominated by various sedges (*Carex* spp.) that were unidentifiable to species due to the early season survey. This wetland is marginal and possesses no discernible surface water outlet.

Wetland W5 is a portion of an old field. The water table in this area is at or near the surface, likely due to repeated disturbance and compaction associated with maintaining the field. The wetland is dominated by meadowsweet (*Spiraea alba* var. *latifolia*), with various herbs such as common wrinkle-leaved goldenrod (*Solidago rugosa* ssp. *rugosa*), sensitive fern, and common grass-leaved-goldenrod (*Euthamia graminifolia*) intermixed.

Wetlands W6, W7, W8, and W9 are all associated with watercourses. These wetlands receive additional flow during periods of seasonal high water, and likely during major storm events as well. W8 and W9 are along the same stream and are of similar character. The understory is dominated by herbs such as American trout-lily (*Erythronium americanum*) and cinnamon fern. The overstory of these wetlands often contains black ash (*Fraxinus nigra*), a frequent floodplain species, as well as green ash (*Fraxinus pennsylvanica*), black cherry (*Prunus serotina*), speckled alder (*Alnus incana* ssp. *rugosa*), and red maple. Wetland W7 is the most highly degraded by disturbance due to proximity to the road and a nearby residence, whereas W9 is generally undisturbed. Wetlands W7, W8, and W9 are considered WOSS under NRPA.

Figure 9-1


N
W16 extension added 5-1-19
W16
W13
W18
Field East of Stream Not Surveyed
Perkins Property
W1
W15
W17
W2
W4
W5
W8
W7
Original Project Site
W3
W10
W6
W9
Eckrote Property
W12
W11
0 125 250 500 750 Feet
Belfast Aquaculture Project
Wetland and Stream Survey
2018 Wetland Survey Date
May 3-4
July 24
August 27-28
Army Corps Data Plot
Stream Under Culvert
Drainage
Intermittent Stream
Palustrine Wetlands
Salt Marsh
Cobble Beach
NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

Wetlands W13 and W15 (W14 = W1) are small wet meadow (PEM1) depressions with vegetative character similar to the emergent portion of W1. These wetlands are relatively limited in function on account of their short hydroperiod and low diversity of wetland plants.

Wetlands 16, 17, and 18 are narrow fringes to stream S9, collectively occupying less than one tenth of an acre. These wetlands are classified as palustrine scrub-shrub (PSS1) wetlands and are dominated by speckled alder (*Alnus incana*) in the shrub layer and spotted touch-me-not (*Impatiens capensis*) in the herb layer. These wetlands provide some flood storage and shoreline stabilization on account of their proximity to the intermittent stream. Their location along the stream results in their classification as WOSS under NRPA.

Wetlands W10 and W12 are palustrine forested wetlands separated by a driveway, but hydrologically connected by an intermittent stream. These wetlands are similar in character and lie on a narrow terrace at the bottom of a deeply incised ravine. Given their small size, these wetlands contain a relatively low diversity of plants, but are dominated by black elderberry (*Sambucus canadensis*), green ash (*Fraxinus pennsylvanica*), and speckled alder (*Alnus incana*) with an understory of sensitive fern (*Onoclea sensibilis*), spotted touch-me-not (*Impatiens capensis*), and cinnamon fern (*Osmunda cinnamomea*). These wetlands are moderately disturbed on account of the adjacent road and driveway. Due to their proximity to the ocean and association with an intermittent stream, they are WOSS under NRPA.

<u>Estuarine/Marine Wetlands</u>

Wetland W11 represents the salt marsh on the Eckrote property. The salt marsh area is relatively small and limited to the mouth of the stream. It is dominated primarily by black rush (*Juncus gerardi*) at higher elevations and smooth cordgrass (*Spartina alterniflora*) at lower elevations. The adjacent beach is dominated by cobble substrate with little to no vegetation.

Table 9-1. Summary of Palustrine and Estuarine Wetlands Identified on Site

Wetland ID	Cowardin Class	Groundwater Recharge/Discharge	Floodflow Alteration	Fish/Shellfish Habitat	Sediment/Toxicant Retention	Nutrient Removal	Sediment/Shoreline Stabilization	Production Export	Wildlife Habitat	Recreation	Educate/Scientific Value	Uniqueness/Heritage	Visual Quality/Aesthetics	Endangered/Threatened Species Habitat	Wetland Description
W1	PFO	X	P	-	-	-	X	X	X	-	-	-	-	-	Coniferous overstory, highly invaded by buckthorn
W2	PFO	X	X	-	-	-	-	-	X	-	-	-	-	-	Deciduous dominated, drains off-site
W3	PFO	-	-	-	-	-	-	X	-	-	-	-	-	-	Small, marginal swale, drains into ephemeral gully off survey area
W4	PFO	X	-	-	-	-	-	-	-	-	-	-	-	-	Isolated pocket, area of standing water

Wetland ID	Cowardin Class	Groundwater Recharge/Discharge	Floodflow Alteration	Fish/Shellfish Habitat	Sediment/Toxicant Retention	Nutrient Removal	Sediment/Shoreline Stabilization	Production Export	Wildlife Habitat	Recreation	Educate/Scientific Value	Uniqueness/Heritage	Visual Quality/Aesthetics	Endangered/Threatened Species Habitat	Wetland Description
W5	PSS	X	P	-	-	-	-	X	P	-	-	-	X	-	Old field, disturbed but high plant diversity, good shrub habitat for wildlife
W6	PFO	-	P	-	X	-	X	P	X	-	-	-	-	-	Stream S7 braids through this area, wetland is broad and saturated prior to roadway
W7	PFO	-	X	-	X	X	X	P	X	-	-	-	-	-	Wetland area around stream S8
W8	PFO	-	X	-	-	-	P	X	-	-	-	-	X	-	Floodplain wetland associated with stream S9
W9	PFO	-	X	-	-	-	P	X	-	-	-	-	-	-	Small floodplain wetland
W10	PSS	X	X	-	-	-	X	-	-	-	-	-	-	-	Narrow fringe on stream S8, surrounded by development
W11	E2EM/M2US	-	-	X	-	-	P	-	X	-	-	-	X	-	Saltmarsh and cobble beach at mouth of stream S9
W12	PSS	X	X	-	-	-	X	-	-	-	-	-	-	-	Narrow fringe on stream S8, surrounded by development
W13	PEM	X	-	-	-	-	-	-	-	-	-	-	-	-	Small emergent wetland along edge of field
W15	PEM	X	-	-	-	-	-	-	-	-	-	-	-	-	Small wet meadow at headwater of stream S6
W16	PSS	X	X	-	-	-	X	-	-	-	-	-	-	-	Floodplain along stream S9
W17	PSS	X	X	-	-	-	X	-	-	-	-	-	-	-	Narrow wetland fringe along stream S9
W18	PSS	X	X	-	-	-	X	-	-	-	-	-	-	-	Narrow wetland fringe along stream S9

* Functional Assessment Qualitative Assessment Categories: P=Principal Function/Value; X=Suitable Function/Value.

†Cowardin Class: PSS = Palustrine (freshwater) Scrub-Shrub; PFO = Palustrine Forested

Streams and Drainages

Based on NRPA criteria, drainage features D1, D2, D3, D4, D6 and D7 are not jurisdictional as they do not have a defined bed and bank. These drainages are the result of stormwater runoff that result in short periods of flow and do not meet the criteria to be jurisdictional. These drainages are typically characterized by no channelization, organic matter in the streambed, and often little or no flowing water during a time of the year when flows are at or near their seasonal peak. Features S3, S6, S8 and S9, and have been determined to be jurisdictional streams as they exhibit at least two of the required criteria.

Site observations did not provide sufficient information to make a jurisdictional determination for drainage features S5 and S10 (**Table 9-2**). In January and February S5 had ice in the channel bed, but it is unclear whether there is continuous flow for six months. S10 did not contain water during August and appears to lack sufficient depth to maintain flow for six continuous months. These two features will require further flow observations and aquatic surveys in the appropriate season to verify jurisdiction. Until that time we have assumed that S5 and S10 are NRPA jurisdictional streams and are included in reported impact numbers.

Table 9-2. NRPA Criteria for Drainages within the Project Area

Stream/ Drainage ID	Defined Bed and Bank	Blue Line on USGS Map	Continuous flow for at least 6 months*	Channel bed composed of mineral material	Aquatic Animals	Aquatic Vegetation	NRPA Jurisdiction
D1	N	N/A					No
D2	N	N/A					No
D3	N	N/A					No
S3	Y	N	Y (May, Jul, Aug, Dec, Jan, Feb)	Y	N/A	N	Yes
D4	N	N	N	N	N	N	No
S5	Y	N	? (Dec, Jan, Feb)	Y	?	N	Maybe
D6	N	N/A					No
S6	Y	N	Y (May, Jul, Aug, Dec, Jan, Feb)	Y	N/A	N	Yes
D7	N	N/A					No
S8	Y	N	Y (May, Jul, Aug, Dec, Jan, Feb)	Y	N/A	N	Yes
S9	Y	Y	Y (May, July, Aug)	Y	N/A	N	Yes
S10	Y	N	? (Aug, Feb)	Y	?	N	Maybe

Jurisdictional streams within the study area commonly provide functions that include groundwater discharge. The intermittent streams on site are also suitable habitat for wetland-associated wildlife species including stream-breeding salamanders and aquatic invertebrates. See **Table 9-3** for a brief summary of features assessed for function on the project site.

Table 9-3. Summary of Functions for Jurisdictional Drainage Features Identified on Site

Feature ID	Flow Regime	Flow Observations	Dominant Bed Composition	Average Width (feet)	Average Depth (inches)	Functions
S3	Intermittent	Low	Sand, silt	4	2	Groundwater Recharge/Discharge, Floodflow Alteration, Wildlife Habitat
S5	Intermittent	Low	Silt, clay	4	2	Floodflow Alteration
S6	Intermittent	Low	Silt, cobbles	3	2	Groundwater Recharge/Discharge, Floodflow Alteration, Wildlife Habitat
S8	Intermittent	Moderate	Silt, clay	5	4	Groundwater Recharge/Discharge, Floodflow Alteration, Wildlife Habitat
S9	Intermittent	Moderate	Silt, clay, cobbles	7	6	Groundwater Recharge/Discharge, Floodflow Alteration, Wildlife Habitat
S10	Intermittent	Dry	Silt, clay	2	1	Floodflow Alteration

Vernal Pools

An initial vernal pool survey conducted on May 3, 2018 located areas of standing water in wetland W1 and W3 that appeared suitable for vernal pool obligate species, although none were observed during this visit. Upon the return visit to the site on May 18, 2018, these areas remained saturated, however the water table had dropped below the soil surface and therefore did not provide for any suitably habitat for amphibian breeding areas. This site does not appear to possess surface water for a sufficient time in the appropriate season to support viable vernal pool habitat. Vernal pool surveys were not conducted on the sites reviewed on July 24, August 27 and 28, or May 1, 2019; however, no potential vernal pools were identified during those surveys.

9.1.3 Impacts to Wetlands, Streams and Vernal Pools

Wetlands

The proposed project will result in direct alteration of about 4 acres (174,713 square feet (SF) of wetland (**Table 9-4**). A site plan showing the wetland and stream impacts, along with other resource boundaries is shown in **Attachment 5, Appendix 5-A**. Freshwater Wetlands W1, W2, W3, W4, W5, W6, W13, and W15 will be directly impacted by the proposed project. There will also be direct, temporary impacts to wetland W11, a coastal wetland, and temporary impacts to the freshwater wetland W16. Additionally, Wetlands W8, W9, and W12 will have impacts within the 75 foot regulated buffer. None of the directly impacted freshwater wetlands meet the criteria for wetland of special significance. Impacts to the upland buffers adjacent to wetlands W8 and W9 are limited to the construction of a road at the crossing of stream S9. The majority of impacts to upland buffers are within previously developed locations.

