4.0 ENVIRONMENTAL ANALYSIS

The environmental consequence of constructing and operating the proposed Weaver's Cove LNG Project would vary in duration and significance. Four levels of impact duration were considered: temporary, short term, long term, and permanent. Temporary impact generally occurs during construction with the resource returning to preconstruction condition almost immediately afterward. Short term impact could continue for up to 3 years following construction. Impact was considered long term if the resource would require more than 3 years to recover. A permanent impact could occur as a result of any activity that modifies a resource to the extent that it would not return to preconstruction conditions during the life of the project, such as the construction of an LNG terminal. We considered an impact to be significant if it would result in a substantial adverse change in the physical environment.

In this section, we discuss the affected environment, general construction and operational impact, and proposed mitigation for each resource. Weaver's Cove Energy, as part of its proposal, agreed to implement certain measures to reduce impact. We evaluated Weaver's Cove Energy's proposed mitigation to determine whether additional measures are necessary to reduce impact. These additional measures appear as bulleted, boldfaced paragraphs in the text. We will recommend that these measures be included as specific conditions to the Certificate that may be issued to Weaver's Cove Energy for this project.

Conclusions in this EIS are based on our analysis of the environmental impact and the following assumptions:

- Weaver's Cove Energy would comply with all applicable laws and regulations;
- the proposed facilities would be constructed as described in section 2.0 of this document; and
- Weaver's Cove Energy would implement the mitigation measures included in the application and supplemental filings to the FERC.

4.1 GEOLOGY

4.1.1 Geologic Setting and Bedrock Units

The proposed project is located within the Narragansett Basin, a regional tectonic feature associated with the Allegheny Orogeny of Pennsylvanian to Early Permian age (320 to 280 million years ago). During the Allegheny Orogeny, Narragansett Basin filled largely with sedimentary rocks which were subsequently metamorphosed to varying degrees. The proposed project is located near the contact between these sedimentary rocks to the west and much older Upper Proterozoic (900 to 540 million years ago) granites of the Fall River Pluton to the east (see figure 4.1-1). This contact extends along the Taunton River, and is locally marked by the Beaverhead, or Assonet Fault, a relict normal fault zone. Faulting and seismicity in the project area is discussed in section 4.1.4.

Bedrock beneath the proposed LNG terminal site is mapped as the Lower Pennsylvanian Pondville Conglomerate, which is composed of quartz and boulder conglomerate in an abundant sandy matrix, and arkose. The Pondville Conglomerate also underlies a portion of the proposed Northern Pipeline route, although most of this route is underlain by light gray granite of the Fall River Pluton. The proposed Western Pipeline route is underlain by Upper and Middle Pennsylvanian sedimentary rocks of the Rhode Island Formation which is composed of sandstone, greywacke, shale, and anthracite, with minor beds of meta-anthracite.

4.1.2 Physiography and Surficial Geology

The project is situated in the Seaboard Lowland Section of the New England Upland Physiographic Province, which is characterized by rolling to flat topography. Topography in the area is largely the result of Pleistocene glaciation (1.8 million years ago to 11,000 years ago) and fluvial and near shore marine processes. The proposed LNG terminal site is situated at an approximate elevation of 20 to 30 feet above MSL. Ground elevations along the 2.5-mile Western Pipeline route range from about 20 feet above MSL near the Taunton River to about 170 feet above MSL at the interconnection with the existing Algonquin G-22 lateral. Ground elevations along the proposed 3.6-mile Northern Pipeline route vary from about 20 feet above MSL near the Taunton River to about 70 feet above MSL at the interconnection with the existing Algonquin G-20 lateral.

Weaver's Cove Energy proposes to alter the surface of the LNG terminal site by placing up to 2.6 million cubic yards of dredged material on the site. As proposed, the dredged material would be dewatered, stabilized, and used to raise the overall grade of the site and to create an earthen landform for visual improvement.

Based on site-specific soil boring data and review of published geological information for the Fall River area, unconsolidated deposits at the proposed LNG terminal site are comprised of the following:

- Non-native fill - This unit is present from approximately 0 to 14 feet below ground surface (bgs) and consists of unsorted sand, silt, and gravel derived, in part, from previous dredging of the Taunton River. Fill materials have been reported in all monitoring wells and soil borings installed at the site;

- Glacial outwash - This unit ranges from approximately 14 to 72 feet bgs and generally consists of fine silty sand with interbedded sandy silt; and

Insert figure

4.1-1 Bedrock Geology in Project Area

- Glacial till - These deposits range from approximately 72 feet bgs to the top of bedrock which was encountered from 76 to 100 feet bgs. The glacial till consists of very dense, poorly sorted sand and gravel with fine silt interbeds and some black shale and pink granite cobbles.

As inferred from surficial soils (Massachusetts Geographic Information System (MassGIS), 2003), unconsolidated deposits along the proposed Western Pipeline route consist of Taunton River sediments, fill, and glacial till. Unconsolidated deposits beneath the proposed Northern Pipeline route are inferred to be fill, glacial outwash, and till (see figure 4.1-2). According to the U.S. Department of Agriculture (USDA), Soil Conservation Service soil survey maps (USDA, 1981), the depth to bedrock beneath both proposed pipeline routes is greater than 5 feet.

Construction and operation of the proposed Western and Northern Pipelines would not alter the geologic or natural topographic conditions in the project area. Although the natural topographic slope and contours would be temporarily altered along much of the pipeline route by grading and trenching activities, Weaver's Cove Energy would restore topographic contours and drainage conditions to the extent practicable to preconstruction conditions following installation of the pipelines.

Blasting is not anticipated for construction of the proposed LNG terminal or the proposed pipelines based on the known and anticipated depth to bedrock in the area. If blasting were to be necessary, it would be conducted in accordance with all applicable laws and regulations.

