

## 4. ENVIRONMENTAL REVIEW

LAI conducted an environmental review of the Project based on information developed by Broadwater and other publicly available reports and data pertaining to the resources of Long Island Sound. A brief summary of each of the publicly available Resource Reports submitted with Broadwater's application and reviewed by LAI may be found in Appendix 5. LAI also researched post-construction monitoring reports prepared for other marine infrastructure projects constructed in Long Island Sound and other similar marine habitats in the Northeast. The scope of this review encompassed the potential impacts arising from the construction of the buried 21.7-mile pipeline from the FSRU to Iroquois, the construction of the YMS tower and riser pipe, and the operation of the pipeline, FSRU and LNG cargo vessels. This review was *not* intended to serve as an independent EIS for the Project. Hence, LAI did not perform an alternatives analysis or an evaluation of cumulative impacts. Furthermore, LAI did not perform a detailed assessment of air emissions or water discharge impacts associated with operation of the FSRU and the LNG carriers; we assumed that the Project would be designed to operate in conformance with all required state and federal permits and certificates, and that permit conditions would ensure protection of air and marine resources. Furthermore, socio-economic impacts not directly related to commercial fishing and boating, noise, and visual impacts were evaluated by Broadwater and in the FERC DEIS, but were not independently analyzed by LAI. LAI's study objectives therefore encompass the following:

- Provide a general overview of the potentially affected resources in Long Island Sound;
- Identify the most significant potential impacts on marine plant and animal resources in Long Island Sound associated with construction and operation of the Project;
- Identify the potential impact on recreational and commercial fishing and boating associated with the construction and operation of the Project, including the delineation of Safety Zones around the FSRU and the LNG carriers;
- Identify technically feasible mitigation methods potentially applicable to Broadwater and research whether these mitigation methods have been successfully implemented for similar projects in similar marine habitats; and
- Evaluate the incremental impact of the Project relative to existing infrastructure, commerce, and other uses of Long Island Sound.

LAI's environmental review was essentially completed prior to the issuance of FERC's DEIS. Various state and federal resource agencies subsequently commented on the DEIS. In Section 6.4, LAI summarizes the significant issues and data gaps identified by these resource agencies.

### ***4.1. Potential Impacts to Marine Plants and Animals***

#### ***4.1.1 Overview of Marine Plant and Animal Resources in Long Island Sound***

Long Island Sound is an estuary, a partially enclosed body of water formed where freshwater from rivers and streams flows into and mixes with ocean water. The tidal, sheltered waters of estuaries support unique communities of plants and animals. Estuarine environments are among the most diverse and productive on earth, creating more organic matter each year than

comparably-sized areas of forest, grassland, or agricultural land.<sup>106</sup> Long Island Sound provides a unique habitat that is sufficiently cool to support some northern species at their southern extent, and warm enough to support some southern species at their northern extent. Birds, mammals, fish, and other wildlife depend on estuarine habitats as places to live, feed, and reproduce. Numerous marine organisms, including most commercially valuable fish and shellfish species, depend on estuaries at some point during their development.

#### *4.1.1.1 Water Quality*

The water quality of Long Island Sound is a function of the exchange of saline water from the offshore waters of the New York Bight<sup>107</sup> and The Race, and the inflow of freshwater from the rivers, uplands and shorelands surrounding Long Island Sound. Direct and indirect sources of pollution to Long Island Sound include sewage treatment plants, industrial discharges, and nonpoint sources (urban and agricultural runoff, atmospheric deposition). Broadwater is located in water designated by the New York State Department of Environmental Conservation (NYSDEC) as Class SA waters (6 NYCRR Part 701). Class SA waters are deemed suitable for shellfishing, and primary and secondary contact swimming and fishing. As Class SA waters, there are defined water quality criteria that must be maintained in order to secure discharge permits. The Broadwater project is located in an area of the Sound identified under the Federal Clean Water Act Section 303(d) as “impaired waters” – waters that do not support designated uses.

The Long Island Sound Comprehensive Conservation and Management Plan (CCMP) was developed in 1994 as part of the Long Island Sound Study (LISS), a cooperative program undertaken by the EPA, NYSDEC and the Connecticut Department of Environmental Protection (CTDEP). The CCMP identifies low dissolved oxygen (DO), or hypoxia, as the most serious water quality impairment in Long Island Sound. As defined by the LISS, hypoxia exists when DO drops below a concentration of 3 milligrams per liter (mg/L). Hypoxic conditions during the summer are mainly confined to the Narrows and Western Basin of Long Island Sound, west of a line from Stratford, Connecticut to Port Jefferson, Long Island,<sup>108</sup> which encompasses the westernmost 2 to 3 mile segment of the proposed pipeline. The primary cause of this hypoxia is consumption of oxygen due to the death and decay of phytoplankton, which are stimulated to excessive growth by nutrient additions (especially nitrogen) from anthropogenic sources. The extensive hypoxia in Long Island Sound has caused Connecticut and New York to initiate development of a Total Maximum Daily Load for biological oxygen demand.

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<sup>106</sup> EPA National Estuary Project, <http://www.epa.gov/owow/estuaries/about1.htm>.

<sup>107</sup> Area of Long Island Sound located between Long Island and the New Jersey coast, including the Hudson River outer harbor.

<sup>108</sup> CTDEP Water Quality Monitoring Page: [http://dep.state.ct.us/wtr/lis/monitoring/lis\\_page.htm](http://dep.state.ct.us/wtr/lis/monitoring/lis_page.htm).

#### 4.1.1.2 *Vegetation*

Broadwater's proposed pipeline from the FSRU to the Iroquois mainline is located in areas where the sea floor is below the photic zone, the maximum depth of light penetration.<sup>109</sup> Marine vegetation requires light to survive, and as a result there is no marine vegetation (algae or seaweeds, vascular plants such as salt marsh grass, or submerged aquatic vegetation in the form of eelgrass) along the project corridor. Single celled plants called phytoplankton occur in the upper layers of the water column along the project corridor. These are an important element of the food web, recycling nutrients and providing a food source for invertebrates.

#### 4.1.1.3 *Invertebrates*

Invertebrates in Long Island Sound can be divided into planktonic, those organisms that dwell in the water column, and benthic, those that dwell on the bottom. Plankton organisms include small crustaceans that are permanent residents, as well as the larval life stages of molluscs such as clams and mussels, and crustaceans such as crabs and lobster. Direct sampling of the Project site through sediment collection and video revealed a soft sediment community that is typical for the depth and sediment type, dominated by marine worms, small crustaceans, tunicates (sea squirts) and sea anemones.<sup>110</sup>

#### 4.1.1.4 *Fish*

Finfish are commercially and recreationally important, as well as important components of the diverse food webs in Long Island Sound. Fish eggs occur both on the seabed and in the water column, depending on the species. Eggs hatch into a larval stage that matures into juveniles and finally adults. Juvenile and adult fish assemblages are highly variable in time and space throughout Long Island Sound because of their mobility and widely varying sensitivities to environmental factors.

Data on the fish population along the Broadwater corridor can be obtained from two sources: the CTDEP Long Island Sound trawl surveys and the National Marine Fisheries Service (NMFS) habitat designations of Essential Fish Habitat (EFH). CTDEP's trawl surveys collect demersal (associated with the bottom) and pelagic (associated with the water column) marine fish and shallow water estuarine fish species. The finfish species assemblage has been observed to vary between a cold-water demersal assemblage and warm water migrants.<sup>111</sup> The cold-water assemblage is dominated by windowpane, winter flounder, and little skate. Seasonal warming causes these cold-water species to move to deeper waters, with replacement by warm water migrants such as bluefish, butterfish, weakfish and scup.

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<sup>109</sup> Whether the lateral is owned and operated by Broadwater or Iroquois is outside the scope of this inquiry. LAI assumes that pipeline ownership and operational control has no bearing on environmental impacts.

<sup>110</sup> Broadwater Resource Report 3.

<sup>111</sup> Gottschall, K.F., M.W. Johnson, and D.G. Simpson. 2000. The Distribution and Size Composition of Finfish, American Lobster, and Long-finned Squid in Long Island Sound based on the Connecticut Fisheries Division Bottom Trawl Survey. 1984-1994. NOAA Tech. Rep. NMFS 148. 195 pp.

Appendices to Broadwater's Resource Report 3 provide information on the major fish species collected during the Long Island Sound Trawl Surveys, with Sound-wide maps of their distribution. However, the information has not been analyzed to identify the potentially affected fish communities along the project corridor, other than a mean finfish count. The NMFS identifies EFH across Long Island Sound. EFH is defined as "those waters and substrate necessary to fish ...for spawning, breeding, feeding, or growth to maturity."<sup>112</sup> Long Island Sound is divided into 10 minute by 10 minute squares of latitude and longitude; each quadrat is associated with a list of managed finfish and molluscan (sea scallop, long finned squid) species that utilize the habitats within the quadrat for the individual life stages (generally eggs, larvae, juveniles, adults, and spawning adults). There is a rebuttable presumption that all areas within an EFH quadrat are important for the listed species. A project proponent may argue that specific habitats that occur in a project area preclude the likely presence of a species, or, alternatively, demonstrate that the construction window or nature of project operations will avoid adverse effects to a species. According to Broadwater, the Project's pipeline corridor contains three EFH quadrats, which provide habitat for 20 of the NMFS-managed species.