Wetlands W1, W3, W4, W13, and W15 will cease to perform wetland functions and values due to the Project. Wetland W2 will have a significant (approximately 66%) reduction in area as a result of the project, but will continue to perform the identified functions and values proportional to its reduced size. Wetland W5 will have a 75% reduction in area as a result of the project and will still be suitable for floodflow alteration and wildlife habitat but no longer will do so in a principal manner. This wetland will no longer be suitable for the visual quality value. Wetland W6 will experience an approximately 66% reduction in size as a result of the project. This wetland will no longer perform floodflow alteration and production export principally but will generally continue to function proportionally to the available area. Impacts to wetlands have been considered in the development of the mitigation package proposed in **Attachment 13.**

Table 9-4. Impacts to Wetland Resources by the Project

Wetland ID	[1]Temporary Impacts (SF)	Permanent Impacts (SF)	Impact Total (SF)	Impact Characterization
W1	0	115,674	115,674	Direct, Fill
W2	0	24,612	24,612	Direct, Fill
W3	0	5,057	5,057	Direct, Fill
W4	0	692	692	Direct, Fill
W5	0	18,672	18,672	Direct, Fill
W6	1,766	3,120	4,886	Direct, Fill
[2]W11	2,611	0	2,611	Direct, Excavation
W13	0	556	556	Direct, Fill
W15	0	708	708	Direct, Fill
W16	1,245	0	1,245	Direct, Excavation
Totals	5,622	169,091	174,713	

1 All temporary impacts are restored in place

2 W11 consists of 2,125 SF of temporary impact to Salt Marsh and 486 SF of temporary impact to Cobble Beach

Streams

There will be a total of 1,325 linear feet (LF) of impacts to streams within the project area (**Table 9-5**). Streams S3, S5, S6, and S9 will be indirectly impacted by the project. Impacts to stream S9 will be limited to a permanent crossing located between wetlands W8 and W9, along with a temporary crossing during the installation of the force main sewer line. The permanent crossing will be constructed in such a manner to not impair flow during storm events. The upper reaches of streams S3, S5, and S6 will be filled as a result of this project. These filled streams will result in the loss of 1,180 LF of stream bed. Impacts to these streams will typically result in the loss of Groundwater Recharge/Discharge, Floodflow Alteration, and Wildlife Habitats in these locations.

Table 9-5. Direct Impacts to Stream Resources by the Project

Stream ID	[1]Temporary Impacts (LF.)	Permanent Impacts (LF)	Impact Total (LF)	Impact Characterization
S3	0	635	635	Direct, Fill
S5	0	459	459	Direct, Fill
S6	0	86	86	Direct, Fill
S9	145	0	145	Direct, Temporary Culvert and Excavation
Totals	145	1,180	1,325	

1 All temporary impacts are restored in place

Vernal Pools

No vernal pools were identified on the site, so there will be no impacts to vernal pools as a result of this project.

Conclusion

The project as proposed will have temporary and permanent impacts to wetlands and streams. No vernal pools are present on Site, thus no vernal pool impacts will occur. Impacts to WOSS have been mostly avoided and the largest stream (S9) has been avoided with exception of a sewer force main and access road crossing. The roadway crossing of S9 will utilize an open bottom culvert that spans the width of the banks. To avoid impact to S9 for the roadway crossing, a crossing location was chosen approximately midway between wetlands W8 and W9 at a point where the stream channel is relatively narrow (average width = 6.67’). To accommodate 1.2 times bank-full width (1.2 x 6.67’ = 8’) and minimize and avoid impact to the stream an approximately 65 foot long culvert is proposed. The culvert will be open-bottom and allow the existing stream profile to remain unaffected while avoiding constriction of the upstream floodplain. Large-block retaining walls are utilized to further reduce impact to up- and downstream areas. Unavoidable impacts have been minimized through the use of side slope grading using 2:1 or 1.5:1 slopes adjacent to wetlands where practicable. Temporary impacts to salt marsh and cobble beach as a result of installing the intake and discharge pipes will be restored in place. Temporary impacts to wetlands and streams resulting from the Route 1 by-pass during construction and the installation of the sewer main will also be restored. Wetland and stream restoration plans have been developed and are provided as part of the mitigation program outlined in **Attachment 13**. All permanent impacts will be mitigated through participation in the in-lieu-fee program, riparian habitat restoration, culvert repairs to improve aquatic passage and deed restrictions on riparian buffers.

9.2 Wildlife

The proposed Nordic Aquaculture project site was evaluated for wildlife and habitat resources via a desktop review of existing information, including reviewing aerial photography (Google Earth), a timber inventory conducted on-site in 2019, e-Bird data, and other publicly available data regarding species distribution from the MDIFW and Maine Department of Environmental Protection (MEDEP), two field visits, and a project review response from MDIFW dated March 11, 2019 (**Appendix 9-A**). The field visit was conducted on the upland parcels on December 12, 2018 and evaluated general wildlife habitat value and potential listed-species habitat. The visit was conducted midday under good weather conditions that included ideal snow cover conditions for tracking.

The desktop evaluation, augmented by a site visit on March 26, 2019, also considered the intertidal portion of Belfast Bay which will be impacted by the intake and outfall pipes. This area is included in the wildlife evaluations because it is designated as Tidal Waterfowl and Wading Bird Habitat (TWWH), which is a regulated Significant Wildlife Habitat under Maine's Natural Resources Protection Act. The desktop sources cited above as well as information collected during the benthic studies conducted for the project were considered for this portion of the evaluation.

9.2.1 Habitat Available

As indicated by review of aerial photography, the proposed project site is similar to the surrounding landscape in natural land cover and amount of human development and activity. Due to high proportion of natural and semi-natural cover types and small amount of developed area, the site is expected to provide good general wildlife habitat for most if not all of the common wildlife species that use the habitats that are present on-site.

Terrestrial Habitats

As detailed in the 2019 timber inventory (CLT, Inc. 2019), and confirmed during the on-site habitat review, the project site consists of level, open fields, and forestland that gradually slopes southward towards Belfast Reservoir Number One. The forest stands are either hardwood (±19 acres) or pine (±15 acres) dominated. Stand age and condition, and remnant barb wire fence on site suggests that the forested areas of the property were previously cleared for farm fields or pasture. Portions of the forested stands appear to have been recently selectively harvested. In the hardwood stand, the cover is dominated by red oak with lesser amounts of red maple, bigtooth aspen, and eastern white pine, as well as small components of six other species (paper birch, sugar maple, eastern hemlock, red spruce, yellow birch, balsam fir). The pine stands are dominated by eastern white pine with lesser amounts of paper birch, balsam fir, red maple, and bigtooth aspen, and a small component of American beech and northern white cedar. The variety of hard and softwood species provides multiple sources of food for wildlife, including acorns, other seeds, and browse, as well as shelter. Some smaller snags are present, and a few larger trees have hollows, but due to the young age of the stands, these features are not abundant.

The field habitat on-site appears to be regularly mowed for hay, which reduces its value for wildlife habitat. However, regularly mowed hayfields do provide habitat for snakes and frogs in summer, and for certain small mammal and bird species year round. The species of bird most likely to use hayfields varies with the season, the height of the vegetation and the mowing regime.

Wetland Habitats

As detailed in **Section 9.1**, the project site supports some wetland habitats, as well as intermittent streams. Due to the soils present on-site, which are predominately silt loam, these wetland and stream habitats have a minimal hydroperiod, limiting their value to wetland-dependent wildlife species that require more constant levels of inundation. However, the intermittent streams on-site do provide some suitable habitat for wetland-associated wildlife species adapted to a limited hydroperiod, including certain stream-breeding salamanders, discussed below, and aquatic invertebrates.

Significant Wildlife Habitats

Two types of NRPA-designated Significant Wildlife Habitat are present in the project area, Inland Waterfowl/Wading Bird Habitat (IWWH), and Tidal Waterfowl and Wading Bird Habitat (TWWH). Although only Reservoir Number Two was designated as IWWH in MDIFW's project review (**Appendix 9-A**), the Maine Natural Areas Program map of the habitat resources in Belfast (**Appendix 9-A**) designates both Reservoir Number One and Number Two as IWWH.

Additionally, the intake and outfall pipes cross and area designated as TWWH. Both of these habitat areas are discussed in greater detail below.

9.2.2 General Wildlife

As noted above, the habitat present in the project site is suitable for a wide variety of species that occur in this region of Maine.

Reptiles and Amphibians

Seasonal conditions during the site visit were not suitable for observing reptiles or amphibians. However, the species potentially present (**Appendix 9-B**) can be estimated based on known distributions and the type of habitat available within the project site. Turtles are not expected to use the site due to the lack of wetland habitats, and turtles that may use the adjacent reservoir are unlikely to use the site as nesting habitat due to the soils and generally wooded, shaded conditions. Likewise, shaded forest habitats are less preferred by the snake species with a known range that coincide with the project site, except for the common garter snake, which is expected to be present throughout the site. Milk, ringneck and northern red-bellied snakes may also be present but would most likely be restricted to forest edges and the field habitats. Because there are no open water wetlands or vernal pools present on the parcel, the potential amphibian species are the northern red-back salamander, a forest-dwelling species which does not require water to breed, and those species adapted to a limited hydroperiod and/or which may have suitable breeding habitat in adjacent areas and that are capable of traveling widely during the non-breeding season, including eastern newt, northern two-lined salamander, and American toad.

Birds

A project-specific avian survey was not conducted. However, bird records from the Little River Hiking Trail (LRT), located immediately south of the site have been submitted to e-Bird (https://ebird.org/hotspot/L4691557) since 2016, and records from the Perkins Road fields (PRF), just to the north of the site, have been submitted since 2013 (https://ebird.org/hotspot/L1440286). The habitat surrounding the LRT is essentially the same as the forest habitat on-site, and the on-site field habitat is contiguous to hayfields on Perkins Road. Therefore, the records from these two locations provide a good indication of the species likely to be present at the project site and are listed in Appendix 9-B. Species from the LRT that are strictly associated with water (the reservoir) are not included in this list. Also note that species that prefer larger fields (e.g., bobolink, savannah sparrow), or that are commonly associated with buildings/human activity (e.g., European starling, house sparrow) are less likely to be present on-site, as the field is smaller than the adjacent hayfield, and has no houses/buildings.

Based on e-bird reports, the species expected to use the TWWH within the project area include all of the common duck and shorebird bird species that occur in this region of Maine. Shorebirds commonly use the Maine shoreline as stopover and feeding habitat during migration, especially during mid- and late summer, while ducks primarily use it as overwintering habitat. Species that have been reported to e-bird from Belfast are listed in **Appendix 9-B**; the duck species listed are specifically reported from the mouth of the Little River while the shorebirds are from the greater Belfast Bay area. During the March 26 site visit to the tidal zone at the mouth of the Little River, large numbers (hundreds) of mallards were observed loafing in the area; smaller numbers (< 10 each) of bufflehead, common goldeneye, and merganser spp. were also observed actively feeding in the intertidal and subtidal shallows.