4.1.3 Mineral Resources

According to the Massachusetts EOEA and the U.S. Geological Survey (USGS, 2001), potentially exploitable construction sand and gravel deposits are present in the vicinity of the proposed project. However, based upon a review of historic USGS topographic maps, MassGIS land use data, and aerial photographs of the project area for 2001, there do not appear to be any active mining operations within one-quarter mile of the proposed project.

The potential for the project to impact future mining in the area is low because the Western Pipeline would be constructed through an area underlain by glacial till that does not contain exploitable sand and gravel deposits, and both the Western and Northern Pipelines would be constructed primarily along existing electric transmission, pipeline, or railroad rights-of-way, which preclude future mining operations.

Other commercially exploitable mineral resources are not known to exist in the project area.

4.1.4 Geologic Hazards

Geologic or other hazards in the project area consist of seismic-related hazards; load-bearing capacity of soils at the LNG terminal site; slope instability; and flooding. Conditions necessary for the development of other geologic hazards, including karst terrain, regional subsidence, avalanches, and volcanism, are not present in the project area.

In general, the potential for geologic hazards to significantly affect the construction or operation of the proposed project is low. The risk of damage resulting from geologic hazards would be avoided or reduced by specific engineering design criteria, ground modification, other construction techniques, and operating procedures to be implemented by Weaver's Cove Energy.

Insert figure

4.1-2 Surficial Geology in Project Area

4.1.4.1 Seismic-related Hazards

The proposed project is situated in an area with a relatively low potential for significant seismic activity. Potential seismic-related hazards that exist in the area include: earthquakes/ground shaking; surface faulting; soil liquefaction and related soil failures; and tsunamis.

Weaver's Cove Energy conducted detailed, site-specific geotechnical and geoseismic studies to evaluate the risk of seismic-induced damage to the proposed LNG terminal. The results of these studies are presented in a report entitled *Geology, Seismology and Geotechnical Engineering Site Evaluation* (Environmental Resource Management et al., 2003), which was prepared in general conformance with *Data Requirements for the Seismic Review of LNG Facilities, NBSIR 84-2833*. The results of these studies and the proposed seismic mitigation plans are summarized below.

Earthquakes/Ground Shaking

The majority of significant earthquakes around the world are associated with tectonic subduction zones, where one crustal plate is overriding another (e.g., the Japanese islands), or where plates are sliding past each other (e.g., California). Unlike these highly active tectonic regions, the East Coast of the United States is located on the "trailing edge" of the North American continental plate, which is relatively seismically quiet. Earthquakes, however, do occur in the project area, largely due to trailing edge tectonics and residual stress release from past orogenic (mountain building) events.

The project area is characterized by low magnitude events that have been recorded since the mid-16th Century. None of these events precludes the safe siting of an LNG terminal (ERM et al., 2003). According to the USGS (2003), the largest recorded earthquake in Massachusetts occurred in 1755 near Cape Ann, approximately 70 miles northeast of the project area. This earthquake is estimated to have been a magnitude 6 event which resulted in Modified Mercalli Intensity VIII damage in the Boston area. Such an event today would cause considerable damage to ordinary, substantial buildings but only slight damage to specially designed structures. The largest earthquakes in New England, other than those that have occurred near Cape Ann, have been near Ossipee, New Hampshire, approximately 200 miles north of the project area (Simmons, 1976).

The largest recorded earthquake in nearby Rhode Island was a magnitude 3.5 event that occurred in 1976 near Newport, approximately 15 miles to the southwest of the project area. The impact of this earthquake included cracked plaster, fallen tabletop lamps, and snow being shaken from rooftops. The level of shaking associated with this magnitude event is generally below the threshold of damage to well built structures.

As required by NFPA 59A (2001), Weaver's Cove Energy conducted a site-specific probabilistic seismic hazard assessment (PSHA) to develop seismic design criteria for the proposed LNG terminal. The seismic hazard analysis included input data for potential seismic sources in the region, including maximum anticipated magnitude, distance from the LNG terminal, recurrence intervals, and consideration of site-specific geologic conditions in attenuation modeling.

The results of the PSHA were used to obtain peak ground acceleration (PGA) and response spectra for the Safe Shutdown Earthquake (SSE, defined as the 5,000-year mean return earthquake) and the Operating Basis Earthquake (OBE, scaled as two-thirds of the Maximum Considered Earthquake (MCE), which is the 2,500-year mean return earthquake). The OBE represents the level of shaking through which the facility should be able to operate and continue operating after its occurrence, with perhaps a brief shutdown for a safety inspection to confirm that no damage occurred. The larger SSE

represents the level of shaking that should not damage the vital, safety-related components of the facility to the extent that they could not function.

Detailed seismic design criteria are presented in Weaver's Cove Energy's seismic report (Environmental Resource Management et al., 2003). In general, the seismic hazard analysis yielded an SSE design earthquake in the magnitude range of 6.2 to 6.4, with a ground surface horizontal peak acceleration of 0.26 gravity (g). These predicted ground motions would be incorporated into the final design of the LNG tanks and other critical structures at the LNG terminal.

Based on the evaluation conducted by Weaver's Cove Energy, the likelihood of a major earthquake occurring in the project area during the operating life of the proposed LNG terminal is low. Weaver's Cove Energy's commitment to meet or exceed the proper design standards would further reduce the potential effects associated with earthquakes to the proposed LNG terminal. Ground shaking would not be expected to affect the proposed pipelines, which would be constructed of modern steel that is capable of remaining elastic during the level of shaking that could potentially occur in the area.

Surface Faulting

As noted in section 4.1.1, the project area is underlain by the Beaverhead Fault Zone. Other faults also exist in the region. The Beaverhead Fault Zone formed approximately 280 million years ago during the later stages of development of the Narragansett Basin (Mosher, 1983), and the most recent movement along the fault zone most likely occurred during the opening of the Atlantic Ocean 65 to 146 million years ago (Environmental Resource Management et al., 2003). Field mapping within a 5-mile radius of the LNG terminal site did not identify evidence of recent surface faulting in the project area. Based on the literature search, field mapping, and generally low level of significant local seismic activity, the potential for surface faulting to occur in the project area is low.