#### 4.1.1.5 Commercially Important Shellfish

Molluscs: Commercially harvested molluscan shellfish species in Long Island Sound include hard clam, sea scallop and the eastern oyster. The water depth at the FSRU and pipeline corridor precludes the presence of oysters, which prefer shallower waters, and sea scallops, which prefer deeper waters. Hard clams or quahogs occur in intertidal and subtidal areas of estuaries, with salinities from 10 to 35 parts per trillion. They occur mainly on clean sand substrates with good water circulation.<sup>113</sup> The hard clam industry has been steadily increasing from the mid-1990s to over 420,000 bags with a value of over \$16 million in 2005. In contrast, the oyster harvest has been steadily declining since two natural diseases resulted in major die-off of oyster stocks in 1997 and 1998. In 2005, the oyster harvest was only valued at \$953,050, greatly diminished from a prior level of over \$40 million in 1995.<sup>114</sup>

No live molluscan shellfish (surf clams, hard clams, or oysters) were observed during surveys of the Broadwater corridor.<sup>115</sup> Fishermen interviewed by Broadwater indicated that conchs or whelks (also known as scungilli) are collected in the Project area.<sup>116</sup> We note that NYSDEC shellfisheries section does not include whelks in its definition of "shellfish."

Lobsters: The American lobster is one of the most valuable commercial fishery species in Long Island Sound. The lobster has two benthic life stages that may be vulnerable to impacts during construction and operation of the Broadwater project. During the early benthic phase (EBP) of the lobster's life cycle, which lasts about two years, the organism moves from its planktonic

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<sup>112</sup> Magnuson-Stevens Act 16 U.S.C. 1801 *et seq.*

<sup>113</sup> Stanley, J.G. and R. DeWitt. 1983. Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (North Atlantic). U.S. Fish. Wildlife Service, FWS/OBS-82/11.

<sup>114</sup> Connecticut Department of Agriculture Statistics, <http://www.ct.gov/doag/cwp/view.asp?a=1369&q=271358>.

<sup>115</sup> Broadwater Resource Report 3.

<sup>116</sup> *Ibid.*

stage to the bottom. The EBP organisms require a cobble substrate for survival. Research indicates that the amount of this substrate can limit population size. During the adult phase, lobsters live on the bottom on a variety of substrates that provide the required shelter. Adult lobster data are acquired both through annual landings data as well as the Long Island Sound Trawl Survey. Lobster abundance (as measured by the Long Island Sound Trawl Survey) and catches have fallen precipitously since 1998. The lobster die off in 1999 was a result of the combination of hypoxia and warm water temperatures, which, combined with over crowding, would have sufficed to produce mortalities. These conditions led to an inhibited immune response and the resultant shell disease. According to recent studies, levels of two of the commonly used pesticides for mosquito control were not a contributing factor, but a third (resmethrin) may have reached dangerous levels in a few embayments.<sup>117</sup> The smaller die-off in 2002 was the result of a new lobster disease, calcinosis, related to warm water temperatures. Diminished catches could mean that the lobster population is more vulnerable to other impacts. The diminished lobster catches and resultant commercial impacts make this a highly sensitive issue.

The Project site, including the anticipated Safety Zone, is currently utilized for commercial lobstering. Lobster pot densities provide a measure of the fishing effort, which is high along the Broadwater pipeline corridor. However, no live lobsters were observed during surveys of the Broadwater corridor. Mud burrows typical of lobsters occurred at several locations.<sup>118</sup>

Crab: Trawl surveys of recreationally important species indicate that abundant crabs in Long Island Sound include spider, lady, rock, blue and flat claw hermit.<sup>119</sup> Lady crab and rock crab are the most abundant. The horseshoe crab (actually more closely related to spiders than crabs) is second only to lobster in abundance in the CTDEP trawl surveys.<sup>120</sup> The Resource Report adds red crab, a deep water crab to this list; however, only one spider crab was observed during the site specific survey of the Broadwater corridor.

#### 4.1.1.6 Turtles

Five marine turtle species could utilize Long Island Sound: the Atlantic Green Turtle, the Atlantic Ridley Turtle, the Hawksbill Sea Turtle, the Leatherback Turtle, and the Loggerhead Turtle. All are listed as threatened or endangered by the U.S. Fish and Wildlife Service. These species have all been occasionally observed in Long Island Sound in the summer months. Their use of Long Island Sound is restricted to summer feeding activities. The Broadwater application excludes the Hawksbill, which is very rare in Long Island Sound, according to information from the Coastal Education and Research Society of Long Island.

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<sup>117</sup> Atlantic Marine Fisheries Commission. April 2005. Habitat Hotline Atlantic. Vol. XII. No. 1; Long Island Sound Lobster Health Symposium. Identifying the Driving Forces Behind the 1999 lobster mortality event- fitting together the pieces of the puzzle.

<sup>118</sup> Broadwater Resource Report 3.

<sup>119</sup> CTDEP 2002, Recreational Fishing Survey.

<sup>120</sup> CTDEP. 2002. *op. cit.*

#### 4.1.1.7 Birds

Bird species that utilize open water habitats in Long Island Sound include ducks, gulls and oceanic birds. Recreationally important waterfowl, such as ducks and geese, including sea ducks, overwinter in Long Island Sound.

#### 4.1.1.8 Marine Mammals

Marine mammals are protected by the Marine Mammals Protection Act of 1972 (MMPA, 16 USC Chapter 31), which ensures that these species are maintained or restored to healthy population levels. Eleven species, including four in the dolphin family, four seals, and three whales, occasionally occur in Long Island Sound. Results of a 1999 census indicated a population of more than 6,000 seals within Long Island Sound waters, the highest number in two decades. Harbor porpoises have been occasionally observed in Long Island Sound. Humpback whales have been occasionally noted in the eastern Long Island Sound. Other whale species are rarely observed.

#### 4.1.1.9 Threatened/Endangered Species

Federally Listed Species: The Endangered Species Act of 1973 (ESA, 16 USC Chapter 35) protects federally listed endangered species. The ESA requires that every federal action be reviewed in order to ensure that actions do not jeopardize the continued existence of a federally listed endangered or threatened species or result in the destruction or adverse modification of the designated critical habitat.<sup>121</sup>

Eight federally and New York State listed marine species could potentially occur in the Broadwater Project area. These include three species of whales and five species of marine turtles. The occasional occurrence of sea turtles in Long Island Sound is solely for feeding purposes during the warmer months (June-November). Whales are infrequent visitors to Long Island Sound. Shortnose sturgeon is also listed as endangered but is unlikely to occur in the Broadwater project area because of its preference for riverine and nearshore marine habitats. Two federally listed bird species, the piping plover and roseate tern, may occur as transients in the Project area.

State-Listed Endangered Species In addition to the eight federally listed species, New York State also lists two marine mammals, the harbor seal and harbor porpoise. These species are discussed above under the marine mammals section. Five species of state-listed turtle, described above, could occur in Long Island Sound. Eight state-listed bird species (two of which are also the federally listed species) occur in coastal Long Island Sound.

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<sup>121</sup> Critical habitat is defined as “(i) specific areas within the geographic area occupied by the species...on which are found those physical or biological features (I) essential to the conservation of the species, (II) which may require special management considerations or protection, and (ii) specific areas outside the geographical areas outside the geographical area occupied by the species that are...essential for the conservation of the species.”

#### 4.1.2 Potential Construction Related Impacts

LAI reviewed Broadwater's filed Resource Reports, which provide an assessment of potential environmental impacts and propose mitigation methods. LAI compared the Broadwater impact assessment to information derived from other marine pipeline and cable projects that have been constructed in the Northeast and elsewhere, if relevant. Other marine projects undertaken in the last five years, such as the Cross-Sound Cable, Duke's HubLine pipeline in Boston Harbor, and Iroquois's Eastchester Pipeline have provided marine construction contractors, project developers, and regulators with extensive field experience. These projects represent the evolving state-of-the-art with respect to marine energy infrastructure construction techniques. They reflect a variety of methods for avoiding, minimizing, and/or mitigating adverse impacts to the marine environment. Where construction or post-construction monitoring data are available, LAI has applied "lessons learned" from these recent projects in evaluating the mitigation methods proposed for Broadwater during construction.