Mammals

Conditions during the site visit were ideal for tracking, and track and sign of eight mammal species were observed in the forested portion of the site, including white-tailed deer, red fox, coyote, fisher, grey squirrel, red squirrel, deer mouse, and porcupine. Based on the timing of the last snowfall, most tracks were less than 24 hours old. Deer, red squirrel, and porcupine sign were common, but not abundant, scattered throughout the parcel, and included scat as well as tracks, sign of feeding, and an actively-used porcupine den located under the overhang of the S3 stream. Tracks for the predator species were less abundant, but relatively wide ranging across the parcel. Deer may feed in the field portion of the site, especially in spring. Mice, voles, and shrews likely use this habitat year-round, and coyote and fox in turn hunt for these small mammals in the field on occasion, throughout the year.

In addition to the species with sign observed on-site, a variety of other mammals that are common in this region of Maine potentially use the habitats on-site, and these species are listed in **Appendix 9-B**.

9.2.3 Special Status Species and Significant Wildlife Habitat

For the purposes of this discussion, special status species include those listed by the State of Maine as Species of Special Concern (SC), threatened (ST), or endangered (SE), as well as species federally listed as threatened or endangered (FT, FE).

Invertebrates

Based on known distribution and habitat preferences of Maine’s special status invertebrate species, none of these species are expected to be present within the project site.

Reptiles and Amphibians

Based on known distribution and habitat preferences of Maine’s special status reptile and amphibian species, none of these species are expected to use habitats within the project site.

Birds

Eight of the 56 terrestrial species that likely use the on-site habitats, based on their habitat preferences and e-bird records, are listed as Species of Special Concern by the State of Maine, and five are designated as Species of Greatest Conservation Need (SGCN). None are listed as State or federally threatened or endangered. Eleven of these 13 special status species are long-distance migrants that spend the winters in Central or South America and their summers in northern latitudes. The wood warblers (American redstart, northern parula, black and white, chestnut-sided, black-throated green, and black-throated blue warblers) depend on upland forest habitats for feeding and breeding, as does the eastern wood-pewee, while the veery uses understory thickets associated with water courses and surrounding uplands, and bobolinks and barn swallows use open fields. The two short-distance migrants, the purple finch and white-throated sparrow, use a variety of edge and wooded habitats. All 13 species are likely to use the site during migration and have at least some potential to nest on the site.

Three of the 21 water bird species with a high likelihood of using the TWWH associated with the intake and outfall pipes, based on e-bird records, are listed as SC (greater scaup, lesser yellowlegs, semipalmated plover), and four additional species are designated as SGCNs (common eider, least sandpiper, long-tailed duck, semipalmated sandpiper). None are listed as State or federally threatened or endangered. The shore birds would use the mudflats of the TWWH as feeding and loafing habitat, and are most likely to be present during migration, especially in late summer. Waterfowl would use the mudflats and submerged areas of the TWWH as feeding and loafing habitat and are most likely to be present during the late fall through early spring period.

Mammals

All of Maine's eight bat species are listed, and based on known distribution and the habitat available, all have some potential to be present during the summer. There are no known hibernacula on or near the project site. The forest cover on-site provides ample summer roosting habitat for the foliage-roosting species (eastern red, hoary, and silver-haired bat, all listed as SC) as well as the northern long-eared bat (SE, FT), which roosts under loose bark and tree trunk crevices and hollows. Structures on-site and nearby provide potential summer roosting habitat for little brown bats (SE) and big brown bats (SC), and forest edges and the nearby reservoir provide suitable feeding areas for all these species as well as the eastern small-footed bat (ST). There are no known maternity roosts on or near the project site. No other listed mammals are expected to be present (**Appendix 9-B**).

Significant Wildlife Habitats

The MNAP mapping which designates Reservoir Number One as IWWH includes the reservoir itself, as well as the shores. Forest cover is generally present right up to the shoreline, which is also relatively steep, and there is no shoreline emergent vegetation to provide cover. All these attributes make the shore low value habitat for inland waterfowl and wading birds. The reservoir itself does provide some opportunity for these species to loaf or feed, especially ducks, which e-bird records indicate are observed on the reservoir in moderate numbers during migration, especially in the spring.

The MDIFW Priority Habitats mapping (**Appendix 9-A**) suggests that the designated TWWH extends out to the -10 ft elevation contour, making the TWWH within the project footprint part of a substantially larger intertidal area that extends roughly from the mouth of the Little River southwards for about ¾ of a mile to Browns Head, a Point on the Northport, ME shoreline. TWWH provides feeding habitat for waterfowl and wading bird species, generally intertidal mudflats, eelgrass and mussel beds where they can forage for aquatic invertebrates. The intertidal area within the project footprint is a mix of cobbly and firm (sandflat) substrates and does not support any mussels, eelgrass, or shellfish beds.

9.2.4 Impact Assessment

In the upland portion of the project site, the project will essentially remove all natural habitats within the development, as the project footprint will consume approximately 38 acres of the approximately 54 acre site. The project will also temporarily impact about 52,000 SF of the intertidal zone that is designated as TWWH. Impacts to the resources affected by the development footprint are discussed below.

Reptiles and Amphibians

The proposed project will render the site essentially unsuitable for reptiles and amphibians, and construction activities may cause direct mortality of individuals of low mobility species living onsite. However, the project should have little to no effect on the overall populations of reptiles and amphibian species in the surrounding area. The site does not provide breeding habitat, or other habitat resources that are not also available in the surrounding area.

Birds

If tree removal takes place outside of the nesting season, construction of the project is unlikely to cause any direct mortality to birds, as they are highly mobile. The proposed project will however render the site essentially unsuitable for birds that depend on unaltered habitats and will remove suitable nesting habitat from the landscape for a variety of species. However, the resources available in the project area are not unique, and the loss of these resources should have only a very minor effect on the bird populations in the area. A few species that are well adapted to living in human altered environment, including house sparrow, European starling, and rock pigeon may benefit from the habitat created by the project.

Mammals

The proposed project will render the site essentially unsuitable for mammals that depend on unaltered habitats and will remove food and cover resources from the landscape for these species. Construction activities may cause direct mortality of individuals of low mobility species living onsite. However, the resources available in the project area are not unique, and the loss of some individual animals and on-site resources should have a minimal effect on mammal populations in the surrounding area.

Listed Species

Impacts to listed birds and bats will be the same as described above by species group. For both taxa, the loss of habitat within the project footprint is relatively insignificant in the context of the amount of habitat remaining in the surrounding landscape and the displacement of individual animals is not expected to have a significant effect on the populations of these species as a whole. Maine statutes do not require special considerations for SC species, and protective measures for state and federally listed bats are only required if known maternity roosts or hibernacula will be impacted by a project. These habitat features are not known to be present on or near the project site.

Significant Wildlife Habitats

No impacts to the IWWH habitat present in Reservoir Number One are expected as a result of the project. The reservoir is buffered from the project site by mature trees, minimizing disturbance impacts. At this time, the only in-water work in inland waters is expected to occur in association with freshwater withdrawal from Reservoir One. This withdrawal will comply with Chapter 587: In Stream flows and lake and pond water levels. The project design will also maintain flow in the streams that currently drain from the site into the reservoir, so there will be no change in the hydrology the supports the habitat resources currently present.

Temporary impacts will occur to a limited area of TWWH as a result of the project. The water intake and outfall pipes that cross TWWH will be buried by digging an open trench, placing the pipes, and backfilling the trench. Construction is proposed for November and December of 2019, and activities will take place when low tides expose the work zone during daylight hours. During the construction process, about 52,000 SF of designated TWWH will be temporarily impacted in the area to be trenched by activities such as the physical disturbance of the trench itself, spoil piles, and staged equipment. These temporary impacts and will affect less than 1% of the designated TWWH in the cove, and the intertidal area that will be impacted by the project does not support habitat features that typically provided the highest quality foraging opportunities for sea ducks and shorebirds. However, the disturbance created by the preconstruction and construction activities involves heavy equipment (multiple excavators, cranes and/or barges) and possibly hoe ramming or blasting if ledge is encountered. The open intertidal landscape provides no visual or noise buffers, and during periods of active construction, the construction zone, as well as the surrounding area will likely be completely avoided by over-wintering waterfowl.

Conclusion

Both temporary and permanent impacts to the wildlife habitat within the project footprint will occur due to construction and operation of the Nordic Aquafarms facility. The temporary impacts, including general disturbance and the disruption of a small portion of the TWWH area, will be short-term and occur only during construction. Construction related disturbance will cease when construction is complete. The disturbed TWWH area is expected to recover to pre-construction conditions within 6 to 8 months, and this impact is not expected to have a significant effect on habitat quality or the species that use it.

The permanent impacts consist of a loss of about 35 acres of terrestrial wildlife habitat, and construction activities may cause some direct mortality of individuals of low mobility species (i.e., reptiles, amphibians, small mammals) that may be present onsite. However, the project should have little to no effect on the overall wildlife populations in the surrounding area. The habitat resources that will be lost to the project footprint are not unique to the area, and the individuals lost are only a very small portion of the wildlife populations in the surrounding area. Additionally, the proposed restoration plan for the S9 stream corridor will provide some improved habitat for a variety of species.

9.3 Fisheries

The proposed site for the Nordic Aquaculture project was evaluated for fisheries habitat resources via a desktop review of existing information, as well as field surveys conducted by Normandeau Associates in 2018. In addition to a literature review, a habitat characterization survey was conducted by towing a diver and a camera along the proposed pipeline route. Also, water quality data were collected to assess the existing ambient conditions at various locations where in-water structures are proposed. MDIFW and the Maine Department of Marine Resources (MDMR) were both consulted for guidance on species of interest as well as suggestions regarding potential impact mitigation strategies.

During analysis, the specific engineering characteristics, and construction plan of the proposed project were used to help determine the potential impact to each species. Impacts were characterized as temporary if they would only exist due to construction activities, or permanent if the impact would continue after construction was finished and facility operation continued.

9.3.1 Habitat Available

Freshwater Habitat

The potential freshwater habitat on or adjacent to the site consists of one reservoir and several intermittent streams. The streams are mainly avenues for water to drain from upland areas during significant rain events. They do not stay watered for enough of the year to present a significant potential habitat for fisheries.

The reservoir, “Belfast Reservoir Number One” is a ponded section between two dams on the Little River. The reservoir does provide adequate habitat for some freshwater species, however there were no specific reservoir species recommended for impact assessment by the state. In order to prevent impact to this water body, erosion and sedimentation control measures will be implemented during Project construction, as outlined in **Attachment 8**, and permanent vegetative buffers will be maintained between the reservoir and the Site. Vegetative buffers will include a 250-foot shoreland zone, measured from the mean high water mark, on the project site of the reservoir with the exception of the areas where the water district office building is currently located. This shoreland buffer is located outside of the Site boundary, but ownership will be maintained by the City of Belfast. The existing water district building will be converted into a visitor center, with access roads and parking added in the area that is closer than 250 feet from the reservoir.

Surface water withdrawal from Belfast Reservoir Number One, through existing intake infrastructure located at the dam is proposed to meet project freshwater needs. The withdrawal will comply with Chapter 587: In stream flows and lake and pond water levels. The reservoir is positioned uniquely, as discharge from this water body flows directly into a tidal inlet of Belfast Bay. Due to this characteristic, minimum instream flows do not apply below the reservoirs lower dam. The rules set forth in **MEDEP Chapter 587** allow a maximum withdrawal from a surface water body such as the Lower Reservoir, even in the absence of inflow, of up to 1.0 acre-feet of water per acre of the waterbody at normal high water between April 1 and July 31, and up to 2.0 acre-feet of water per acre of the waterbody at normal high water from August 1 to March 31 during any given year. The Chapter 587 rules also allow for any surplus water demonstrated to have been delivered to the Lower Reservoir beyond the maximum acre-foot withdrawals to be included in the overall withdrawal. If any work should be required for this project within waters considered to be inland fisheries habitat, an in-water work window of July 15th to October 1st will be observed, as requested by MDIFW. At this time, no changes to the existing intake pipe are proposed, so no freshwater work is expected.