Soil Liquefaction

Secondary seismic effects triggered by strong ground shaking are often more serious than the shaking itself. Soil liquefaction is a physical process in which saturated, noncohesive soils temporarily lose their bearing strength when subjected to strong and prolonged shaking. Soil liquefaction can also lead to other ground failures including settlement and lateral spreading.

Soil borings, cone penetration tests, geophysical surveys, and laboratory analyses were performed to determine the physical and engineering properties of existing soils at the LNG terminal site. Given the definition of the SSE and OBE from the PSHA, detailed seismic soil response and liquefaction analyses were performed using deterministic methods. These studies concluded that liquefaction would not be expected to occur in the event of the less significant MCE or OBE seismic events (Environmental Resource Management et al., 2003). However, the existing loose, silty soils at the LNG terminal site are marginally susceptible to liquefaction when subjected to the ground motions associated with the SSE (the 5,000-year earthquake). Calculated dynamic one-dimensional ground settlements due to liquefaction would be in the range of 2 to 4.5 inches.

As noted in section 4.1.2, Weaver's Cove Energy proposes to alter the surface of the LNG terminal site by placing up to 2.6 million cubic yards of dredged material on the site. The dredged material would be used to raise the grade of the site and to construct a berm and landform, but none of the dredged material would be placed beneath the LNG tank. Due to the physical properties of the stabilized dredged material and placement of the material above the existing groundwater table at the site, the dredged material would not be susceptible to liquefaction (Environmental Resource Management et al., 2003).

Six potential ground improvement alternatives were evaluated to mitigate liquefaction-susceptible soils, including deep mixing, jet grouting, permeation grouting, dynamic deep compaction, compaction grouting, and vibro-replacement (stone columns). Based on this analysis, Weaver's Cove Energy proposes that stone columns be used to reinforce soils beneath the proposed LNG tank foundation. With the installation of stone columns under the LNG tank, level soil liquefaction studies concluded that the soils under the tank would not be susceptible to liquefaction.

Full-scale field tests would be conducted at the beginning of the project to ensure that the stone column method would have the intended effect of reinforcing soils to the point where they are no longer susceptible to liquefaction during the seismic design events. It is anticipated that the stone columns would be placed beneath the LNG tank foundation in a grid pattern on 8- to 10-foot centers between columns. The columns would be constructed to the depths of potentially liquefiable soils 50 to 55 feet below existing ground surface by advancing an 18-inch diameter vibrating steel probe, which would create a borehole by laterally displacing existing soils. Once the boreholes for each column are created, they would be backfilled with compacted crushed stone.

In conclusion, detailed site-specific studies indicate that soils at the proposed LNG terminal site are marginally susceptible to liquefaction in the event of the 5,000-year earthquake. Installation of stone columns would reduce the potential effects of liquefaction at the LNG tank location and, as discussed in sections 4.1.4.2 and 4.1.4.3, would also improve the load-bearing capacity and stability of slopes in the LNG tank area.

Because the risk of a strong earthquake in the project area is low, the potential for soil liquefaction to occur along the proposed pipelines is low. Seismic activity has not disturbed existing pipelines in the project area. Liquefaction-induced settlements were not calculated for specific soils along the pipeline routes; however, the calculated settlements in the range of 2 to 4.5 inches for the proposed LNG terminal site during the 5,000-year earthquake would not pose a significant risk to the proposed pipelines due to the linear extent and ductility of the pipelines.

Tsunamis

Tsunamis are long oceanic waves generally caused by seismic activity. While a tsunami could potentially occur along the East Coast of the United States, only two Atlantic Ocean tsunamis have been recorded: a tsunami which struck Lisbon, Portugal in 1755, and one which struck eastern Canada in 1929. The probability of a significant tsunami occurring along the East Coast is very low (NOAA, 2003a). In addition, construction of the proposed LNG terminal would include raising the overall elevation of the site, constructing and/or fortifying the existing sea wall, and constructing a 15-foot-high berm around the storage tank and process area, all of which would mitigate potential impacts from tsunamis, tidal waves, or rogue waves.

4.1.4.2 Load-Bearing Capacity

The load-bearing capacity and stability of existing soils beneath the proposed LNG tank was modeled based on soil boring data from the tank area and two assumed conditions: the case of the 273-foot-diameter tank and the case of the 10-foot wide ring wall footing.

Using conservative assumptions and applying a safety factor of 3, both models result in estimated settlement due to static loading of 6 to 8 inches at the center of the tank and 3.5 to 4.5 inches at the edge of the tank, assuming that the foundation is supported with stone columns. The maximum differential settlement of 4.5 inches is less than the 6-inch differential settlement tolerance specified by the LNG tank

manufacturer. The use of stone columns also results in meeting the manufacturer's specifications for maximum allowable total differential settlement ("tilt") across the entire LNG tank of 9 inches.

Given the linear extent and ductility of modern pipelines, existing geologic materials along the proposed pipeline routes are expected to have sufficient capacity to support the pipelines.

4.1.4.3 Slope Instability

Weaver's Cove Energy conducted preliminary phase static and dynamic slope stability analyses of the proposed LNG terminal site. The analyses were based on soil profiles developed from site soil borings and assumed that dredged material would be used to raise the site grade and to create a landform. A number of factors were considered in the analyses including final site grades, various levels of filling of the LNG tank, whether or not existing soils are reinforced through stone column construction, and whether or not liquefaction occurs. Slope stability analyses results indicate the following:

- The calculated static slope stability factors of safety for trial slip surfaces that pass under or through the proposed LNG tank area are 3 and greater for the proposed site grading and tank loading;

- Based on pseudostatic analyses, ground accelerations of 50 percent gravity (0.5 g) or greater would be required to reach a calculated safety factor of 1 in the absence of liquefaction;

- A slope stability safety factor of less than 1 is calculated assuming that liquefaction accompanied with lateral spreading occurs, and assuming no ground improvement is undertaken;

- Installation of the proposed stone columns would increase the slope stability factor to greater than 3 beneath the proposed LNG tank, even if liquefaction were to develop;

- The LNG tank performance analyses did not rely on waterfront structures to provide lateral or vertical support for the LNG tank. The only heavily loaded structures that the waterfront walls would be supporting are the perimeter roadway and berms to be constructed adjacent to the river. To minimize any potential effects on slope stability, these structures would be located as far from the LNG tank as site conditions permit;

- Short-term construction phase deformation control and dynamic loading considerations could result in design and construction of limited, local foundation treatments, such as stone columns or piles, directly beneath the structures; and

- The slopes of the berms, mounds, and walls to be constructed on the site with dredged material or other materials would require appropriate design to provide sufficient stability and calculated factors of slope stability safety.