Submarine pipelines utilize a variety of construction methods depending on depth to bedrock, surface substrate conditions, distance from shore, and water depth. Each construction method has an associated impact footprint on the substrate and can cause changes in water quality by causing disturbed sediments to become suspended. Seafloor impacts can extend from the direct footprint of a trench to adjacent areas when sediments removed from the trench are sidecast, or to far field areas where sediments released into the water column are redeposited.<sup>122</sup> If excavated sediments are not removed, they may be subject to dispersion into farfield areas by strong currents resulting from storm events. Seafloor impacts may also include the footprint of any anchors or spuds that are used to position and stabilize the installation barge. The recovery of the seafloor to pre-construction conditions depends on the geophysical characteristics of the sediments that were disturbed, on the dynamic environment such as waves and currents, as well as on how the trench is backfilled. Depending on the site conditions, the trench may be mechanically backfilled with indigenous material, backfilled with imported material such as rock, or allowed to naturally backfill by re-sedimentation. Restoration of ecological function depends on factors such as type of preexisting biological community, complexity of the habitat, source of biota for recruitment, and time of year of the impact.

Broadwater plans to use a subsea plow as the primary method for installation of the pipeline. Plowing is typically done following assembly of the pipe and placement on the substrate. For burial of the pipeline to about eight feet below the surface, as for the HubLine project, the plowing technique results in a pipeline trench on the order of 20 to 25 feet wide at the surface of the seabed. The spoil material is displaced on both sides of the trench cut by the plowshares. Depending on the substrate conditions and burial requirements, more than one passage of the plow may be required. After the pipeline is located to the desired depth, the trench spoil may be placed back on top of the pipeline or the excavated materials could be allowed to recover the trench through natural sediment transport processes. While Broadwater proposed to actively backfill only 10% of the pipeline trench, FERC in the DEIS recommended that the entire trench be actively backfilled. Plowing is generally preferable to the jetting method of trenching, in

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<sup>122</sup> The word "trench" is used in this context to mean the cut created by any construction method.

which a high-pressure water or air jet excavates a trench approximately 40 feet wide. Jetting disperses excavated sediments, particularly fine-grained particles, farther from the trench than plowing does. Burial of the pipeline following jetting can be accomplished through the same methods as for plowing. Seafloor impacts may also include the footprint of any anchors or spuds that are used to position and stabilize the installation barge. If slack in the cables contacts the seafloor as the anchors are repositioned by tugs, sediments may also be disturbed. Anchor cable sweep can be minimized by installing mid-line buoys to support the cables.

Geotechnical conditions encountered in the substrate may require contingency planning for certain areas, such as along the Stratford Shoal. In this area, Broadwater proposes to use dredging as a backup method. This would result in a wider trench and somewhat greater disturbance of sediments. As currently envisioned, the installation of the Project pipeline would not entail blasting, horizontal directional drilling (HDD), or construction through contaminated sediments, which are more complex construction techniques. Bedrock areas were avoided during the route selection process because of the expense and environmental impacts of blasting. This is beneficial to marine biota since the environmental effects of blasting can be more significant than other methods for a variety of reasons. Blasting may cause destruction of rare habitat that is difficult to replicate and recovers more slowly than soft substrate. Blasting generally prolongs the duration of construction and may cause concussion impacts to fish or marine mammals. Small areas of bedrock or heavily contaminated sediments would require placing the pipeline on the sea floor and covering it with an armoring of stone rip-rap or concrete mats, which locally alters the substrate and habitat. HDD is typically only employed in near-shore environments. HDD uses a trenchless process, so that there is minimal direct disturbance to the ocean bottom where the pipeline is located. The impacts are usually restricted to the entry and exit points, and includes turbidity, deposition of drilling fluids (inert materials), and disturbance of bottom sediments.

As proposed by Broadwater, the pipeline installation will require three passes: one pass to lay the pipeline, followed by two plowing passes to achieve the minimum burial depth of 7 to 9 feet. Broadwater proposes an 8-point mooring vessel with mid-line buoys on half of the 8 anchor cables. With this configuration, project construction would disturb a total of 2,235.2 acres. The largest contribution would be associated with anchor cable sweep (2,020 acres), plowing of the pipeline trench and sidelaying of spoils (197.3 acres) and the footprint of the anchors (16.5 acres). Impacts from the pipeline installation can be grouped into five basic categories:

- Direct habitat disturbance related to excavation (plowing) of the trench;
- Direct impact to marine species associated with the trench plowing;
- Sediment resuspension (water quality impacts) and deposition (benthic impacts) resulting from trench plowing;
- Substrate disruption related to anchor cable sweep; and
- Permanent habitat alteration related to placement of armoring materials, such as may be used to cover and protect other cables that the pipeline intersects.

Impacts related to the construction of the FSRU could include the following:

- Sediment disturbance during installation of the mooring system;
- Noise and other disturbance to mobile marine organisms; and
- Withdrawal and discharge of seawater for hydrostatic testing with potential use of biocides.

The following sections describe potential construction impacts, mitigation methods, and habitat recovery rates, based on experience from similar marine infrastructure projects. The timing of construction affects the type and level of impacts that may occur. Avoiding construction during the sensitive life stages of marine species will minimize potential impacts. These impacts can vary depending on the species. Broadwater expects to restrict all pre-construction and construction activities to the colder weather months. As reported in the DEIS, Broadwater proposes to initiate pre-lay surveys for the pipeline in September 2009. In-water work on the pipeline would take place between October 2009 and April 2010. The YMS and connection to the FSRU would be scheduled for September through November 2010.

#### *4.1.2.1 Water Quality Impacts*

Water quality is directly affected by the displacement and disturbance of bottom sediments and the resultant release of sediments into the water column. This causes increased turbidity, which can affect habitat and marine species. The suspension of sediments into the water column can temporarily affect water quality through the reduction of DO and depth of light penetration. Contaminants, if present in the sediments, also may potentially be released. The suspended sediment drifts with the water currents and eventually settles on the bottom. Coarse sediments generally settle quickly, whereas finer sediments remain suspended in a plume for longer periods of time. Water quality impacts associated with construction are generally short in duration. Generally, a turbidity plume generated by bottom disturbance will dissipate within hours of cessation of the activity that caused it. Release of anoxic organic sediments into the water column can also remove dissolved oxygen from the water column in the immediate vicinity of the disturbance. The magnitude of this effect is controlled by a number of factors including water depth, substrate conditions, currents, and construction technique.

Release of contaminants from sediments into the water column does not appear to be a significant concern for the Project. The preferred pipeline route avoids the most contaminated areas in the Sound, which are generally higher in the western region of the Sound and within harbors and coastal embayments. Sediment sampling along the pipeline alignment and review of existing sediment chemistry data showed the presence of metals, volatile organic compounds, and dioxins, but none that exceeded the NYSDEC technical and operational guidance series for sediment and dredged material.<sup>123</sup> No polycyclic aromatic hydrocarbons, polychlorinated biphenyls, or pesticides were detected in sediment samples collected along the pipeline route. Broadwater has used these data in the MIKE 3 model, a hydrodynamic model that has been widely used by the U.S. Army Corps of Engineers (USACE) for projects in New York and New

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<sup>123</sup> Broadwater Resource Report 2.

Jersey, including Long Island Sound. Broadwater's modeling results indicated that estimated contaminant levels would fall within acceptable water quality standards for Class SA water.

#### 4.1.2.2 Impacts on Benthic Communities

Benthic communities may potentially be impacted by direct disturbance of bottom sediments from construction and from the cable sweep during the construction vessel anchoring process, with resultant mortality by displacement or burial. Indirect impacts from the associated turbidity and sediment deposition could include mortality by suffocation beneath silt, interruption of spawning and migration, habitat loss or alteration, and introduction of water pollutants, if present. Benthic invertebrates in the areas of direct impact from the subsea plow and from pile driving for the YMS will likely be killed. Larger, more mobile invertebrates and fish may be able to avoid the disturbance. Loss of the benthic community also results in the loss of habitat value for predators, although scavengers such as lobsters and crabs may be attracted to the newly disturbed substrate because normally buried benthic organisms may be exposed on the surface.

Broadwater reports that the largest portion of the disturbed seafloor area would arise from anchor cable sweep as the construction vessels are positioned along the pipeline corridor. Attaching mid-line buoys to support the anchor cables would minimize the disturbance. In the DEIS, FERC recommended that mid-line buoys be attached to all anchor cables, and suggested that this could substantially reduce the area of impact. The effectiveness of this method continues to be a topic of discussion between Broadwater and FERC.<sup>124</sup>

Recovery time is dependent on the type of benthic community. The benthic community along the Broadwater corridor is a relatively mature community, typical of stable conditions. This type of community repopulates more slowly than shallower communities that are exposed to more energetic near-shore conditions and more frequent disturbance. Based on similar types of disturbances in similar habitats elsewhere, including along the Cross Sound Cable construction corridor, the benthic assemblage previously existing along the Project pipeline corridor would be expected to repopulate over a period of months to one or two years.<sup>125,126,127</sup> However, opportunistic or pioneering species of benthic invertebrates would begin recolonizing within a period of days to weeks, depending on the timing of the disturbance.<sup>128,129</sup>

Recovery of the fish and shellfish functions is in part dependent on the recovery of the benthic infauna within the sediment, which help create the appropriate food resources and habitat for

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<sup>124</sup> LeBoeuf, Lamb, Greene & MacRae LLP for Broadwater Energy, LLC, Comments on Draft Environmental Impact Statement, January 23, 2007, and response to Environmental Information Requests, July 10, 2007.