<u>Marine Habitat</u>

Other than the first short distance from shore, the marine portion of the proposed path of the intake and discharge pipes contains habitat that is very homogenous. Upon review of the underwater video recorded by Normandeau Associates in August 2018, the most predominant habitat within the subtidal area is fine grain sandy, silty, muddy substrate mixed in with relatively small cobble, and almost no vegetation. Additionally, circular depressions in the seafloor are quite abundant in the bay. These depressions are referred to as “Pockmarks”, they are an unusual geological feature that occurs worldwide as described in Fandel 2013[3]. These pockmarks are formed primarily by the escape of methane gas through the estuarine sediment, which displaces the substrate thereby forming the pockmarks. Pockmark size ranges from 1 m to greater than 1 kilometer in diameter. These pockmarks will be avoided in the path of the pipes due to the added difficulty of installing pipe across these features. Under the proposed design, the terminus of the pipes will be located closer to shore than any of the major pockmarks that occur in the bay. The pockmarks are recorded in the bathymetric survey completed by Normandeau in 2018 (see **Attachment 12 -** Natural Resource Report) and shown on plan **CS-101**.

In the closest section to shore, in the subtidal area, there are some small patches of vegetation that could be used as viable habitat for a variety of finfish or shellfish species. Vegetation consisted of common intertidal and shallow subtidal species. Two Fucaceae species: Bladderwrack (*Fucus vesiculosus*) and *Ascophyllum nodosum*, were observed, as well one rhodophyte species identified to be Irish Moss (*Chondrus crispus*). Also present are smaller amounts of some larger diameter substrates including cobble, boulders, and shells. These small patches of vegetation did not represent a substantial portion of the proposed construction area.

[3] Fandel, C. L. 2013. Observations of Pockmark Flow Structure in Belfast Bay, Maine. Thesis. Submitted to the University of New Hampshire

Fishes, crabs, sea stars, and shellfish were not very prevalent in the video, but it is likely some of the mobile organisms detected the towed camera and boat, moving from the visual field. This indicates that the majority of the seafloor life is likely to temporarily relocate on its own and presumably re-colonize the area post-construction. Mobile organisms will likely recolonize the area post-construction. Sessile organisms will begin recolonization after the first spawning season post-construction. Wilber and Clarke (2007)[4] found that recovery time in dredged channels generally ranged from one to six months although in some cases it was more than one year. Recovery was ascribed to immigration by adults and/or settlement of larvae. Where larval settlement was the primary mechanism, timing of the disturbance relative to the natural reproductive cycles locally would affect the duration of time needed for recovery.

9.3.2 Finfish

MDIFW did not request impact assessment for any freshwater species which might be found in Reservoir One. Maine DMR recommended impact assessment for five species of finfish which use the marine habitat. Those species are American eel (*Anguilla rostrata*), alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), winter flounder (*Pseudopleuronectes americanus*), and rainbow smelt (*Osmerus mordax*). In this document, the two herring species will be combined into a single assessment for "river herring" as they are generally grouped.

For the project area, MDMR asked that American eel impact analysis be focused on the "elver" lifestage as this is the stage during which eels attempt to migrate up into freshwater. After being spawned in the Sargasso Sea, leptocephalus larvae drift at sea for up to a year and are transported north by the Gulf Stream. Leptocephali larvae metamorphose into early unpigmented juveniles called glass eels as they approach the North American coast at 60-65 mm in length. Collette and Klein-MacPhee (2002)[5] describe that during this metamorphosis the body changes into a cylindrical form, alteration in head and jaw aspects occur, and the digestive tract becomes functional. Glass eels appear in southern New England in March at 50-90 mm in length. They migrate upstream primarily at night into freshwater where they feed, become pigmented (elvers), and slowly grow until sexually mature, which can take up to 20 years. However, they may reach maturity as small as 28-30 mm long for males and 45 mm for females. Glass eels and elvers use a wide range of temperatures, burrow into sand, mud, snags, plant masses and other bottom types during the day and in between upstream movements and have been reported in salinities from 0 to 25 ppt according to Greene et al. (2009)[6]. Although there is not currently upstream passage infrastructure in place at the dams on the Little River in Belfast, young eels could still be present as they are known to be able to climb nearly vertical wetted structures to get upstream. Due to the depth and placement of the intake, it is unlikely that the proposed project would have a significant impact on elvers because they will already be developed swimmers and able to avoid getting sucked into the intake.

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[4] Wilber, DH and DG Clarke. 2007. Defining and Assessing Benthic Recovery Following Dredging and Dredged material Disposal. Proceedings of the 2007 Dredging Summit and Expos, Western Dredging Association. Pp. 603-618

[5] Collette, B.B. and G.K. Klein-MacPhee, Eds. 2002. Bigelow and Schroeder's Fishes of the Gulf of Maine, 3rd edition. Smithsonian Institution Press, 748 pp.

[6] Greene, K.E., J.L. Zimmerman,R.W. Laney, and J.C. Thomas-Blate. 2009. Atlantic coast diadromous fish habitat: A review of utilization, threats, recommendations for conservation, and research needs. ASMFC Habitat Management Series #9. 463 pp.

Bigelow and Schroeder (1953)[7], Cooper (1961)[8], Collette and Klein-MacPhee (2002)[5] describe that alewife and blueback herring are very similar anadromous, euryhaline, coastal, pelagic fish that are difficult to distinguish from one another and occur in similar habitat. Since it is difficult to visually distinguish between the two species, they are often considered together under the name "river herring". Bigelow and Schroeder (1953)[7] states that spawning occurs in these species in late April to mid-May in Maine. This means that in the spring, adults could be moving through the project area on their way to the mouth of the Penobscot River. After spawning, adults return to sea while young-of-year remain in fresh water for several months before gradually descending to the ocean. Juveniles tend to immigrate in waves as early as June and as late as October. As the egg and larval stages only occur in freshwater, those juveniles which could exist in the project area on their way to the ocean will already be developed enough to be unaffected by the operation of the intake. Additionally, the in-water work window will ensure that migrating individuals will not be injured during construction.

Winter flounder come inshore during late winter and early spring to spawn and adults move offshore following spawning according to Pereira et al. (1999)[9]. Winter flounder eggs are both demersal and adhesive. They are laid in masses and stay on the seafloor during incubation. The incubation period is temperature dependant and typically lasts 2 to 3 weeks. When larvae emerge, they are planktonic, drifting in open water, but remaining close to the coves or inshore waters which they use as nursery habitat. They quickly become demersal as the metamorphosis from an upright swimming fish to a flat fish begins. Juveniles settle in shallow water and estuaries in very high densities. Some reports suggest that recently settled groups of young-of-year winter flounder can exceed densities of 1 individual per square meter. It is thought that most juvenile individuals overwinter in estuaries, but some are documented to do so offshore. In the Gulf of Maine adults spawn from February through May, later than in more southern portions of the range. Additionally, spawning can occur in water shallower than 5 m in the Gulf of Maine. Spawning substrate and depth can be quite variable, but sandy substrate seems to be slightly preferred. Eggs are generally deposited in 90 m of water or less, often being as shallow as just a couple meters. Additionally, it is thought that spawning adults tend to choose to release eggs in areas with minimal flow to prevent recently hatched larvae from drifting far from suitable nursery habitat. The project area, with its mainly soft bottom, would likely be suitable habitat for the Winter flounder spawning and nursery habitat. As this species spawns during the proposed in-water work window, the project may disturb some spawning individuals. However, the projects footprint is not very large when compared to the whole of Belfast Bay, so individuals should be able to flee and still spawn in adjacent equivalent habitat during construction. After the facility begins operation it is possible that some eggs and larvae would get sucked into the intake and lost via the intake filtration process.

As described by Carlander (1969)[10], and Scott and Crossman (1973)[11], Rainbow smelt are schooling, pelagic fish that occupy inshore coastal waters. In spring, typically March-May in New England, they undertake significant migrations leaving coastal waters and traveling to freshwater streams to spawn

[7] Bigelow, H.B., and W.C. Schroeder. 1953. Fishes of the Gulf of Maine. Fishery Bulletin 53: 1-577.
[8] Cooper, R.A. 1961. Early life history and spawning migration of the alewife, Alosa pseudoharengus. Master's thesis. University of Rhode Island, Kingston, Rhode Island.
[9] Pereira, J. J., Goldberg, R., Ziskowski, J. J., Berrien, P. L., Morse, W. W., and Johnson, D. L. 1999. Essential Fish Habitat Source Document: Winter Flounder, Pseudopleuronectes americanus, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-138. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center.
[10] Carlander, K.D. 1969. Handbook of Freshwater Fishery Biology.Volume One. The Iowa State University Press, Ames, Iowa. 752p.
[11] Scott, W.B. and E.J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada. Bulletin 184. 966p.

above the head of tide. Spawning rainbow smelt that come inshore during spawning season do have the potential to have their migration to upriver spawning areas affected by the project. If individuals come inshore in March, they may come into contact with construction activities. Although spawning occurs in freshwater, after hatching, larvae drift quickly to estuarine waters, making it possible for larvae to occur in the project area. This will likely not be an issue during construction because eggs will not drift into the project area until after the end of the in-water work window.   However, once the facility begins operating, larval Rainbow Smelt may be impacted by the intake. Rainbow smelt serve as important forage for a wide variety of important predator species in the Gulf of Maine, which suggests that loss of individuals of this species could effect other species in the bay which use it as forage.

9.3.3 Shellfish

MDMR recommended impact assessment for four species of shellfish. Those species are American lobster (*Homarus americanus*), Atlantic sea scallop (*Placopecten magellanicus*), blue mussel (*Mytilus edulis*), and softshell clam (*Mya arenaria*). According to MDMR, softshell clams are mapped and known to be present in the area of the proposed project's intake and discharge pipelines. There is one blue mussel farming lease approximately 2 miles from the project area. Although blue mussels are not mapped by MDMR in the immediate project area, it is possible that they would use this habitat.

MacKenzie and Moring (1985)[12] describes that the American lobster uses a wide variety of substrate. Additionally, Chang et al. (2010)[13] discusses the many habitat variables which are correlated with the presence or absence of lobsters at various size classes and life stages. Although no lobsters or burrows were observed during the pipeline habitat survey conducted by Normandeau Associates, the literature suggests that the project area could be suitable for some life stages of this species. As eggs of this species hatch from May to October, it is not expected that the in-water construction will significantly impact lobster in the project area. Individuals present during the November 1st through April 1st in-water construction window are most likely to be fully or nearly fully developed, making them mobile enough to self-relocate to a safe distance from construction activities. After the facility begins operating its seawater intake, it is possible there will be impacts to the early planktonic larval stages.

Hart and Chute (2004)[14] describes the life history of the Atlantic sea scallop. An individual can produce up to 270 million eggs over a lifetime. After eggs are fertilized, they are slightly denser than seawater and remain on the seafloor until they develop into free-swimming larvae.   Sea Scallops are pelagic for their first two larval stages, remaining planktonic and drifting with currents as they begin to develop the shell, eye spots, and foot. At the end of the larval pelagic period, Sea Scallops begin their pediveliger stage in which they descend to the bottom and attach to the substrate. During this non mobile stage, individuals who descend onto soft or sandy substrate have a much lower survival rate than those that land on harder substrate onto which they can more securely fasten. The proposed pipeline path, with its almost completely homogenous

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[12] MacKenzie, C., and J.R. Moring. 1985. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic) --American lobster. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.33). U.S. Army Corps of Engineers, TR EL-82-4. 19 PP.