According to the USGS (1982), the project area is situated in an area of low landslide occurrence and susceptibility. In eastern Massachusetts, increased landslide susceptibility is largely related to the presence of marine clay, which is unstable on steep slopes. Neither of the proposed pipeline routes nor the proposed LNG terminal site is underlain by marine clay (USGS, 1982). The potential for landslides to occur would be further reduced through the use of appropriate erosion control measures during construction.

Based on these analyses, it appears that potential slope instability can be managed. To ensure that the issue of slope instability is adequately addressed, **we recommend that:**

- **Weaver's Cove Energy prepare final engineering design plans ensuring the stability of all site grades and the waterfront walls and file these plans with the Secretary <u>prior to construction</u>.**

4.1.4.4 Flooding

Flash Flooding

The potential for flash flooding to occur and significantly impact construction or operation of the proposed project is low. The greatest potential for flash flooding to occur in the project area is associated with tropical storms, which are usually accompanied by significant precipitation over a short period of time. The potential effects associated with high rainfall events during construction would be mitigated by implementing the FERC Plan and Procedures. After construction, the proposed LNG terminal would be stabilized with permanent erosion control measures such as berms and vegetative cover, and a stormwater management system would be constructed to manage and divert precipitation to the Taunton River without causing erosion of the site or the river bed or banks. Weaver's Cove Energy's implementation of the FERC Plan and Procedures, which include revegetation of disturbed soils, would also minimize the effects of high rainfall events during construction and operation of the proposed pipelines.

Hurricane Storm Surge

Storm surge, the abnormal rise in sea level due to the wind and pressure forces associated with hurricanes and other tropical storms, is often the most significant cause of damage to facilities and property in low lying coastal areas.

According to NOAA (2003b), 11 hurricanes made landfall in either Massachusetts or Rhode Island from 1900 through 1996. None of the storms were classified as Category IV or higher storms. However, 5 of the 11 were classified as Category III hurricanes, with maximum sustained wind speeds of 111 to 131 miles per hour (mph) and typical storm surges of 9 to 12 feet. The NOAA data also indicate that nearly all hurricanes that struck New England during the referenced time period were moving faster than 30 mph, which would tend to minimize storm surge height and duration.

The current elevation of the proposed LNG terminal site is approximately 20 to 30 feet above MSL, and the proposed construction would include raising the overall elevation of the site, fortifying the existing sea wall, and constructing a berm around the storage tank and process area. Therefore, the proposed LNG terminal site would be protected against storm surge associated with hurricanes on the order that are likely to impact the project area.

4.1.5 Paleontological Resources

The project area is underlain by sedimentary rocks that are known to contain plant fossils, but which are not protected or highly regarded (Environmental Resource Management, 2003a). Bedrock would not be encountered during construction of the proposed LNG terminal and would not be expected to be encountered during construction of the proposed pipelines. Therefore, construction and operation of the proposed project would not impact paleontological resources.

4.2 SOILS AND SEDIMENTS

4.2.1 Soil Resources

LNG Terminal

Soils at the proposed LNG terminal site include approximately 52 acres of Urban Land, 20 acres of Udorthents, and 1 acre of Paxton very stony fine sandy loam.

According to the Soil Survey of Bristol County, southern part (USDA, 1981), Urban Land in the project area consists of areas covered by structures, which include parking lots, industrial areas, and roads. Natural soils in these areas have been so severely disturbed that they can no longer be identified. Small areas of Udorthents and undisturbed natural soils comprise about 15 percent of the Urban Land map unit.

Udorthents in the project area consist of nearly level areas formed by excavating or filling for construction projects. Examples of these alterations include athletic fields, housing developments, and interstate highways. Small urbanized areas and natural soils comprise about 15 percent of the Udorthents map unit.

Based on previous soil borings on the LNG terminal site, the Urban Land map unit soils are composed of three distinct materials: old dredge fill, glacial outwash, and glacial till. From ground level to about 14 feet bgs the soils are composed of unsorted, brown sand, silt, and gravels, which were generated and placed on the site in conjunction with former dredging operations. The sediment from about 14 to 72 feet bgs consists of greenish-gray to brownish-gray silty sand and sandy silt outwash deposits. Below about 72 feet bgs, the sediment is gravelly to sandy glacial till.

Construction of the LNG terminal would include the stabilization, placement, and grading of up to 2.6 million cubic yards of sediment dredged from the federal navigation channel and turning basin. These activities would permanently affect and generally bury about 52 acres of Urban Land and about 15 acres of Udorthents and raise the grade of the site above the 100-year floodplain elevation. These activities would not have a significant environmental impact on soils at the LNG terminal site because the soils have already been severely impacted by previous dredge disposal activities and land uses.

Due to the generally level topography at the site, runoff and erosion would be minimal; however, as the grade of the site is raised, runoff potential from the edges of the berm, landform, and other raised areas would increase. Erosion and sedimentation at the site would be controlled and mitigated during construction and operation of the facility through implementation of the measures specified in the FERC Plan and in a site-specific Erosion and Sedimentation Control Plan and a Stormwater Management Plan (see section 4.3.2 for information regarding the Stormwater Management Plan). These measures would include installation of sediment filters and barriers during construction to control and prevent the flow of silt-laden water into adjacent wetlands and the Taunton River. Following construction, the site would be stabilized with permanent erosion control measures such as vegetative cover.