<sup>125</sup> Six-Month Post Installation Benthic Monitoring Survey for the Cross-Sound Cable Project, New Haven, CT to Shoreham, NY. October 14 to November 20, 2002. Prepared by Ocean Surveys, Inc.

<sup>126</sup> Kropp, R.K., Diaz, R., Hecker, B, Dahlen, D., Boyle, J.D. Hunt. C.D. 2000. 1999 Outfall Benthic Monitoring Report. Boston: Massachusetts Water Resources Authority. Report ENQUAD 2000-15. p. 230.

<sup>127</sup> Murray, P.M. and H.L. Saffert. 1999. Monitoring Cruises at the Western Long Island Sound Disposal Site. DAMOS contributing No. 125. U.S. Army Corps of Engineers. Waltham, MA. 80 pp.

<sup>128</sup> Rhoads, D.C., P.L. McCall, and J.Y. Yingst. 1978. Disturbance and Production on the Estuarine Sea Floor.

<sup>129</sup> Murray, P.M. and H.L. Saffert. 1999. *op. cit.*

larger organisms. Mobile fish and larger invertebrates such as lobster may be able to avoid construction activities and return as part of the habitat recolonization. Other species that rely on substrate-specific characteristics, such as winter flounder and other demersally spawning fish can begin using the habitat as it returns to its previous condition.

#### 4.1.2.3 Lobster and Shellfish

The potential effects of the Broadwater Project on lobsters have received considerable attention due to the commercial importance of the fishery and its apparent vulnerability following recent die-off events in Long Island Sound. The potential impacts from Broadwater may be exacerbated because the population is under stress. Sources of construction-related mortality for lobster may include direct contact with construction equipment, increased exposure to predators if the open trench or cover material acts as a barrier to migration, burial of lobsters in the trench during backfilling, and loss of EBP habitat. Impacts can be minimized by restricting activity to cold water temperature periods when movement of lobsters is at the annual low, and the probability of encounter between lobsters and construction is reduced. Regardless of the time of year, any lobsters residing in the path of the active trenching and side casting activity will likely suffer mortality, but the probability of "new" lobsters entering the area of construction activity is minimized when temperatures are lower. The construction window for marine infrastructure projects in the Northeast is typically November through April.

Preliminary post-construction monitoring data from the HubLine project in Boston Harbor indicates that lobsters recolonized the substrate within what Massachusetts Division of Marine Fisheries (MADMF) terms "a relatively short period of time."<sup>130</sup> Lobster catches along the HubLine corridor have not shown a difference when compared to control areas outside of the HubLine construction area.<sup>131</sup> Although there are clearly ecological differences between Boston Harbor and Long Island Sound, the HubLine experience indicates that mitigation methods to protect lobster habitat can be successfully implemented.

EBP lobsters prefer complex habitat that provides shelter, especially cobble beds.<sup>132</sup> This type of habitat is likely to occur mainly in the Stratford Shoals area of the Project corridor. Habitat alteration or loss can be minimized by backfilling a plowed trench with the native gravel and cobble.

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<sup>130</sup> HubLine, in Boston Harbor, provides useful insights regarding the success of state-of-the-art marine construction mitigation and lobster recolonization. Although it is not located in Long Island Sound, the lobster populations and commercial importance are similar to Broadwater's Project area. HubLine relied upon time of year work windows to minimize impacts during trenching and pipelaying operations. When construction extended beyond the April 30 deadline, Algonquin, a Duke company, was required to pay \$5 million to the Commonwealth of Massachusetts to compensate for impacts to aquatic resources. The compensation is being used for a variety of studies that are being conducted by MADMF. The approval was based on the assumption that it would be less detrimental to marine biota to continue work beyond the traditional work window rather than stop the work, leaving an open trench and exposed pipe in some locations, and resume the following year, interrupting ongoing recovery.

<sup>131</sup> MADMF. 2005. Monitoring and Assessment Update 7-7-05.

<sup>132</sup> Palma, A.T., R.A. Wahle, and R.S. Steneck. 1998. Different early post-settlement strategies between American lobsters *Homarus americanus* and rock crabs *Cancer irroratus* in the Gulf of Maine. *Mar. Ecol. Progr. Ser.* 162:215-225.

Most of the commercially-important molluscan shellfish, including hard clams, oysters and sea scallops, are not harvested within the Broadwater Project area, and therefore impacts to these species are not significant.

#### *4.1.2.4 Finfish Impact Assessment*

Finfish have the potential to be affected by construction through direct contact with construction equipment, obstruction of migrations, blasting, pile driving, and degradation of habitat. Fish are mobile organisms that will to a great extent avoid construction activities. Degradation of habitat can occur due to siltation from trenching activities, increased suspended solids affecting water quality, and modification of the habitat following backfilling. Demersal fish that live on the bottom are most susceptible to habitat degradation. Release of pollutants from contaminated sediment is another possible source of habitat degradation, but sediment sampling indicates that this is unlikely to be an issue along the Project site. The offshore location of the Project, in combination with time of year restrictions, will minimize disruption to anadromous fish migration. Fish eggs and larvae are susceptible to increased turbidity and siltation resulting from dredging, especially if the eggs are demersal. Most larvae are poor swimmers and it is not expected that they could avoid any areas of high turbidity. However, it is likely that elevated turbidity would be a short-term condition and only in a small area around active construction.

The primary impact to pelagic species and lifestages would be a temporary increase in suspended sediments in the water column. Increased suspended solids are generally short-lived and not lethal to finfish. Data from the HubLine water quality monitoring support this conclusion.<sup>133</sup> Demersal fishes are found in close association with the bottom, and therefore are sensitive to siltation and changes in bottom composition resulting from trenching activities. In the short term, it is expected that most adult demersal fishes will be able to avoid construction activities. However, eggs, larvae, and juveniles, particularly demersal eggs, will be susceptible to siltation and turbidity effects. Eggs are expected to be more resistant to turbidity as their food source is contained within the egg, although eggs from some commercially-important species such as winter flounder and ocean pout, may become silted over and experience mortality. Larvae and to a lesser extent juveniles may be more susceptible to turbidity impacts because they have limited ability to avoid high turbidity and are actively seeking food sources after the yolk-sac stage. Time of year restrictions can be used to minimize impacts.

Pile driving during the construction of the YMS tower for the FSRU may have adverse effects on finfish. Pressure waves from pile driving (and blasting) cause barotrauma on finfish swim bladders.<sup>134</sup> The degree of damage varies depending on the species, age, and distance from the activity. According to Broadwater, the pile driving for the tower construction is expected to occur over a period of days to a few weeks. Therefore impacts can be minimized by restricting the activity to the time period when most sensitive species are absent.

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<sup>133</sup> TRC Environmental Corporation. 2004. HubLine Pipeline Project: Construction Water Quality Monitoring Summary Report, January 30, 2004.

<sup>134</sup> Hardyniec, S. and S. Skeen. 2005. Pile Driving and Barotrauma Effects. TRB Paper No. 05-2242.

#### 4.1.2.5 *Submerged Vegetation*

Seagrass and algae beds occur outside of the Broadwater corridor and will not be adversely affected.

#### 4.1.2.6 *Birds*

Because birds are highly mobile during feeding and migration, construction-related impacts to most marine birds will be negligible. Various species may be displaced temporarily from feeding and resting areas as the construction vessels traverse through particular habitats. However, because of their mobility and large ranges, the birds typically will utilize other available habitat during construction and move back into the work areas quickly after construction is complete. This brief loss, if any, of feeding and resting habitat and the additional energy expended to depart from normal movements generally represent little to no threat to any marine birds. Potential impacts will also be mitigated through time-of-year restrictions on the construction period.

#### 4.1.2.7 *Marine Mammals and Sea Turtles*

The likelihood of impacts to marine mammals or sea turtles is expected to be limited because project permit and certificate requirements typically prohibit construction during periods when such species would be present in Long Island Sound. Furthermore, agencies are likely to require marine mammal monitoring during construction, and contingency plans in the event of a marine mammal sighting.

#### 4.1.2.8 *Other Construction-Related Impacts*

Other secondary impacts during construction include increases in vessel traffic, air emissions from construction vessels and onshore support and fabrication facilities, and the risk of vessel collisions or fuels spills. These impacts would be short term. Construction is anticipated to be scheduled during the fall and winter months when fishing and boating activities are reduced and the potential for impacts would be minimized. If authorized, construction would be conducted in compliance with state and federal regulations and permit conditions. Broadwater is currently in discussion with NYSDEC regarding requirements for a State Facility air permit to authorize construction and a Title V operating permit (under NYSDEC's delegated authority).<sup>135</sup>

In 2003, during construction of the tie-in at Northport of the Iroquois Eastchester pipeline, odorized gas was vented to the atmosphere. During this venting, weather conditions unexpectedly changed, causing an atmospheric inversion, and many odor complaints were received from neighboring communities. Because the tie-in location for the Broadwater pipeline will be 9 or 10 miles from either shoreline, the potential for odor impacts is significantly reduced. Nonetheless, during the construction, care should be taken to closely monitor weather conditions and only vent when atmospheric conditions are conducive.