[13] H. Chang, J & Chen, Yong & Holland, Daniel & Grabowski, Jonathan. (2010). Estimating Spatial Distribution of American Lobster Homarus Americanus Using Habitat Variables. Marine Ecology Progress Series. 420. 10.3354/meps08849.

[14] Hart, D. R. and Chute, A. S. 2004. Essential Fish Habitat Source Document: Sea Scallop, Placopecten magellanicus, Life History and Habitat Characteristics, Second Edition. NOAA Technical Memorandum NMFS-NE-189. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center.

fine grain muddy substrate, is not ideal habitat for scallops, so significant impact from project activities is not expected.

Belding (1914)[15] describes a variety of factors that impact the success of the softshell clam including currents, substrate, depth and salinity. Currents are perhaps the most critical factor as water flow over the clam beds provides oxygen, and planktonic and detrital food sources. Increased turbidity and/or total suspended solids (TSS) are likely to have the most notable impact on shellfish such as the softshell clam, as during periods of increased sediment load in the water, bivalve feeding behavior is generally disrupted. For species such as softshell clams as well as blue mussels, the duration of the increased suspended solids would play a significant role in determining impact to the bivalves in the area (Wilber and Clark 2001)[16]. However, these shellfish are able to tolerate a wide variety of concentration of suspended solids, depending on the duration. For example, most bivalves can tolerate short term extreme increases in TSS by simply shutting down feeding behavior altogether until conditions improve.

9.3.4 Impact Assessment

<u>Finfish</u>

Impacts to finfish is expected to vary based on species. Of the species assessed, only winter flounder is expected to be present in the project area during construction. This species is known to spawn in the area during the in-water construction window. Although this species is expected to be in the vicinity, spawning adults are expected to self-relocate and should be able to successfully spawn in adjacent and equivalent habitat available in the bay. The other species are not expected to occupy the project area in significant numbers during construction, so minimal construction impact should occur. Overall, the impact from construction on the species assessed is expected to be insignificant.

After the facility begins operation of the intake, the only ongoing potential for loss of finfish due to project operations would be by eggs and larvae at the intake. The intake is engineered to have a through screen velocity of less than 0.5 ft/sec, which will effectively minimize the chance for adult fish to become caught at the intake screen. The screen itself is proposed to be a 1 inch slot size wedge wire mesh, which will allow any larvae and eggs smaller than 1 inch to pass through the screen. It is not expected that mortality would occur due to temperature, rather, eggs and larvae would be lost via filtration of all the water entering the facility. The most likely species to experience this impact would be winter flounder and rainbow smelt as these species are likely to have the egg and/or larval life stages present in the vicinity of the intake. There is some chance that young glass or elver stage eels could be impacted by the intake, but it is unlikely that this would be significant as their swimming ability should be developed enough for them to avoid the screen due to the low intake velocity. The significance of impact of early life stages due to the intake cannot be accurately quantified at this time, as no ichthyoplankton data was collected associated with this project.

Once the aquafarm begins operating, the cleaned discharge water is not expected to significantly impact water quality for finfish in the area. Refer to the previously-submitted data tables in the Project Maine Pollutant Discharge Elimination System (MEPDES) permit application submitted

[15] Belding, D. L. 1914, Conditions Regulating the Growth of the Clam (*Mya Arenaria*). Transactions of the American Fisheries Society, 43: 121-130.
[16] Wilber, D. H. and Clarke, D. G. 2001, Biological Effects of Suspended Sediments: A Review of Suspended Sediment Impacts on Fish and Shellfish with Relation to Dredging Activities in Estuaries. North American Journal of Fisheries Management, 21: 855-875.

on October 19, 2018 for projected effluent concentrations and ambient water quality concentrations.

Shellfish

Mortality of individuals of the four shellfish species in question is not likely to occur strictly from the temporary increase in TSS during construction activities. Juvenile and adult lobsters will self-relocate during construction, thereby minimizing the chance for significant impact. Scallops, blue mussels, and softshell clams will be able to modify their behavior to temporarily endure the change in water conditions until their area of residence is no longer part of the active construction zone. Once the aquafarm begins operating, the cleaned discharge water is not expected to significantly impact shellfish in the area. Refer to the previously-submitted data tables in the Project MEPDES permit application submitted on October 19, 2018 for projected effluent concentrations and ambient water quality concentrations. If loss of adult shellfish is observed, it is most likely to occur by the individual being physically crushed by a piece of equipment used during in-water construction. As an impact mitigation measure, this project will restrict all in-water work in the marine environment to November 1st to April 1st. Construction activities are not expected to significantly impact the shellfish community in the area. After construction is complete, all shellfish should be able to resume routine use of the project area.

During facility operation the only ongoing potential for loss of shellfish due to project operations would be the loss of eggs and larvae at the intake. The intake's less than 0.5 ft/sec engineered intake velocity will minimize the chance for adult shellfish to lost at the intake screen, and the intake itself will be located approximately 8' above the seafloor. The screen itself is proposed to be a 1 inch slot size wedge wire mesh, which will be too large to reduce the intake of larval and egg life stages smaller than 1 inch. It is not expected that mortality would occur due to temperature, rather, eggs and larvae would be lost at the intake. As mentioned for finfish the significance of this impact cannot be accurately quantified at this time, as no ichthyoplankton data was collected associated with this project. It can be inferred that the overall impact to larval and egg life stages of shellfish in the bay will be less severe than that of a similarly designed intake (same through-screen velocity and mesh size) operated by a power plant for cooling water. This is because the estimated seawater volume pumped by the aquaculture facility is a much smaller overall volume than the cooling water volume pumped by a typical power plant.

No commercial shellfisheries are expected to be negatively affected by the project because the proposed project area is located within an area which MDMR has classified as a prohibited shellfish growing area.

Conclusion

The proposed project will include impacts that are either temporary or permanent. Temporary impacts will include those that occur only during construction. This would include increases in total suspended solids, increased noise, temporary loss of habitat, and potentially some mortality of sessile organisms that experience physical contact with construction equipment. The overall footprint of the temporary impact is expected to be approximately 108,000 ft^2 along the 2,700 LF of pipe which will be buried after construction. This section will be backfilled to return the seafloor to its original condition after installation of the pipes.

Permanent impacts will include any impacts that will exist in perpetuity after construction has concluded and the facility has begun operating. Permanent impacts expected from this project will include the alteration of approximately 144,000 ft^2 of habitat along the 3,600 LF of pipe which will remain anchored above the substrate on the seafloor. Additionally, any minimally developed life stages (eggs and larvae) which drift by the facility's seawater intake will likely be lost at the intake.

9.4 Benthos

As mentioned above, Belfast Bay contains hundreds of pockmarks. It is uncertain whether degassing is actively occurring with evidence existing both for (e.g. Kelly et al. 1994)[17], and against (Ussler et al. 2003)[18] an actively venting field. However, the proposed project is not expected to have any impact on or be impacted by the pockmarks because there is no overlap between the proposed project and the pockmarks (see Bathymetric Survey included in the **Attachment 12 –** Natural Resources Report).

9.4.1 Benthic Data – Methods and Results

On November 28 and 29, 2018 sediment cores were taken using a vibracore. Eight samples from Belfast Bay were taken with a 4-inch diameter core: seven samples along the proposed pipeline route at the time (A6, A7, A8, A9, A10, A11, and A12) and one sample approximately 750 ft north of the pipeline (B3) (see **Figure 9-2**). Firm substrate with large cobbles prevented obtaining samples from locations A1, A2, A3, A4, A5, B1, and B2. The top 6 inches of each core were thoroughly washed in the field through a 500-micron mesh sieve and preserved in rose bengal stained, 10% buffered formalin. Samples were shipped for processing to the Normandeau Biological Laboratory in Bedford, NH, with appropriate chain of custody forms.

The proposed pipeline has since been updated; previous Stations 16+00 through 41+00 (corresponding to sampling Stations A3 through A10) have been shifted to the north up to approximately 1,000 ft (305 m) at the farthest point (Station 23+00). Although benthic sampling Stations A6 through A10 are no longer along the current proposed pipeline, based on the similarity among samples taken, it is very likely that the benthic habitat along the current pipeline is very similar to sampling locations ranging from 150 to 1,000 ft to the south and provides an adequate representation for this analysis.

In the laboratory, macroinvertebrates were washed through a 500-micron mesh sieve. All soft substrate macrofaunal organisms were identified to the lowest practical taxon (usually species) and enumerated, with the exception of groups which, by convention, are identified to higher taxa (e.g., nemerteans, nematodes, and oligochaetes). Immature or damaged specimens missing the necessary diagnostic features for identification to the target taxonomic level were identified to the lowest practical taxon. Quality control checks were performed on 10% of all samples processed, with at least 90% of the organisms from each sample being removed. The results are presented in **Table 9-6**.

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[17] Kelley, J.T., Dickson, S.M., Belknap, D.F., Barnhardt, W.A., and Henderson, M., 1994, Giant sea-bed pockmarks: evidence for gas escape from Belfast Bay. Geology, v. 22, p. 59-62.
[18] Ussler, W. III, Paull, C.K., Boucher, J., Friederich, G.E., and Thomas, D.J., 2003, Submarine pockmarks: a case study from Belfast Bay, Maine. Marine Geology, v. 202, p. 175-192.

Figure 9-2


N
B1
A1
B2
B3
A2
A10
A3
A9
A11
A4
A8
A5
A7
A6
0 250 500 1,000 1,500
Feet
Nordic Aquafarms
Belfast, Maine
Sediment Sample Locations
Sediment Location Sampled
Sediment Location Not Sampled
Current Pipeline Route
NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

Overall, abundance of benthic organisms was relatively low. A total of 18 species or species groups were identified: two nemerteans (ribbon worms), 12 annelids (including 10 polychaetes, one oligochaete, and one archannelid, a primitive form of polychaete), one gastropod (snail), and three bivalves (clams). The mean number of individuals per sample ranged from 1.0 at Stations A7, A8, A10, and B3 to 12.8 at Station A11 (**Table 9-6**). Two species groups accounted for a majority of the abundance: bivalves (57%) and polychaetes (including archiannelida, 37%). Two species, bivalve *Nucula proxima* and polychaete *Aricidia (Acmira) catherniae* were recorded in relatively high numbers compared to other taxa. *N. proxima* (Atlantic nut clam) accounted for 98%of bivalves, ranging from 1 individual (sample A8) to 51 individuals (sample A12) per sample. The Atlantic nut clam occurs in muddy habitats from Nova Scotia to Florida and reaches approximately ¼ inch in length (Abbott 1974)[19]. Similarly, *A. catherinae* accounted for 59%of polychaetes, with 30 individuals recorded in one sample (A6). This species is a deposit feeder commonly found in the waters of Northeast US (Pembroke et al. 2013[20]; Maurer and Leathem 1980)[21].

The substrate along projected pipe path is characterized as mostly homogenous sandy/silty/muddy sediment with cobble mixed in.

Table 9-6: Abundance (Number of Organisms Per 4”x6” Core; 0.500mm mesh) of Benthic Macrofauna. Belfast Bay, Maine, November 28-29, 2018.