Pipeline Facilities

According to published soils information (USDA, 1981), the proposed pipelines would cross eight different soil series. These series include poorly to very poorly drained, sandy-textured soils with very slow to slow permeability (Ridgebury and Whitman series); moderately well drained to well drained, sandy- and loamy-textured soils with slow and very slow permeability (Newport, Pittstown, and Woodbridge series); and sandy-textured, well to somewhat excessively drained soils with moderately

rapid to rapid permeability (Hinckley and Merrimac series). All of the mapped soils exist in stony to extremely stony surface phases. The pipelines would also cross Urban Land and Udorthents, discussed above.

Pipeline construction activities such as clearing, grading, trench excavation, and backfilling, and the movement of construction equipment along the rights-of-way could impact soil resources in several ways. Clearing would remove protective cover and expose the soil to the effects of wind, sun, and precipitation, which could increase the potential for soil erosion and the movement of sediments into sensitive areas. Grading and equipment traffic could compact soil, reducing porosity and percolation rates resulting in increased runoff potential and decreased soil productivity. Trench excavation and backfilling could lead to mixing of topsoil and subsoil which could lower soil productivity. Contamination from spills or leaks of fuels, lubricants, and coolants from construction equipment could also impact soils.

The meter and regulation station at the terminus of the Northern Pipeline would be located within an area of Udorthents. Construction and operation of this facility would affect about 0.9 acre of these soils. The meter and regulation station at the terminus of the Western Pipeline would be located within an area of Paxton extremely stony fine sandy loam. Construction and operation of this facility would affect about 1.4 acres of these soils. Soils at this latter meter and regulation station would be susceptible to erosion due to the slopes at the site and would have a poor revegetation potential. Weaver's Cove Energy would minimize soil erosion and sedimentation impacts by constructing the facilities in accordance with the FERC Plan. Both meter and regulation stations would be covered with gravel pads as part of the site restoration activities. The meter and regulation station for the Western Pipeline would require construction of a permanent access road, which would follow the existing Algonquin G-22 pipeline right-of-way from Stevens Road in Swansea to the station. There would be no additional soil impacts because the access road would utilize an area already disturbed by an existing access trail and right-of-way. Access to the meter and regulation station for the Northern Pipeline would be over existing hard-surfaced roads and would have no additional impacts on soils.

Soils along the Northern and Western Pipeline routes were evaluated for characteristics that could affect construction or increase the potential for construction-related soil impacts. Table 4.2.1-1 provides a summary of significant soil characteristics along each pipeline route. Each of the soil characteristics is discussed separately below.

TABLE 4.2.1-1

Acreage of Soil Characteristics for the Proposed Pipeline Rights-of-Way a/

Facility	Total	Prime Farmland b/	Hydric Soils c/	Compaction Prone d/	Highly Erodible e/	Revegetation Concerns f/
Northern Pipeline	32.2	3.8	0.8	0.0	13.5	11.7
Western Pipeline	26.5	12.5	5.3	0.0	2.7	14.0
Pipeline Total	58.7	16.3	6.1	0.0	16.2	25.7

a/ Acreage is based on a variable-width construction right-of-way, but does not include access roads or temporary extra workspace. Values within a row do not sum to the total listed in the total column because soils may occur in more than one characteristic class, or may not occur in any class listed in the table.

b/ As designated by the Natural Resources Conservation Service (NRCS) and includes farmland of local or statewide importance.

c/ As designated by the NRCS.

d/ Includes soils in somewhat poor to very poor drainage classes with surface textures of sandy clay loam and finer.

e/ Includes soils with slopes greater than 8 percent and soils designated by NRCS as highly erodible land.

f/ Includes soils with slopes greater than 8 percent, shallow watertables, high surface stones, and dense subsoils.

Prime Farmland

The USDA defines prime farmland as "land that is best suited to food, feed, fiber, and oilseed crops" (Soil Survey Division Staff, 1993). This designation includes cultivated land, pasture, woodland, or other lands that are either used for food or fiber crops or are available for these uses. Urbanized land and open water are excluded from prime farmland. Prime farmland typically contains few or no rocks, is permeable to water and air, is not excessively erodible or saturated with water for long periods, and is not subject to frequent, prolonged flooding during the growing season. Soils that do not meet the above criteria may be considered prime farmland if the limiting factor is mitigated (e.g., by use of artificial drainage). In addition to prime farmland, soils that are capable of producing high yields of food, feed, fiber, or forage crops when treated or managed according to acceptable farming methods, but fail to meet one or more of the criteria of prime farmland are considered to be farmlands of state or local importance.

Twenty-eight percent (16.3 acres) of the total area that would be affected by the proposed pipelines is designated prime farmland or farmland of local or state-wide importance. However, none of this land is actively cultivated. Most prime farmland along the routes is located within existing electric transmission line or pipeline rights-of-way and is unavailable for agricultural development. Consequently, there would be no impacts on prime or locally important farmland as a result of pipeline construction.

Hydric Soils

Hydric soils are defined as "soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part" (Federal Register, July 13, 1994). Soils that are artificially drained or protected from flooding (e.g., by levees) are still considered hydric if the soil in its undisturbed state would meet the definition of a hydric soil. Generally, hydric soils are those soils that are poorly and very poorly drained. About 10 percent (6.1 acres) of the proposed pipeline routes are underlain by hydric soils.

Due to extended periods of saturation, hydric soils can be prone to compaction and rutting. If construction activities, particularly the operation of heavy equipment, occur when these soils are saturated, compaction and rutting could occur. The hydric soils within the proposed construction rights-of-way are relatively coarse-textured and would not be susceptible to compaction. Weaver's Cove Energy would minimize rutting of these hydric soils by constructing the pipelines, as much as possible, during the driest portion of the year and by using construction mats where wetland soils cannot support equipment.