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<sup>135</sup> Most recently, LeBoeuf, Lamb, Greene & MacRae LLP, Response to FERC's Environmental Information Request, July 10, 2007.

### *4.1.3 Potential Impacts During Project Operations*

#### *4.1.3.1 Impacts of Operation on Marine Resources*

The footprint of the FSRU will measure approximately 5.7 acres. The extent of the shaded area beneath the FSRU has not been calculated but will vary depending on season and time of day. Since the FSRU is free to pivot around the mooring base, the shaded area will not be fixed but will shift based on wind and currents. The FSRU will lie in approximately 93 feet of water with a draft of approximately 40 feet, leaving approximately 53 feet of water underneath the structure. Broadwater indicates that the YMS tower will be an open structure but will straddle approximately 13,000 square feet of the sea floor, which is the area within the four legs of the tower. As discussed elsewhere in this report, approximately 2 to 3 LNG carrier vessels will arrive at the FSRU per week. Potential operational impacts associated with the operation of the FSRU and LNG carrier vessels include:

- habitat alteration and loss beneath the YMS tower and creation of new habitat along the legs of the tower;
- reduction in water column area and shading of the water column and possibly sea floor beneath the FSRU;
- entrainment/impingement from sea water intake by the FSRU and LNG carriers;
- reduction in the area available for commercial and recreational fishing and boating;
- impacts associated with increased shipping traffic due to increased potential for spill, ballast water discharge, and collisions with marine mammals and turtles;
- increased light and noise from the FSRU and the LNG carrier vessels; and
- possible circulatory changes from the FSRU and YMS tower, and thermal impacts from cooling water discharge and the YMS riser pipe.

Potential impacts on the marine environment from the operation of the pipeline include permanent changes to the substrate if backfilling remains incomplete, potential release of gas and liquid dropout from the pipeline if there is a breach, periodic redistribution of sediments during pigging of the pipeline, and potential thermal impacts. Broadwater reports that the temperature of the gas traveling through the pipe would range from a maximum of 130°F at the YMS to a low of 50°F at Iroquois.

#### *4.1.3.2 Water Quality Impacts*

Operational impacts associated with increased shipping traffic such as spills and discharges will be minimized through adherence to federal regulations and industry standards. The FSRU, LNG carriers, and other support vessels would be expected to conform to the EPA's Spill Prevention, Control and Countermeasures (SPCC) protocols and Oil Pollution Act, minimizing the potential for contaminant discharge. All discharges from the FSRU would conform to the State's SPDES standards, protecting water quality and aquatic life from acute and chronic effects.

Operational impacts on water quality associated with operation of the pipeline are expected to be minimal, and only associated with an accidental breach of the pipeline. The effects of the pivoting FSRU with a 40 foot draft combined with a subsurface tower with a 13,000 square foot footprint on water circulation are not known but expected to be small because of the size of the water body and distance from the shoreline. No other studies were found that could provide insight into this evaluation. The FSRU is located outside of areas in Long Island Sound considered to hypoxic, with levels of DO between 3.5 and 4.79 mg/L.<sup>136</sup> Given that the FSRU is in an area that is at low risk but still potentially vulnerable to a low oxygen event, it would be important for the Project to evaluate this risk thoroughly, possibly through water quality modeling. Since low oxygen has an adverse effect on benthic invertebrates, fish and lobsters, the results will be applicable to these other resources.

Of critical importance in gauging potential water quality impacts, Broadwater indicates that the regasification process will be a closed-loop glycol-water system. Therefore it will not involve any seawater intake or discharge. FSRU water intake will amount to an annual average of 5.5 million gallons per day, principally for ballast with a lesser amount for fire-fighting and other on-board personnel needs.<sup>137</sup> The ballast will be treated with a biocide and discharged as LNG is taken on. Other FSRU discharge will be from the on-board desalinization plant and the on-board waste water treatment plant. All discharge streams from the FSRU will be monitored and required to meet the NYSDEC water quality criteria and SPDES permit limits for protection of Long Island Sound.

Broadwater reports that the LNG carriers will typically be steam powered and will intake an average of 22.7 million gallons per day, consisting of ballast and cooling water. The LNG carriers, like most large commercial vessels in the Sound, would treat cooling water with low doses of a biocide to prevent fouling. The LNG carriers are not expected to discharge any ballast water in Long Island Sound. Broadwater evaluated the thermal impact of cooling water discharge from an LNG carrier while offloading at the FSRU. Broadwater modeled a “worst case” scenario, assuming a type of LNG vessel with a high thermal discharge flow rate and surface water temperatures typical of summer months. The resulting thermal plume is expected to exceed the NYSDEC thermal criterion – 1.5°F above ambient temperature – for an average distance of 23 m from the point of discharge. Since the discharge port is located about 45 m from the aft of the LNG carrier, the thermal plume would not extend beyond the end of the channel between the FSRU and the carrier vessel, and would have a localized footprint of only 0.22 acres.<sup>138</sup>

The water intake requirements of the FSRU are relatively small compared to other energy projects situated around Long Island Sound. For example, in Connecticut, Bridgeport Harbor Station is currently permitted to withdraw 152 million gallons per day, New Haven Harbor is permitted to withdraw 410 million gallons per day, and the Millstone nuclear power plant is

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<sup>136</sup> <http://www.dep.state.ct.us/wtr/lis/hypo/fsindex.htm>.

<sup>137</sup> Broadwater General Project Description, Resource Report 1.

<sup>138</sup> LeBoeuf, Lamb, Greene & MacRae, LLP, Broadwater Response to FERC’s March 6, 2007 Environmental Information Request, May 7, 2007.

permitted to withdraw 1.5 billion gallons per day. On Long Island, Northport Station is permitted to withdraw 938 million gallons per day and Port Jefferson Station is permitted to withdraw 398 million gallons per day.

Broadwater proposes to use a copper-based anti-fouling paint on the hull of the FSRU and on the YMS tower to retard the growth of organisms. The copper has the potential to leach into seawater. Broadwater modeled this impact and reported that the resulting copper concentration (1.0005 microgram per liter) would be below EPA's ambient water quality criteria for acute and chronic exposures.<sup>139</sup> FERC has requested further information on the type of copper-based paint proposed to be used and also the potential for flaking of paint during periodic hull cleaning.

#### *4.1.3.3 Impacts on Benthic Communities*

The pipeline will be buried in a trench with a minimum depth of 7 to 9 feet, which is expected to eliminate any surficial thermal impact. No long term impacts from pipeline operation would be expected, with the exception of the potential for a release. Burial of the pipeline is expected to provide protection from anchor drag damage that might result in a release of gas and condensate. The YMS tower would disturb or eliminate the benthos in a minimum of a 13,000 square foot area when it is installed. Construction details of the tower are not in publicly available volumes of Broadwater's application, but Broadwater has indicated that a mud net will span the area underneath the tower and provide support for the four legs of the YMS tower during construction. This is a wooden mesh structure that will gradually become covered with sediment. Any hard substrate structures (YMS tower and FSRU hull) would be rapidly colonized with fouling organisms, particularly within the photic zone, unless such growth is effectively retarded by the anti-fouling paint. Unless regularly removed, this would create a food source for larger invertebrates and fish, along with habitat diversity. The soft substrate beneath the mooring tower would be rapidly colonized with pioneering organisms; continuous disturbance from the mooring structure or periodic physical removal would change the benthic community to a pioneering community typical of disturbed conditions.

Increased ship traffic increases the risk of introducing invasive species through ballast water or hull fouling. Broadwater asserts that the LNG cargo vessels will not discharge ballast within Long Island Sound, which will help minimize this risk.

Decommissioning and removing the FSRU after its 30-year life span will remove the associated organisms. Broadwater suggests that the YMS tower could be removed from the seafloor or, alternatively, abandoned in place and used as an aid to navigation.<sup>140</sup> Currently, although controversial, the subsurface structures of some oil rigs elsewhere in the U.S. are being left in place rather than remove the diverse fauna that has developed (the rigs-to-reef program).

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<sup>139</sup> Broadwater Resource Report #2, p.2-66.

<sup>140</sup> Broadwater Resource Report 1, p. 1-30.