	Site A							Site B
Taxon	**A6**	**A7**	**A8**	**A9**	**A10**	**A11**	**A12**	**B3**
Nemertea								
Cerebratulus lacteus							1	
Fragilonemertes rosea					1			
Annelida								
Polychaeta								
Ampharete finmarchica							3	
Aricidea (Acmira)catherinae	30							
Bipalponephtys cornuta		1					1	1
Cirratulidae	1				1			
Eteone longa		1					1	
Heteromastus filiformis	1					1		
Levinsenia gracilis				1				
Nephtys incisa		1			1			
Ninoe nigripes					1	2		
Spiophanes bombyx	3							
Oligochaeta								
Oligochaeta	5							
Archiannelida	19							
Mollusca								
Gastropoda								
Frigidoalvania pelagica						1	4	
Bivalvia								

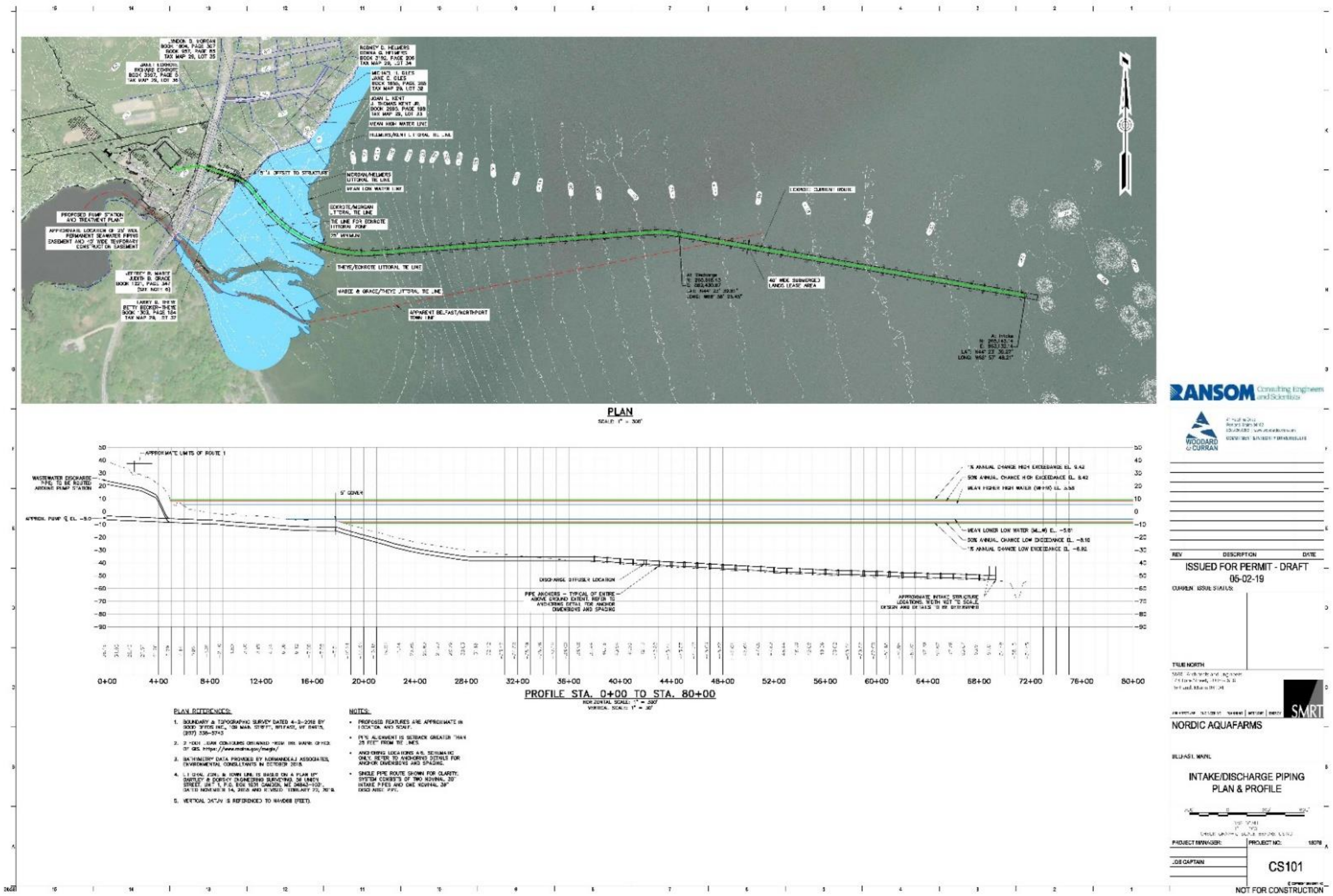
[19] Abbott, R.T. 1974. American Seashells The marine Mollusca of the Atlantic and Pacific Coasts of North America. Van Nostrand and Reinhold Company, New York. 663 pp.
[20] Pembroke, AE, RJ Diaz, and EC Nestler. 2013. Harbor Benthic Monitoring Report: 2012 Results. Boston: Massachusetts Water Resources Authority. Report 2013-13. 41 pages.
[21] Maurer, D. and W. Leathem. 1980. Dominant Species of Polychaetous Annelids of Georges bank. MEPS (3): 135-144.

Taxon	Site A							Site B
	A6	A7	A8	A9	A10	A11	A12	B3
Ameritella agilis	1							
Arctica islandica							1	
Nucula proxima			1	4	3	47	51	
Total Abundance	**60**	**3**	**1**	**5**	**7**	**51**	**62**	**1**
Mean number of individuals per sample	**8.6**	**1.0**	**1.0**	**2.5**	**1.4**	**12.8**	**8.9**	**1.0**

9.4.2 Benthic Impacts

Below is a summary of construction activities and equipment that may impact benthic communities, listed by phase, corresponding to location (station) as the project proceeds from the shoreline through the subtidal zone (**Figure 9-3,** for larger scale see **Attachment 1.B,** plan **CS101**).

Figure 9-3


PLAN
PROFILE STA. 0+00 TO STA. 80+00
0+00
4+00
8+00
12+00
16+00
20+00
24+00
28+00
32+00
36+00
40+00
44+00
48+00
52+00
56+00
60+00
64+00
68+00
72+00
76+00
80+00
PLAN REFERENCES:
NOTES:
RANSOM Consulting Engineers and Scientists
WOODARD & CURRAN
REV
DESCRIPTION
DATE
ISSUED FOR PERMIT - DRAFT
05-02-19
CURRENT ISSUE STATUS:
TRUE NORTH
SMRT
NORDIC AQUAFARMS
INTAKE/DISCHARGE PIPING
PLAN & PROFILE
PROJECT MANAGER:
PROJECT NO:
JOB CAPTAIN
CS101
NOT FOR CONSTRUCTION

Existing stream/shoreline interface (station 4+00)

At approximately station 4+00, at the existing stream/shoreline interface, a 3-sided sheet cofferdam will be installed to allow the pipe to make the transition from elevation plus 10 to elevation minus 8. No data are available regarding impacts to benthos from pile driving in the intertidal zone or on the shore.

Intertidal (mudflats) station 6+00 to 14+00

All tidal and intertidal pipe will be installed by the Float and Sink Method. Pipes will be prefabricated in appropriate long lengths at another location, floated and towed to the site and temporarily moored alongside the trench route. The pipes will ride the tides and set on the mudflat during low tide for a short period while the trench is prepared. The alignment and location will be established with simple grade stakes and offsets. Several excavators will be staged at the upland easement area and will crawl directly on the mudflats to dig the trench as tides allow. Temporary wood crane mats will be used to bridge over the stream outlet at the shoreline intersect to maintain stream flow and provide for excavator passage. Using several excavators, it is envisioned to take a few days for the trench to be ready for pipe installation. The pipe will be positioned into the trench on an outgoing tide and joined to the preceding pipe at the 3-sided cofferdam at the shoreline. Then the pipes will be backfilled with the excavators shaping the trench surface to the original mudflat line. Then the excess soil, rocks and boulders will be removed and disposed of, leaving the mudflat in the same profile appearance as originally found.

In the event ledge is encountered before the desired trench depth is achieved it will be profiled and submitted for evaluation. Ledge removal will be accomplished by hoe ramming or an excavator with a ripper tooth or a qualified blasting contractor with experience in underwater ledge removal.

Pipes submerged below water and buried in trench (station 14+00 to 33+00)

Excavation equipment will be barge mounted and continue trenching and pipe installation in the same manner until the water becomes too deep at which time the excavators will be replaced by barge mounted crane and clam shell bucket. In these submerged zones the trench will be somewhat over-excavated to account for some wash in between tide cycles. Turbidity curtain will be used surrounding the immediate excavation similar to dredging projects.

Temporary H-pilings will also be used for tethering the floating pipes that await installation and the floating siltation boom which will surround the excavation. Floating 3’ silt boom can be deployed to follow the excavation but must be of shallow depth to allow for tides and currents. Preassembled pipes with the concrete ballast blocks will be floated in next to the barges and readied for installation when the trench is prepared. Excavators on barges will dig the trench and side cast the material in the same manner as stated above to approximately station 25+00 at which time crane and clamshell will complete the remaining 1,000’ feet of trench. All the excavation barges will be equipped with mooring spuds to hold position in the currents, winds and tide flows.

Once the pipes are positioned in the trench, divers will verify proper alignment and installation criteria before backfilling. Backfill operations will be by the same manner the excavation was completed; excavator and/or crane with clamshell will retrieve the side cast spoils back into the trench to cover the pipes. Divers will verify and video the backfill is adequate but not above the original seafloor profile. Once the pipe trench is confirmed as acceptable seafloor topography, the remaining excess spoils will be loaded onto barges and sent to an upland disposal site. And the seafloor topography will be smoothed to the original profile and verified by divers and video.

Pipes laid on the seafloor (station 33+00 to 42+00/69+00)

All work will be performed from floating spud barges, push boats and smaller watercraft. No floating silt boom will be used in this zone.

Intake structures and discharge diffusers

Spud barges will be positioned on location and divers will survey the existing bottom so obstacles can be removed, and the seafloor can be prepared to accept these final portions of this piping. The discharge diffuser will be mated to the discharge pipe and be sunk with that last leg of pipe. The intake structures will be crane set and divers will likely install a final insert pipe to join the pipe ends to the intake structure piping. Divers will survey and video the final configuration of these end points.

Temporary Structures

Project activities that will cause temporary impacts to the benthos include: dredging, rock removal by hoe ramming, rock removal by blasting, pile driving (installation of three-sided sheet pile cofferdam at approximately station 4+00), pipe laying, pipe burial, and vessel traffic. Temporary impact types include increased turbidity from resuspended solids, underwater noise, acoustic shockwave (restricted to rock blasting; **Table 9-7**), and disturbance of benthic habitat.

Table 9-7. Summary of Impacts to the Benthic Community during Proposed Project Construction and Operation

Project Activity	**Impact Type**							
	Permanent Impact				**Temporary Impact**			
	Change in Bottom Habitat	**Change in Water Quality**	**Intake Pipe**	**Removal/ Change in Bottom Sediment**	**Disturbance / Bottom Sediment Change**	**Increased Turbidity & Resuspended Sediment**	**Underwater Noise**	**Acoustic Shockwave**
Dredging				X	X	X	X	
Rock Removal, Blasting				X	X	X		X
Rock Removal, Hammering (Hoe Ram)				X	X	X	X	
Pile Driving[1]						X	X	
Construction Vessel Traffic						X	X	
Pipe and Collar Installation	X			X	X	X	X	
Operation of Facility Intake			X	X[2]				

Project Activity	Impact Type							
	Permanent Impact				Temporary Impact			
	Change in Bottom Habitat	Change in Water Quality	Intake Pipe	Removal/ Change in Bottom Sediment	Disturbance / Bottom Sediment Change	Increased Turbidity & Resuspended Sediment	Underwater Noise	Acoustic Shockwave
Operation of Facility Discharge		X		X[2]				

1 Installation of temporary piles during construction.
2 Loss of bottom habitat due to presence of intake and discharge structures

Increased turbidity and Resuspended Solids

Vibracore sediment samples were collected in Belfast Bay on November 29, 2018. Multiple samples were collected for grain size analysis, while two samples, B3 and A6/A7 composite (See **Figure 9-2**), were submitted for chemical and physical characteristics analysis. Sample B3 was a depth composite sample extracted from the sediment surface at station B3 to a sediment depth of 8 ft. 4 in. Sample A6/A7 composite was a two sample composite from stations A6 and A7. Station A6 was sampled from sediment surface to a depth of 5 ft. 4in. while station A7 was sampled from the sediment surface to a depth of 10 ft. 4 in.