High groundwater levels associated with the hydric soils could create a buoyancy hazard for the pipelines. Special construction techniques such as concrete coating and other weighting methods would be used to overcome buoyancy hazards during operation of the pipelines. Dry season construction and/or trench dewatering would minimize buoyancy problems during construction.

Compaction Potential

Soil compaction modifies the structure and reduces the porosity and moisture-holding capacity of soils. Construction equipment traveling over wet soils could disrupt the soil structure, reduce pore space, increase runoff potential, and cause rutting. The degree of compaction is dependent on moisture content and soil texture. Fine-textured soils with poor internal drainage that are moist or saturated are the most susceptible to compaction and rutting. Soils that would be disturbed by the pipeline construction activities do not have soil textures or drainage characteristics that would make them highly susceptible to soil compaction. Consequently, no compaction-related soil impacts would be expected.

Erosion

Erosion is a continuing natural process that can be accelerated by human disturbance. Factors that influence the degree of erosion include soil texture, soil structure, length and percent of slope, vegetative cover, and rainfall or wind intensity. Soils most susceptible to erosion by water are typified by bare or sparse vegetative cover, noncohesive soil particles with low infiltration rates, and moderate to steep slopes. Wind erosion processes are less affected by slope angles. Clearing, grading, and equipment movement could accelerate the erosion process and, without adequate protection, result in discharge of sediment to waterbodies and wetlands. Soil loss due to erosion could also reduce soil fertility and impair revegetation.

Soils along both pipeline routes are not susceptible to wind erosion. However, about 27 percent (16.0 acres) of the proposed pipeline routes consist of highly erodible land (HEL) that is susceptible to water erosion. Most of these soils (13.3 acres) are located along the Northern Pipeline route, while the remainder (2.7 acres) is located along the Western Pipeline route. An additional 5.5 acres of soils (most along the Western Pipeline route) are designated by the NRCS as potentially highly erodible land (PHEL). PHEL consists of those soils that have the potential to be highly erodible, but cannot be designated as highly erodible land without a field determination of slope percent and length. Despite the presence of HEL and PHEL, extensive erosion would not be expected in most locations along the pipeline routes, due to the gently sloping topography in the area. Stream banks and areas with slopes greater than 8 percent (all 16.0 acres of HEL) would be most susceptible to erosion resulting from construction of the pipelines. Weaver's Cove Energy would implement the stream crossing methods outlined in the FERC Procedures and the erosion and sediment control practices specified in the FERC Plan to minimize potential impacts from erosion (see Appendices E and F). Specific erosion and sedimentation control measures that would be implemented include installation of slope breakers, on slopes greater than 5 percent, and sediment barriers, such as straw bales or silt fence, at stream crossings and at the base of slopes adjacent to wetlands and roads. Application of seed, mulch, and erosion control fabric would also be used to control erosion and stabilize the rights-of-way following construction.

Revegetation Concerns

Successful restoration and revegetation is important to maintain soil productivity and to protect the underlying soil from potential damage, such as erosion. About 44 percent (25.7 acres) of the soils that would be affected by pipeline construction activities have a poor revegetation potential (table 4.2.1-1). These soils include those with stony or rocky surface layers, shallow water tables, or dense subsoils and potentially erosive soils with slopes greater than 8 percent that would require additional stabilization to promote germination and seedling establishment. In accordance with the FERC Plan, Weaver's Cove Energy would mitigate the effects of poor revegetation potential by applying fertilizer, pH modifiers, and using mulch (where appropriate) to create a favorable environment for the re-establishment of vegetation. Weaver's Cove Energy would further enhance revegetation potential by using seed mixes recommended by local soil conservation authorities to reseed the rights-of-way.

Soil Contamination

Contamination from spills or leaks of fuels, lubricants, and coolant from construction equipment could adversely affect soils. The effects of contamination would typically be minor because of the low frequency and volumes of spills and leaks. Weaver's Cove Energy would develop an onshore SPCC Plan that specifies cleanup procedures in the event of soil contamination from spills or leaks of fuel, lubricants, coolants, or solvents.

In addition to the LNG terminal site, Weaver's Cove Energy identified two hazardous or contaminated sites along the pipeline routes (see table 4.3.1-1 in section 4.3.1). Construction of the pipelines in the vicinity of these sites could disturb contaminated soils. Additional contamination could be encountered within the existing naphtha pipeline right-of-way along the proposed Northern Pipeline route. To address potential impacts associated with encountering contaminated soils during construction, **we recommend that:**

- **Weaver's Cove Energy prepare a plan for the discovery and management of contaminated soils and groundwater. This plan should comply with applicable state and federal regulations and should provide for management of contaminants at known sites and include procedures for the identification and management of unknown contaminants in other locations. The plan should be filed with the Secretary for review and approval by the Director of the Office of Energy Projects (OEP) <u>prior to construction</u>.**

4.2.2 Sediments

As discussed in section 2.4.1.3 and the *Dredging Program Report* (C2D, 2003), Weaver's Cove Energy would dredge up to 2.6 million cubic yards of sediment from the federal navigation channel and the turning basin.[1] The dredged sediment would be stabilized with portland cement and placed as structural fill on the LNG terminal site. As part of the planning for the dredging operations, Weaver's Cove Energy included an adjustment (bulking) factor of 20 percent (or 1.2 times the *in-situ* volume of dredged material) to account for changes in bulk density that occur when dredged sediments are disturbed by excavation. Based on the estimated *in-situ* volume of dredged material, the "bulked" volume of dredged sediment would be about 3.1 million cubic yards. In its comments on the draft EIS, Weaver's Cove Energy indicated that this bulked volume of sediment was used to estimate the number of scows that would be required to manage the sediments. Weaver's Cove Energy also indicated that FERC staff had inappropriately used the bulking factor to estimate the volume of dredged material that would be placed at the site. The sediment volume estimate has been revised and no longer includes the bulking factor.