#### 4.1.3.4 *Phytoplankton and Vegetation*

Because the substrate is below the photic zone, no submerged vegetation (*e.g.* algae or eel grass) is present around the FSRU site. The only primary producers would be phytoplankton, single celled plants in the portions of the water column that receive light. The amount of production by these plants depends on the presence of light and nutrients. Since the FSRU has a draft of about 40 feet, it may eliminate the area of primary producers under the FSRU and reduce primary production in the shaded areas. However, because the FSRU will pivot around the mooring tower, the shading in any specific location would not be continuous. Water under the FSRU will circulate with the normal currents, reducing the impact of shading. Hard surface areas of the FSRU and YMS tower will be colonized by vegetation such as diatoms and kelps, increasing habitat complexity and food resources for herbivores.

#### 4.1.3.5 *Lobster*

Potential operational impacts on lobster include barriers to movements and permanent alteration of habitat especially for EBP lobsters. One issue of concern for many marine infrastructure projects has been whether the incompletely backfilled open trench or the sidecast materials surrounding the pipeline pose a barrier to migrating lobsters. Preliminary results from the HubLine project indicate that the open trenches and surface laid pipeline have not been an impediment for lobster movements.<sup>141</sup> Diver inspections of the existing Long Island Sound 1385 Cable have not reported observing lobsters in distress. These field observations suggest that other cables on the seafloor in Long Island Sound have not posed a significant obstacle to lobster movement.<sup>142</sup>

The YMS tower will disturb or eliminate an area of approximately 13,000 square feet for lobster production. Additional details on how the structure will be arrayed on the sea floor are necessary to evaluate the impacts. Hard substrate structures may provide habitat complexity and necessary cover, depending on how the structure is configured. The mesh underneath the tower will collect sediment through natural sediment transport and will colonize with organisms typical of soft substrate. Also unknown is whether the pivoting FSRU and its shading will affect the underlying lobster population. Because lobster harvesting will be precluded beneath the FSRU, and possibly throughout the Safety Zone surrounding the FSRU, lobster population may be beneficially affected in this area.

#### 4.1.3.6 *Finfish Impact Assessment*

Demersal fishes with specific habitat requirements are most susceptible to the long-term impacts due to habitat modification arising from Project operation. These fishes would include those that have specific preferences for spawning, young-of-year, or feeding habitat. Substrate restoration and other engineering measures to minimize siltation and turbidity can minimize the potential for

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<sup>141</sup> TRC and Normandeau Associates. 2003. HubLine Pipeline Project Supplemental Monitoring Report, Lobster Assessment. <http://ma.gov/dfwele/dmf/programsandprojects/hubline/monitoring.htm#hub>. Accessed 7/24/05.

<sup>142</sup> Task Force on Long Island Sound, 2003. Comprehensive Assessment and Report, Part II Environmental Resources and Energy Infrastructure of Long Island Sound. June 3, 2003.

population-level impacts to demersal fish species. EFH coordination with NMFS should thoroughly evaluate these impacts on a species by species basis based on the type of habitat disturbed and the type of construction method.

Operation of the Project would result in minor but long-term impacts to finfish due to water intake and discharge from the FSRU. Impingement and entrainment through the intake structures will cause losses to ichthyoplankton (fish eggs and larvae) and adults. However, these losses are not expected to affect the overall finfish or lobster population within Long Island Sound.<sup>143</sup> Broadwater intends to minimize these losses by locating the intake structure at mid-depth, 40 feet below the surface, where ichthyoplankton densities are lower. Broadwater also proposes to limit intake flow velocities to 0.5 feet per second and use small mesh screen (0.2-inch mesh) across the intake structure to minimize losses. To minimize the growth of organisms within seawater systems on the FSRU, sodium hypochlorite will be injected into the intake stream. Complete or near complete mortality of entrained organisms is expected. Residual chloride levels will also be present in the discharge, but are not expected to have an adverse impact on marine organisms.

The FSRU will reduce or eliminate about 13,000 square feet of demersal fish habitat. Additional details on how the structure will be arrayed on the sea floor are necessary to evaluate the impacts. Hard substrate structures will be colonized by fouling organisms, which will provide a food source for some species. As a result, the finfish assemblage may change locally. It is not known whether the pivoting FSRU and its shading will affect the underlying demersal population. Decommissioning the structure in 30 years will eliminate the community that has developed.

#### *4.1.3.7 Birds*

The FSRU and the LNG carrier vessels will be lighted. Lighting may attract some seabird species, especially at night, and may cause disorientation and death. Collisions during migration, particularly during adverse weather conditions, may cause mortality. Broadwater intends to minimize these potential impacts by utilizing best management practices for design and use of lighting and other components on the FSRU. Increased LNG carrier traffic and the FSRU itself may locally interfere with seabird resting and feeding.

#### *4.1.3.8 Marine Mammals and Sea Turtles*

Increased ship traffic and the addition of the FSRU and YMS tower may increase the probability of a collision with these species. These species are rare and under federal protection, so any potential impacts should be resolved through agency coordination either through the Marine Mammal Protection Act or Endangered Species Act.

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<sup>143</sup> FERC Broadwater DEIS, p. 3-58.

## 4.2. *Potential Impacts to Commercial and Recreational Fishing*

### 4.2.1 *Commercially Important Marine Resources*

Research commissioned by the LISS, a cooperative program initiated by the federal government, Connecticut, and New York in 1985, estimated that more than \$5 billion is generated annually in the regional economy from boating, commercial and sport fishing, swimming, and beachgoing within and along Long Island Sound. Commercial and recreational fisheries in Long Island Sound are valued at over one billion dollars. In 2001, over 325,000 Connecticut anglers made over 1.7 million fishing trips, catching nearly 6.5 million fish.<sup>144</sup> Four species, bluefish, striped bass, scup, and summer flounder, composed over 90% of the catch. Tautog and winter flounder were once important recreational species, but catches have been low in recent years.<sup>145</sup> Management efforts are causing only modest increases.

#### 4.2.1.1 *Crab*

Recreational surveys indicate important crabs in Long Island Sound include spider, lady, rock, blue and flat claw hermit.<sup>146</sup> Most abundant are lady crab (most abundant in fall), followed by rock crab (most abundant in spring); the remainder are relatively uncommon. Lady crab catches show evidence of a recent decline, with 2001 catches the lowest since 1992. Spring spider crab and rock crab catches have also been decreasing since 1994-1996. None of these species was mentioned in Broadwater's interviews with fishermen who frequent the proposed Project site,<sup>147</sup> so crab fishing does not appear to be important in the Project area.

#### 4.2.1.2 *Lobster*

The lobster fishery is important in Long Island Sound and has declined significantly since the 1998 lobster die-off. The Broadwater project is located in an area that is utilized for lobster fishing. Squid are mentioned as an important by-catch species by local fishermen, but it is not clear whether squid harvesting occurs independently in the Project area.<sup>148</sup>

#### 4.2.1.3 *Molluscan Shellfish*

Commercially harvested molluscan shellfish species in Long Island Sound include hard clam, sea scallop and the eastern oyster. None of these appear to be harvested in the Project area. No live molluscan shellfish (surf clams, hard clams, or oysters) were observed during surveys of the

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<sup>144</sup> No equivalent data are readily available for New York.

<sup>145</sup> Gottschall *et al.*

<sup>146</sup> CTDEP 2002, A Study of Marine Recreational Fisheries in Connecticut. F 54-R-21. Annual performance report.

<sup>147</sup> Broadwater Resource Report 8.

<sup>148</sup> Broadwater Resource Report 8.

Broadwater corridor.<sup>149</sup> Interviews with fishermen that use the Broadwater area included conchs or whelks as important.<sup>150</sup> New York does not include whelks in its definition of “shellfish”.

#### *4.2.1.4 Finfish*

Commercially important finfish in the Project area include scup, butterfish, bluefish, tautog, striped bass, summer and winter flounder, and windowpane. Recreationally important species include bluefish, scup, summer flounder, striped bass, tautog, and winter flounder.<sup>151</sup>

### *4.2.2 Potential Impacts from Construction and Operation*

Sections 4.1.2 and 4.1.3 detailed potential impacts to the populations of finfish and shellfish from both construction and operation of the Broadwater Project. Any changes to these populations would potentially affect the industry. Therefore, this section will focus on potential impacts other than related to threats to the population size. Potentially affected species are limited to offshore fisheries and shellfish identified above. Nearshore shellfish beds and fisheries, including oyster and quahog resources, will not be affected by the Project.

#### *4.2.2.1 Construction-Related Effects*

Construction-related effects include inability to access commercial and recreational boating and fishing areas, possible fishing and lobster gear loss, and potential loss of income for fishermen unable to relocate their effort away from the construction activities. Lobster fishing occurs year-round. Fishing for various finfish species varies seasonally depending on the species, but also occurs year round. Restricting the construction window to the winter months will reduce recreational conflicts but will not reduce conflict with commercial lobstering and finfishing. This will result in a loss in the ability to fish within the active construction area, and associated income loss for the construction period. Gear conflicts may be reduced by marking the construction locations clearly and publicizing the construction schedule and location.<sup>152</sup> While in theory updating the construction schedule on a daily basis could provide other users with the information necessary to make decisions about whether to set fixed gear such as lobster pots in a particular area, typical marine construction programs involve simultaneous activities at multiple locations, so commercial fishermen would likely avoid the entire construction route. Thus gear losses are likely due to entanglement with construction vessels and would require compensation.