Sediment within the project area is predominately silt, sand, and mud, with some rubble and cobble materials mixed in. As a result, impacts from sedimentation and increased turbidity will be higher in soft bottom areas compared to hard substrate. TSS concentrations associated with mechanical clamshell bucket dredging operations have been shown to range from 105 mg/L in the middle of the water column to 445 mg/L near the bottom (210 mg/L, depth-averaged, ACOE 2001)[22]. Burton (1993)[23] measured TSS concentrations at distances of 500, 1,000, 2,000 and 3,300 feet (152, 305, 610 and 1006 meters) from dredge sites in the Delaware River and were able to detect concentrations between 15 mg/L and 191 mg/L up to 2,000 feet (610 meters) from the dredge site. Based on these studies, elevated suspended sediment concentrations at several hundreds of mg/L above background may be present in the immediate vicinity of the bucket but would settle rapidly within a 2,000- foot (610 meter) radius of the dredge or hammering, or blast location.

Analysis results indicated that the sediment samples would be "non-toxic" or at least do not meet the characteristic of toxicity based on 40 CFR 261.24. The full description of analysis methods and laboratory report can be viewed in **Section 18** of the Developments **Site Location of Development Application (SLODA) Application**.

While laboratory results do not indicate that disturbed sediments would need to be handled as hazardous waste, studies indicate elevated mercury levels in Penobscot Bay due to contaminated

[22] Army Corps of Engineers (ACOE). 2001. Monitoring of Boston Harbor confined aquatic disposal cells. Compiled by L.Z. Hales, ACOE Coastal and Hydraulics Laboratory. ERDC/CHL TR-01-27.
[23] Burton, W.H. 1993. Effects of bucket dredging on water quality in the Delaware River and the potential for effects on fisheries resources. Versar, Inc. 9200 Rumsey Road, Columbia, MD 21045.

releases during operation of a former chlor-alkali plant in Orrington, ME between 1967 and 1970 (see **SLODA, Section 18** for details).

Dissolution of contaminants during dredging, blasting or hydraulic hammering in the vicinity of the project could temporarily degrade water quality and affect habitat value in Belfast Bay. Contaminant levels are minimal in and adjacent to the project area. However, any negative impacts resulting from re-suspended contaminants would be short-term and temporary, lasting only as long as the construction phase of the project: five weeks during submerged and buried pipe installation (end of November and all of December) and eight weeks during pipe installation on sea floor (January and February).

Although it is anticipated that there will be a significant increase in turbidity in the immediate area of construction, these effects should be short in duration, and minimized by dredging as much as possible during low tide and with a land-based excavator. For the deeper sections which need to be dredged, a crane barge with a bucket will be used along with silt booms to minimize increased TSS.

Underwater noise

Underwater noise sources include dredging, hoe ramming, pile driving, drilling, and construction vessels. The sources with the highest sound pressure levels are pile driving and hoe ramming. Unless unforeseen issues arise, all piles will be installed using a vibratory hammer to minimize underwater noise intensity. If larger rocks need to be removed, a hoe ram will likely be utilized to break the rocks free for removal. When this occurs, operators will use a soft start technique to drive mobile aquatic organisms away to a safer distance. Bubble curtains are another potential exclusion technique.

Many aquatic invertebrates appear to use hydrodynamic receptors to detect, localize and identify predators, prey, conspecifics, submerged objects, or food falling to the seabed (Hawkins and Popper 2017)[24]. Several crustaceans appear to be especially sensitive to sound transmitted through the substrate (Edmonds et al. 2016[25]; Roberts et al. 2016)[26] and some aquatic invertebrates communicate with conspecifics by means of sound and vibration (Patek et al. 2009)[27]. However, data regarding impacts to invertebrates from underwater noise are limited. Determination of the impact of man-made sound on invertebrates is complex and information on how to assess potential impacts on invertebrates is not available (Hawkins and Popper 2017)[26].

Acoustic shockwave

Data regarding impacts on invertebrates from underwater blasting are scarce. There are however a few older studies that examined the effects from blasting on crabs. The study placed blue crabs

[24] Hawkins, A.D. and A.N. Popper 2017. A sound approach to assessing the impact of underwater noise on marine fishes and invertebrates. ICES Journal of Marine Science. 74(3): 635-651.
[25] Edmonds, N. J., Firmin, C. J., Goldsmith, D., Faulkner, R. C., and Wood, D. T. 2016. A review of crustacean sensitivity to high amplitude underwater noise: data needs for effective risk assessment in relation to UK commercial species. Marine Pollution Bulletin, 108: 5–11.
[26] Roberts, L., Cheesman, S., Elliott, M., and Breithaupt, T. 2016. Sensitivity of Pagurus bernhardus (L.) to substrate-borne vibration and anthropogenic noise. Journal of Experimental Marine Biology and Ecology, 474: 185–194.
[27] Patek, S. N., Shipp, L. E., and Staaterman, E. R. 2009. The acoustics and acoustic behavior of the California spiny lobster (Panulirus interruptus). The Journal of Acoustical Society of America, 125: 3434–3443.

(*Callinectes sapidus*) in cages on the bottom (body of water and exposed crabs to a 30 lb unconfined charge of TNT. Unconfined charges would have more substantial impacts than confined charges. Results indicated that about 90% of the blue crabs were killed at 25 ft (7.6 m), under peak pressures exceeding 800-900 pounds/square inch, psi (5,516-6,206 kPa), and very few (7%) died at 150 ft (45.7 m), where pressure reached about 270 psi (1,862 kPa; Anonymous 1948)[28]. In a review of several similar studies on blue crabs and some shrimp species, results indicate that invertebrates are relatively insensitive to pressure related damage from underwater explosions (MDEP 2012)[29]. Results from the above study are likely to be conservative, because the blasts were unconfined. However, if the results were applied to this project, impacts to benthic invertebrates would not likely exceed a radial distance of 150 ft from blasting (Anonymous 1948)[30].

Change in benthic habitat

Burial of the intake and discharge pipes will temporarily change approximately 36,000 ft^2 of intertidal habitat (Station A1 – A3) and 72,000 ft^2 of subtidal benthic habitat (Stations A4 – A8; **Figure 9-2**) during construction. After the substrate is temporarily relocated to allow the pipe to be buried, the benthic sediment will be filled back in to allow resumed use by benthic species. Any remaining sediment that was displaced by the pipe installation will be disposed of at an upland disposal site. Studies indicate that soft-bottom habitats are known to recover relatively quickly (Newell et al. 1998)[30]. Once construction is completed, benthic habitat over the buried pipes is expected to return to pre-construction level in 6 to 8 months (Newell et al. 1998)[32].

<u>Permanent Structures</u>

As part of the proposed project design, three pipes will be installed into the marine habitat; two intake pipes and a single discharge pipe. The intake pipes will extend approximately 4,280 feet farther into Belfast Bay than the single discharge pipe. At approximately 33+00 (x-axis distance on **Figure 9-3**) or 0.5 miles offshore, the pipes transition from below the seafloor to above. From this point out to the discharge and intake (linear distance of approximately 3,900 ft [0.7 miles]), the pipes and baffles will be permanent fixtures along the seafloor. The three discharge valves and the intake structure will also be permanent.

Project activities that will cause permanent impacts to the benthos include: dredging, rock removal by hoe ramming, rock removal by blasting, installation of pipe and collar baffles and the operation of the intake structures by taking up eggs and larval stages of benthic organisms Removal or change of bottom sediment, change in bottom habitat from soft bottom to hard substrate, loss of eggs and larvae and change in water quality at the discharge are potential impacts to the benthos. Each of these impacts are discussed individually below.

[28] Anonymous. 1948. Effects of underwater explosions on oysters, crabs, and fish. Chesapeake Biological Laboratory, Publication No. 70, pp. 1-43.
[29] MDEP (Massachusetts Department of Environmental Protection). 2012. Attachments for response to USEPA comments on the January 18, 2012 submission by the Commonwealth of Massachusetts for the New Bedford Marine Commerce Terminal (NBMCT). Submitted June 18, 2012.
[30] Newell, R.C., L.J. Seiderer, and D.R. Hitchcock. 1998. The impact of dredging works in coastal waters: A review of the sensitivity and disturbance and subsequent recovery of biological resources on the sea bed. Oceanography and Marine Biology. An Annual Review. 36: 127-178.

Removal or change of bottom sediment

Beginning at the point at which pipes will be placed above the seafloor, there are two possible changes that may occur with the bottom sediment. First, if rock is removed, then any organisms on that surface will be disturbed and removed. An estimate for the square footage of rock to be removed is not available. Once the pipes are installed, hard-bottom organisms (for example barnacles, encrusting bryozoans etc.) will be able to recolonize the hard pipe surface. Second, if no rock is present, pipes and baffles will be installed over the soft sediment, causing a permanent shift from soft bottom to hard substrate. The total area of loss of soft bottom along the pipeline is estimated to be 144,000 SF.

Uptake of eggs and larval stages of benthic organisms

The end of each of the two intake pipes will have a 90-degree elbow which will send the actual point of intake up off the seafloor by about 8ft. Current engineering designs include an intake which is designed to have a maximum through-screen velocity of less than 0.5 ft/sec. The intake is currently planned to have an intake with 6 panels in a hexagonal structure equipped with 1-inch wedge wire mesh. During facility operation the only ongoing potential for loss of benthic organisms due to project operations would be by eggs and larvae smaller than the 1-inch screen size. It is not expected that mortality would occur due to temperature change.

Currently no plankton studies have been conducted to provide supporting data to this assessment. The project assumes that any benthic invertebrate species with a life history to suggest that spawning could occur in the specific habitat in the project path will have eggs or larvae present at some point in the year.

Changes in water quality

Desktop analyses predict that the discharge water will not have a significant impact on the water quality of Penobscot Bay. The methods proposed to prevent pathogenic materials and parasites from entering or leaving the facility are well documented. A multi-step process will be employed including micro-filtration of the effluent to remove particles through a 0.4-micron filter provided by Mitsubishi. The water treatment technologies will reduce solids, phosphorous, and biochemical oxygen demand (BOD) by 99% and total nitrogen by 85%. Oceanographic models simulating the effects of the residual discharge contents (see Attachment I of the MEPDES Application, Oct 2018) indicated the effluent would disperse quickly and is not expected to cause negative effects to the benthos. Nordic Aquafarms outflow pipe is not expected to negatively affect the benthos in the project area.

<u>Conclusion</u>

Impacts to the benthos in the project area during construction and operation of the Nordic Aquafarms salmon aquaculture facility will be both temporary and permanent. The temporary impacts, including increased turbidity and TSS and potential release of contaminants during dredging, rock removal, and pipe burial; and underwater noise from dredging, hoe ramming, pile driving, and construction vessels will be short-term and occur only during construction (from November 1 through April 1). The benthic habitat along the below-seafloor portion of the pipeline (approximately 108,000 SF will be removed but is expected to recover to pre-construction conditions within 6 to 8 months.