Weaver's Cove Energy would add 8 percent cement (on a mass basis) to the dredged material. Based on the *in-situ* volume of 2.6 million cubic yards of sediment and a wet density of 79 pounds per cubic foot for the untreated dredged material, we estimate that about 83,000 cubic yards of cement would be used to stabilize the dredged material. Dewatering and the placement, grading, and compaction of the sediment placed on the site would result in a smaller volume of material actually being placed on the LNG terminal site. To account for this volume reduction, Weaver's Cove Energy used a preliminary "reduction factor" of 0.86. This reduction factor includes an allowance for the volume of cement that would be added to stabilize the dredged material. Applying a reduction factor of 0.86 to the volume of sediment (with cement added) yields a volume of about 2.3 million cubic yards that would need to be accommodated on the site for 2.6 million cubic yards of *in-situ* dredged sediment. To account for the potential need to use additional cement to achieve appropriate engineering properties for the stabilized sediment, we also analyzed the volume of sediment plus cement that would result from the use of 10 percent cement. The addition of 10 percent cement would not change appreciably the amount of material after compaction (2.3 million cubic yards based on a 0.86 reduction factor) that would need to be placed on the site. In its comments on the draft EIS, Weaver's Cove Energy indicated that based on revised engineering estimates, the likely achievable reduction factor could be more than 70 percent; however, for planning purposes they have adopted a more conservative value of 80 percent reduction. Based on this

[1] This estimate includes 1 foot of overdredge, as proposed by Weaver's Cove Energy, and is the volume of dredged material that will be analyzed throughout section 4. See section 2.4.1.3 and our responses to comments on the draft EIS (Appendix L) for a discussion of the overdredge issue.

revised reduction factor, the volume of dredged sediment that would need to be accommodated at the site (assuming 8 percent cement) would be about 2.1 million cubic yards.

We believe the bulking and reduction factors assumed by Weaver's Cove Energy are reasonable based on the experiences of other regional dredging projects involving mechanical dredging of similar sediments as well as cement stabilization and upland placement (Beaudoin, 2004a). For example, the planning estimates for the Dredged Materials Management Program in Fall River Harbor conducted by OCZM in the late 1990s used a bulking factor of 20 percent. The planning estimates for the Providence River and Harbor Maintenance Dredging Project used a 30 percent bulking factor; however, field observations of sediment bulking associated with this latter project indicate that actual volume increases due to bulking were around 10 percent or less (Beaudoin, 2004a).

Weaver's Cove Energy conducted a comprehensive sediment sampling and analysis program, approved by both the COE and DEP, to characterize the sediments that would be dredged from the federal navigation channel and the turning basin. The sediment sampling and analysis program followed the tiered approach required by the COE and EPA (COE, 2003; EPA and COE, 1991, 1998; EPA-New England and COE-New England, 2002) and included Tier I and Tier II analyses. Weaver's Cove Energy submitted a draft Sediment Sampling and Analysis Plan (SAP) for the Tier III testing to the COE in January 2004. In September 2004, the COE (with concurrence from the EPA) approved the SAP with slight modifications. A summary of this approved SAP is provided below. The original COE approval memo, which includes specific details of the plan, is provided in Appendix K.

The Tier I evaluation, based on historical sediment core data and a review of regional sources of pollution, indicated the potential presence of polycyclic aromatic hydrocarbons (PAHs), trace metals, and pesticides in the near-surface sediments within the federal navigation channel and turning basin. Although point source discharges into the Taunton River were identified, as well as historical spills that could have reached the river, a review of previous sediment sampling results did not identify any discrete locations of high concentrations of pollutants.

The Tier II coring program was based on the results of the Tier I evaluation. For the Tier II program, Weaver's Cove Energy collected sediment cores from 43 locations within the proposed dredging area, exclusive of the East Channel (see figure 4.2.2-1). Dredging modifications in a portion of the East Channel were found to be necessary after the field efforts for the sediment sampling and analysis program were completed. However, data from cores within the East Channel collected during a recent coring program conducted by Massachusetts OCZM were used for initial comparison with the analytical results obtained by Weaver's Cove Energy. As part of the Tier III sampling and analysis program, additional cores were collected from the East Channel area in the Fall 2004. The analysis of these cores allowed an additional comparison of the sediment in the East Channel with sediments from the adjacent dredging segment. Further discussion of the East Channel cores is included later in this section.

The 43 cores resulted in 55 sediment samples, based on observed stratification within individual cores. The cores were not composited horizontally for analytical purposes (i.e., individual cores from separate locations were not combined before analysis), but similar strata within individual cores were mixed vertically to obtain samples for analysis. Each of the 55 samples represents a discrete stratum within an individual core. The sediment samples collected by Weaver's Cove Energy were analyzed for physical parameters, including grain size, total solids, water content, total organic carbon content, and Atterberg Limits (a series of physical measurements that partially characterize the engineering properties of sediment). The sediment samples were also analyzed for the following chemical compounds: PAHs, polychlorinated biphenyls (PCBs), pesticides, and trace metals, as specified by the COE; and extractable petroleum hydrocarbons (EPHs), volatile organic compounds (VOCs), and the toxicity characteristic leaching procedure (TCLP), as specified by the DEP.

Insert figure

4.2.2-1 Sediment Core Locations Weaver's Cove Energy's Sampling Program

sheet 1 of 4

Insert figure

4.2.2-1 Sediment Core Locations Weaver's Cove Energy's Sampling Program

sheet 2 of 4

Insert figure

4.2.2-1 Sediment Core Locations Weaver's Cove Energy's Sampling Program

sheet 3 of 4

Insert figure

4.2.2-1 Sediment Core Locations Weaver's Cove Energy's Sampling Program

sheet 4 of 4

The results of the sediment sampling and analysis program are summarized below. A more detailed description of the program is provided in Weaver's Cove Energy's *Dredging Program Report* (C2D, 2003). An electronic copy of this report is available under the "Proposal" link on Weaver's Cove Energy's website at www.weaverscove.com.