#### *4.2.2.2 Operational Effects*

Operational effects include those related to any population changes in commercially-important species, discussed in Section 4.1.2 and 4.1.3. Other possible effects include LNG carrier traffic interference with commercial and recreational boating and fishing, the loss of fishing and boating access around the FSRU and the Safety Zone, gear losses associated with increased shipping

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<sup>149</sup> Broadwater Resource Report 3.

<sup>150</sup> Broadwater Resource Report 8.

<sup>151</sup> Broadwater Resource Report 8.

<sup>152</sup> The HubLine project made use of a website for this purpose and published construction monitoring reports.

traffic, and effects related to the creation of an inaccessible and protected community underneath the FSRU and within the Safety Zone. According to the DEIS, “The Project would not interfere with natural coastal processes that supply beach materials to land adjacent to such waters and would not result in flooding or erosion.”<sup>153</sup> However, neither the DEIS nor any of the Broadwater Resource Reports specifically address whether increased LNG carrier vessel traffic, particularly in and near The Race, would contribute to increased wave action and shoreline erosion.<sup>154</sup>

The Broadwater Project will involve approximately two to three LNG cargo vessel dockings per week. This represents an increase in ship traffic, which may increase the likelihood of gear loss. Within the Safety Zone, an area of approximately 1.5 square miles would likely be lost to fishing and recreational boating. Based on Broadwater’s fishermen outreach program, Broadwater determined that up to 5 lobstermen currently set pots within that area. Up to 12 fishermen trawl in this area. The actual area lost would be greater for trawlers, who utilize established east/west trawl lanes. Displacement of these users might increase usage and conflicts in other areas. Broadwater indicates that it has initiated an outreach program to commercial and recreational users. Compensation for gear and revenue losses from lost fishing, lobstering and whelk catch opportunities will likely be necessary and could be administered either through the State as a trustee, a fishermen’s association or other third party. A history of reported catches can provide a basis for compensation for lost catches, but this information is often of uncertain accuracy.

The undersea mooring of the FSRU will become colonized with fouling organisms, which will attract a variety of larger invertebrates and finfish. Oil rigs, which have similar subsurface structures, have become natural reef systems that some finfish are attracted to.<sup>155</sup> To the extent that Broadwater intends to have divers remove these organisms periodically, such communities would be short-lived. The absence of fishing could increase the fish and lobster population under the FSRU and associated Safety Zone, acting like a refuge or small Marine Protected Area (MPA). A review of the literature did not uncover any studies that confirmed that MPAs do enhance marine fish and shellfish populations.

#### ***4.3. Commercial Shipping in Long Island Sound***

Long Island Sound is an important commercial shipping corridor for ports in Connecticut and New York. Formal navigational channels are not delineated in the Sound. However, there are established traffic patterns into the major commercial harbors and along the long east-west axis of the Sound. These are illustrated in Figure 41. The FSRU is proposed to be sited to the north of the primary east-west shipping route, and west of a primary north-south shipping route. As seen in Figure 42, the Safety Zone recommended by the USCG would encroach upon the primary east-west shipping route, requiring some vessel traffic to modify course.

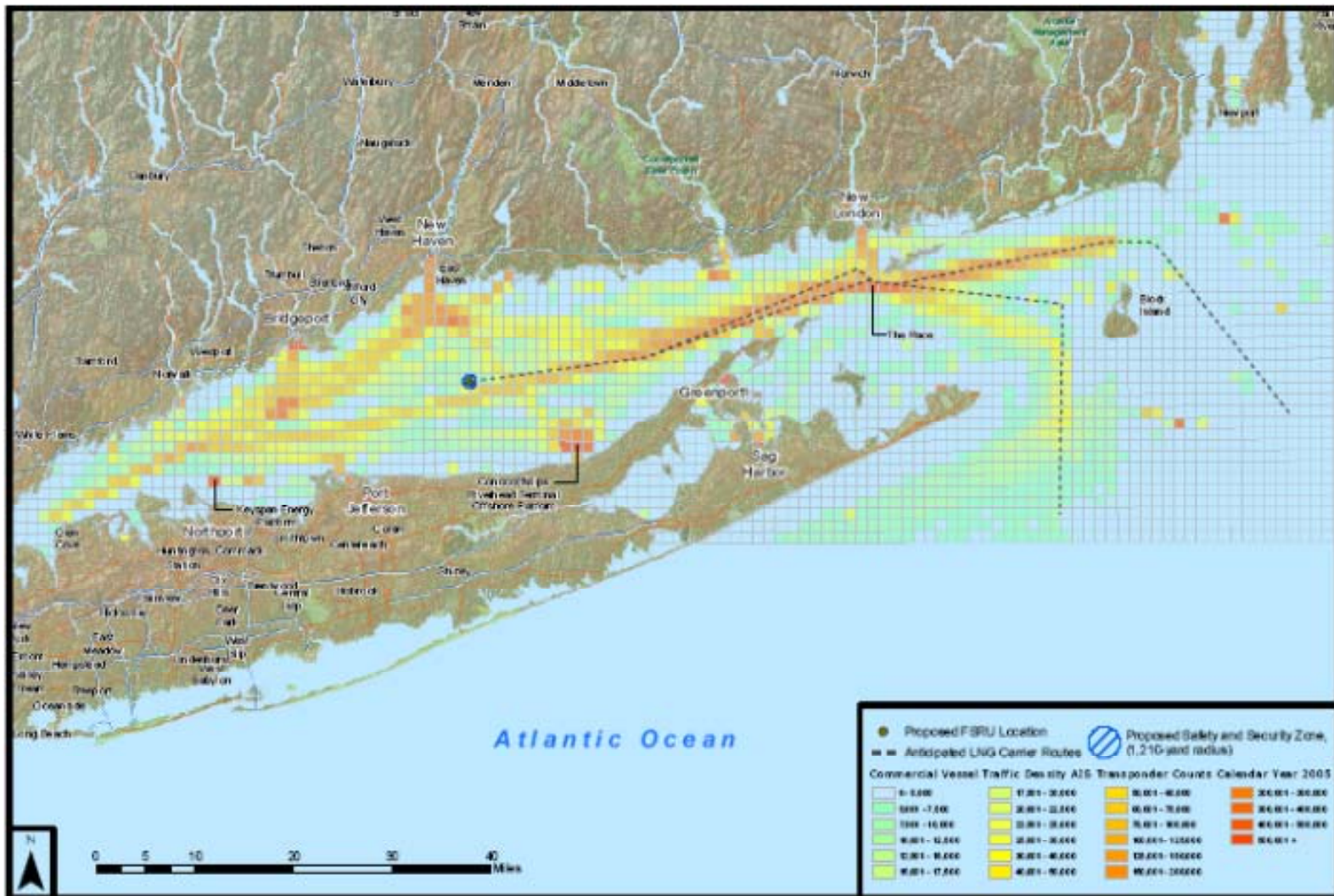
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<sup>153</sup> FERC, Broadwater DEIS, p. 3-105.

<sup>154</sup> The potential for shoreline erosion and other impacts due to a fire on an LNG carrier was addressed in a response to a FERC Environmental Information Request and found to be not significant. LeBoeuf, Lamb, Greene & MacRae, LLP, Response to FERC Environmental Information Request, June 5, 2007.