The permanent impacts will include the loss of 144,000 SF of soft bottom habitat due to presence of the two intake pipes, associated intake head, one discharge pipe, and its associated duck bill dispersion apparatus. The loss of this area is minimal considering the amount of similar available habitat throughout Belfast Bay. Other permanent impacts include loss of eggs and larvae of benthic organisms smaller than the 1-inch screen at the intake pipe. Model results and desktop analysis indicate that changes in water quality are not expected to substantially impact benthic organisms or habitat due to the state of the art technology and experience from other similar projects.

9.5 Great Pond Impacts

The Site is adjacent to the Lower Little River Dam (the "Lower Dam"), a 30-foot high, 126-foot long concrete and masonry dam. The Lower Dam impounds the Little River into a reservoir that is approximately 37 acres with a capacity of approximately 600 acre-feet (Wright-Pierce, 2018). The Lower Dam and reservoir (also called Belfast Reservoir 1 or the Lower Reservoir) served as the public water supply for the City of Belfast from circa 1887 to 1956, and then as a backup water supply until 1980, when the BWD completely transitioned its water supply to groundwater sourced from the Goose River Aquifer. The Site abuts the lower reservoir along approximately 285 ft of shoreline, with the remainder of the shoreline residing in the 250 ft buffer zone to be owned by the City of Belfast.

Part of the facility's freshwater will be withdrawn from the Lower Reservoir, in addition to onsite groundwater wells and municipal water. In accordance with Chapter 587, the surface water withdrawal is proposed as 70 gpm plus additional through put as defined under the regulations. As described in the accompanying **SLODA Application, Chapter 15**, surface water availability is estimated to be at least 250 gpm., based on historical withdrawal, current capacity, and recharge from the Little River. Primary freshwater sources will be groundwater wells and municipal water, with the surface water from the lower reservoir acting as a make-up source for periods of higher freshwater demand. As described in Nordic's MEPDES permit application, the extracted freshwater will be treated with the process water and discharged into Belfast Bay, under the conditions established in the MEPDES permit.

The ability to reliably extract surface freshwater is contingent on the existence of the Lower Reservoir, which is maintained by the lower dam. Were a breach of the lower dam to occur, the surface withdrawal method could be temporarily halted until conditions can be assessed and extraction resumed. See **Section 9.7** for additional detail of threats to the current dam infrastructure.

9.6 Flooding

The Site Location of Development Standard regarding flooding impacts states that the activity will not unreasonably cause or increase the flooding of the alteration area or adjacent properties nor create an unreasonable flood hazard to any structure (38 MRSA 484.7).

<u>Potential flooding Impacts</u>

The stormwater management systems for the proposed development are designed such that rainfall from a 50 year 24-hour storm will infiltrate, be detained on the site, or be conveyed directly to the ocean, such that there will be no increase in storm water outflow from the site when compared to the stormwater outflow prior to development. Plan views of the proposed stormwater management system can be found in **Attachment 1.B, CE110-CE118** and details **CE501-CE504**. Further discussion of the facility stormwater management system, along with relevant calculations, can be found in **Section 12** of the **SLODA.**

Stormwater management design will decrease the volume of runoff conveyed to potential riverine flooding sources on or adjacent to the proposed development boundaries, and therefore will not create an unreasonable flood hazard to any proposed or existing structure.

Flood Insurance Rate Map and Base Flood Elevation

The site is located on Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) panel number 23027C0463 with an effective date of July 6, 2015. **Appendix 9-C** shows the boundary of the proposed development area overlaid on the effective FIRM panel. The proposed development area intersects two riverine Special Flood Hazard Area (SFHA) zones and one coastal SFHA zone. The riverine zones include a zone associated with Reservoir One along the southern boundary of the site and a zone associated with the unnamed stream along the northeastern boundary of the site. Both riverine zones are classified as unnumbered (approximate) A zones on the FIRM and do not have assigned regulatory Base Flood Elevations (BFE). The site is also adjacent to a coastal AE zone located between the dam at Reservoir One and Route 1. The BFE of the coastal AE zone is 14 feet North American Vertical Datum 1988 (NAVD88).

The FEMA Flood Insurance Study (FIS) and FIRM do not provide BFEs for the approximate A zones. However, FEMA does provide guidance for estimating the BFE in approximate A zones when necessary for floodplain management decisions (FEMA guidance document 265). Using the simplified elevation contour interpolation method, it is possible to approximate the BFE for the site by comparing the mapped flood zone boundary to topographic data for the area. According to the effective FIS for Waldo County, 2-foot elevation contours derived from composite LiDAR data that was taken between 2006 and 2011 provided by the Maine Office of Geographic Information System (MEGIS) were used to delineate flood zones on the effective FEMA FIRM. The same elevation contour data were obtained from MEGIS and compared to the approximate SFHA boundaries. The comparison gives conservative estimate of the BFE for Reservoir One of 21 feet above the NAVD88. Approximate BFEs along the unnamed stream range from 23 feet NAVD88 at the inlet of the culvert at Route 1 to an elevation of 65 feet NAVD88 at the northern end of the site approximately 1950 feet upstream from the Route 1 culvert. An approximate BFE profile for the unnamed stream is provide in **Appendix 9-D.**

Impact on Flooding

Stormwater management design for the proposed development on the site will reduce the total volume of runoff that reaches either riverine flooding source by a combination of detention, infiltration, and conveyance directly to the ocean. This will tend to reduce peak flows for the flooding sources when compared to the existing hydrology of the site, which in turn will tend to decrease 1% annual chance Base Flood Elevations. Within areas subject to coastal flooding the site development will not change the topography or hydrology such that no impact to coastal flooding is expected.

With exception of hydraulic structures that are designed to convey stormwater, structures on the site will be constructed either outside the existing SFHA or above the existing approximated BFE. Because development will not cause an increase in the BFE, development will not cause an unreasonable increase in the flood hazard for any new or existing structures or any adjacent properties.

9.7 Perceived Threat to Infrastructure

DAM BREACH ANALYSIS

General Discussion

Breach is the sudden failure of a dam and release of the water from behind it. Breach can result through a variety of mechanisms, including: an increase in the hydraulic forces on a dam during high flows, mechanical failure caused by events such as an earthquake or sabotage, or as a result of long-term, steady erosion of the foundation or an abutment. For concrete dams, such as these, failure typically relates to mechanical failure brought on by extreme high flows or due to deterioration of concrete, or both. When the water level at a dam increases enough during a flood, abutment failure leading to dam breach is possible. At the same time, hydraulic force on the dam increases as the water level increases. The amount of this force is directly proportional to the depth of the water at the dam.

Dams are generally designed to be strong enough to withstand the forces of predictable flooding but are not normally designed to withstand the largest flood that could possibly occur in a watershed, primarily due to economic considerations. The design flood to be used for analysis is typically selected based on the hazard rating of the dam. The most significant flood that could be expected, based on the meteorological and hydrological characteristics of a watershed, is called the Probable Maximum Flood, or PMF. The PMF is a hypothetical event. The flood a dam is designed to withstand is normally expressed as a percentage of the PMF. This less serious flood is called the Test Flood. The Test Flood (also called the Design Basis Flood (DBF)), is difficult to evaluate because it requires estimating the intensity of future weather conditions.

Breach Analysis

The Army Corps of Engineers recommended in their 1979 assessment efforts that the Upper and Lower Little River Dams be evaluated using a Test Flood of 50% of PMF. In their analysis of the watershed and flood hydrology, the Corps of Engineers evaluated the depth of water in the Little River at the location of each dam and in the river channel below each dam under 50% of PMF conditions.

In the river channel downstream from the Upper Dam at the Herrick Road Bridge, the routed flow (total discharge over the dam) would result in a water depth of 12 feet, or 3.9 feet below the low chord of the bridge. Downstream of the Lower Dam, the routed flow would result in a water depth in the river channel of 10 feet, well below the Route 1 bridge. The depth of water at both dams under these conditions would be above the abutments and this may result in abutment erosion, but damage to downstream structures is not expected to occur under the Test Flood conditions.

It was determined that in the event of a breach at the Upper Dam, the resulting “flood wave” would continue on to the Lower Dam reservoir and overtop the Lower Dam. The breach wave could possibly damage or destroy the Lower Dam and damage the adjacent Water District facilities and could result in loss of life should anyone be in the immediate area.

In addition to the original Army Corps assessment, in July of 2018 another assessment of the upper and lower Little River dams was conducted by Wright Pierce and presented here in **Appendix 9-E**. Based on the current state of the structure of the Upper Little River Dam the report presented a range of recommendations, from significant reconstruction to complete removal. The Lower Little River Dam was found to be in better shape structurally, though it was recommended that further structural assessment be conducted on the left bank retaining wall. It is predicted that if done in a controlled manner the alteration or removal of the Upper Little River Dam will not cause the degradation or failing of the Lower River

Dam, and thus retain the Lower Reservoir. Based on the conclusions of this report, it is predicted that the Lower Dam, and thus the Lower Reservoir, is not in imminent risk of failure, and the only current threat to said infrastructure is the failure of the Upper Dam.

Lower Dam Breach

The Corps of Engineers analyzed a breach failure of the Lower Dam under a Full Dam condition. Under the Full Dam condition, the elevation of the water surface would be 30.3 feet, or 5.3 feet deep over the spillway. The Corps' failure analysis based on an instantaneous, catastrophic failure of the Lower Dam predicts a discharge of 14,780 cubic feet per second. The resulting breach wave would raise the water level in the downstream channel adjacent to the bridge to 19 feet above the channel bottom. Water would not overtop the U.S. Route 1 bridge but will possibly damage it. Damage to a building just downstream from the Route 1 bridge downstream of the Lower Dam will also possibly occur.

If breach failure of the Lower Dam is considered under a 50% PMF condition, the elevation of the water surface would be 36.7 feet, or 11.7 feet deep over the spillway portion of the dam (6.4 feet over the abutment portions). An instantaneous, catastrophic failure of the Lower Dam in this case predicts a discharge of 33,300 cubic feet per second. The resulting breach wave would raise the water level in the downstream channel adjacent to the bridge to 23.6 feet above the channel bottom. Water would not overtop the U.S. Route 1 bridge but will possibly damage it. Damage to a historic building just downstream from the Route 1 bridge downstream of the Lower Dam will also possibly occur.

The Corps did not consider the impact on the Lower Dam of a simultaneous Upper Dam breach while a 50% PMF precipitation event is occurring in the Little River watershed. Under this condition, inflow to the Lower Reservoir would include the routed outflow (including breach flow) from the Upper Reservoir and inflow from the watershed area between the Upper and Lower Dams. Under this condition, the total peak flow reaching the lower dam is estimated to be 29,920 cfs. The elevation of the water surface at the Lower Dam would be 39.7 feet, or 14.7 feet over the spillway (9.4 feet over the abutment portions). A subsequent instantaneous, catastrophic failure of the Lower Dam is predicted to result in a discharge of 38,790 cubic feet per second. This breach wave would raise the water level in the downstream channel adjacent to the bridge to 25.1 feet above the channel bottom. Water would overtop the U.S. Route 1 bridge to a water depth of 8.6 feet over the roadway, likely damaging or destroying it. Damage to a historic building just downstream from the Route 1 bridge downstream of the Lower Dam will also possibly occur.

APPENDIX 9-A

MDIFW an MNAP Information

APPENDIX 9-B

Wildlife Lists

APPENDIX 9-C

Flood Insurance Rate Map

APPENDIX 9-D

Approximate Unnamed Stream Base Flood Elevation Profile

APPENDIX 9-E

Wright-Pierce Dam Study

Ransom Consulting, Inc.