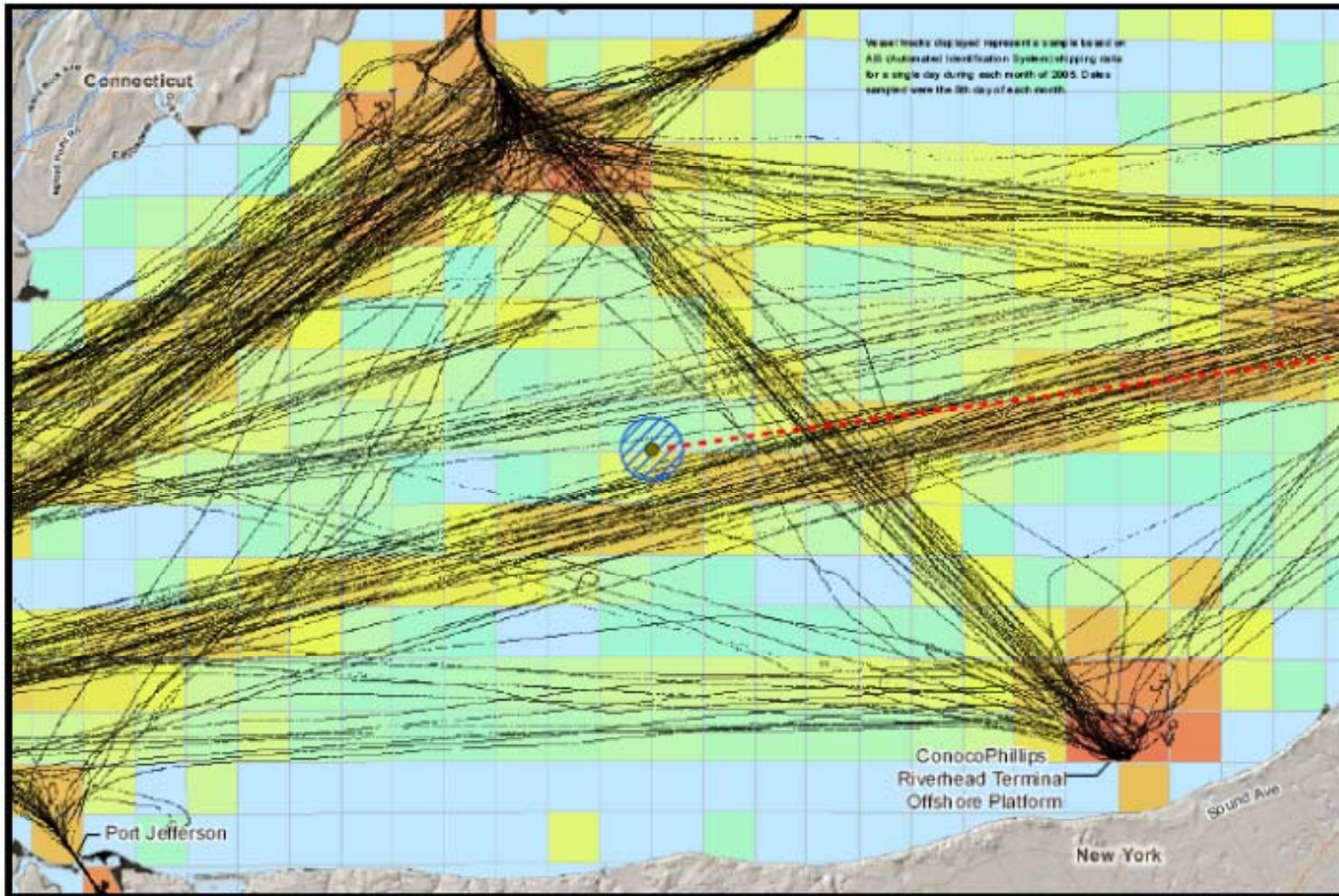
<sup>155</sup> Minerals Management Service. 1997. Offshore oil and natural gas resource management: Cumulative Effects 1992-1994. MMS 97-0027.

Figure 41 – Vessel Traffic Density<sup>156</sup>



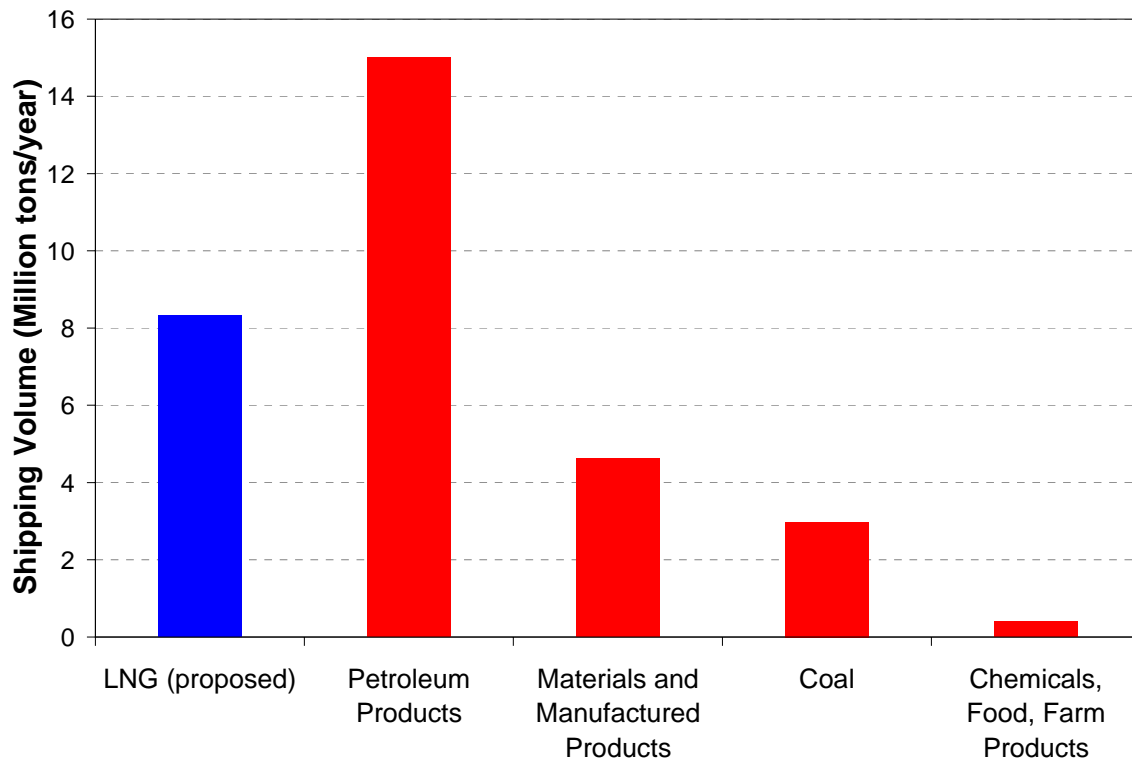
<sup>156</sup> From FERC Broadwater DEIS, based on vessel trace data compiled by USCG for 2005.

Figure 42 – Vessel Tracks in the Vicinity of the FSRU<sup>157</sup>



<sup>157</sup> Ibid.

**Figure 43 – Shipments To or From Long Island Sound Ports (2003)<sup>158</sup>**



The petroleum supply chain for Long Island and southern New England is dependent on barges and small coastal tankers that utilize Long Island Sound. Other commodities shipped through the Sound include coal (chiefly for power plants in Connecticut), petrochemicals and other chemicals, sand and gravel, and imported produce and other food products. On a commodity tonnage basis, LNG shipments arriving at Broadwater would represent an increase of 36% over current commerce in Long Island Sound, based on the most recent data available (Figure 43), *assuming all other commodities remain unchanged*. However, to the extent that the 1.0 Bcf/d of gas from the Project displaces demand for petroleum in the region, petroleum tanker and barge traffic will be reduced. This may reduce the risk of petroleum spills in Long Island Sound. In addition, the decrease in natural gas prices ascribable to the Project may promote repowering of existing steam plants on Long Island and/or conversion of core heating load from oil to gas, thus enabling a net savings in emissions of NO<sub>x</sub>, SO<sub>2</sub>, and CO<sub>2</sub>. LAI has not quantified this potential benefit.

Table 12 presents commercial vessel counts for ports in Long Island Sound. This information is included in the DEIS and is based on data compiled by the USACE in its annual report of Waterborne Commerce of the U.S., as well as additional information obtained by Broadwater. Data for year 2003 is the most recent available. The table includes domestic and foreign commercial vessels, but does not include fishing vessels, escort tugs, or through traffic that is transiting the entire Sound without calling on any port. It also does not include vessels calling on

<sup>158</sup> U.S. Army Corps of Engineers, Waterborne Commerce of the United States, Calendar Year 2003.

or departing from Flushing Bay and East River, NY, which may traverse Long Island Sound. Ingoing and outgoing trips are both counted individually. The anticipated number of LNG carriers, about 118 per year (236 transits), would represent an increase of about 0.4% of the current commercial vessel traffic in Long Island Sound, based on total transits, and 43% of the self-propelled bulk tankers currently arriving at Long Island Sound ports. However, because through-traffic is not included in this data, these percentages are a very conservative overestimate of the incremental effect of the LNG carriers. Furthermore, it does not consider the potential displacement of petroleum tankers and barges by LNG deliveries. LNG carriers would be among the largest vessels currently operating in Long Island Sound. However, unlike the coastal tankers and barges currently delivering petroleum products to Long Island and Connecticut, the LNG carriers would always occupy the central shipping corridor, and thus would be more distant and less visible from either shoreline. Further information on the impact of LNG carriers on other marine traffic within Long Island Sound, and particularly within The Race, is discussed in Sections 5.7.1.2, 5.10 and 6.3.1.

**Table 12 – 2003 Commercial Vessel Traffic To and From Ports in Connecticut and Long Island<sup>159</sup>**

<b>Deepwater Port</b>	<b>Vessel Trips per Year</b>	<b>Transit Tankers</b>
Bridgeport, CT	21,695	27
New London, CT	10,933	12
New Haven, CT	3,639	470
Port Jefferson, NY	22,515	4
Northville, NY	1,207	31
Asharoken, NY	282	11
Northport, NY	68	0
<b>Total</b>	<b>60,339</b>	<b>555</b>

<sup>159</sup> Source: USACE 2003.