Weaver's Cove Energy conducted a Tier III sediment analysis in accordance with its approved SAP to assess the suitability of the proposed dredged sediments for open water disposal (see section 3.6.2 for additional information about the open water disposal alternative). Tier III testing assesses the impact of contaminants in the dredged material on appropriately sensitive and benchmark organisms to determine if there is the potential for an unacceptable toxicity or bioaccumulation impact at the open water disposal site. The data generated during the Tier III testing also provide a means of assessing project-specific impacts on aquatic organisms within the dredging footprint.

The original SAP required the collection of 47 individual cores from various parts of the proposed dredging footprint. These areas included the federal navigation channel (including the 30-foot deep East Channel), the turning basin (including proposed improvement areas), and the proposed construction access channel adjacent to the LNG terminal site. These 47 cores were to be composited into 8 cores representing sediment from each of the major segments proposed to be dredged. Depth soundings made during sediment coring operations for the Tier III sampling indicated that 10 of the 47 core locations were already essentially at the proposed dredging depth. As a result, there was not sufficient sediment to collect a sample from these locations. Consultations among Weaver's Cove Energy and the COE and EPA, resulted in a revised SAP that specified sampling at 35 core locations and compositing into seven core samples. The eighth composite core required by the original SAP consisted of native sediments from the Turning Basin. Weaver's Cove Energy was advised by EPA and COE staff that the eighth composite core could be eliminated because the volume of native sediment that could be readily distinguished from the maintenance sediment was smaller than originally expected and the grain size of the native sediment was very coarse and unsuitable for the biological analyses of the Tier III tests. The material collected to create the eighth core was archived by Weaver's Cove Energy at the request of the COE and EPA. In addition to cores from the project area, reference samples were collected for concurrent analyses from the MBDS reference location and from the reference location for the RISDS. The composited dredged area cores and the reference site cores were used to conduct 10-day bioassay tests, 28-day bioaccumulation tests, and suspended particulate bioassay tests (EPA-New England and COE-New England, 2004; EPA/COE, 1991). Additional elutriate testing and analysis of the background river water were also conducted as part of the Tier III program.

The Tier III testing of the sediments was completed and the results were submitted to the EPA and COE on April 11, 2005. Preliminary analysis of the results indicates that most of the proposed dredged sediments would be suitable for open water disposal. We note, however, that the EPA and COE have not made a final determination as to the suitability of the dredged sediments for open water disposal. Although the sediments appear suitable for offshore disposal, Weaver's Cove Energy has indicated that it currently has no plans to dispose of dredged material at an open water offshore site.

Physical Analyses

The results of the grain size analyses indicated that the sediments in the proposed dredging area generally consist of silts and clays (i.e., greater than 50 percent of the sediment passes a #200 sieve). Sediments along the federal navigation channel were dominantly silts and clayey silts, whereas sediments within the turning basin contained slightly more sand, usually found in the deeper portions of the cores. On average, cores from the federal navigation channel consisted of 16 percent clay, 76 percent silt, 5 percent fine sand, 2 percent medium-fine sand, and 1 percent medium or coarse sand. In aggregate, this

material would be classified as silt. Total solids[2] averaged 46 percent in cores from the channel. Average water content[3] was 119 percent and total organic carbon averaged 1.1 percent. The average composition of all turning basin cores was 11 percent clay, 47 percent silt, 25 percent fine sand, 13 percent medium-fine sand, 3 percent medium sand, and 1 percent coarse sand. In aggregate, this material would be classified as sandy silt. Samples from the turning basin exhibited somewhat greater intra-core stratification than cores from the federal navigation channel. Turning basin cores averaged 60 percent total solids, 76 percent water content, and 1.3 percent total organic carbon.

Chemical Analyses

The results of the chemical characterization of the proposed dredged sediments are based on a statistical analysis of the 55 individual core strata analyzed by Weaver's Cove Energy. The statistical evaluation provides a more representative composite of the chemical characteristics of the sediment than physical compositing of cores prior to laboratory testing. The average chemical results of all samples are discussed below because the dredged material would be effectively composited during the stabilization and upland reuse process proposed by Weaver's Cove Energy.

Statistical averages were compared to a number of commonly accepted, ecologically risk-based screening criteria to assess the potential hazards posed to the aquatic environment by the dredged sediment. Marine sediment values presented in the NOAA Screening Quick Reference Tables (Buchman, 1999) were used in assessing the COE-requested compounds. The following three NOAA screening criteria, listed in increasing order of the magnitude of potential impacts, were used for comparisons:

- Effects Range-Low (ERL) - a criterion representing the lower 10th percentile sediment concentration at which effects may begin to be observed in sensitive species and rarely result in adverse biological impacts;
- Probable Effects Level (PEL) - a criterion representing concentrations above which adverse biological effects are frequently expected; and
- Effects Range-Median (ERM) - a criterion representing the median (50th percentile) sediment concentration, above which effects frequently occur.

In select instances, when no values for the above three criteria were available, the statistical results were compared to the Apparent Effects Threshold (AET). Individual AETs are essentially equivalent to the concentration of a contaminant observed in the highest non-toxic sample from the studies reviewed to develop the SQUIRTS tables (Buchman, 1999). Because of this, AETs represent a screening concentration above which adverse biological effects would always be expected based on a specific test organism exposed to that single contaminant. It should be noted that AET values were developed for use in Puget Sound, Washington, and are not easily compared directly to other benchmarks (Buchman, 1999). However, the use of these criteria when no others are available provides a method of comparison where one would otherwise be lacking. Further, we have no reason to believe that the organisms in the Taunton River and Mount Hope Bay are any more or less sensitive to potential impacts from the four contaminants for which the AET criteria were used than are the aquatic organisms in Puget Sound.

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[2] The solids content is expressed as a mass per unit volume (milligrams per liter) based on a known volume of sediment and water, and sums to 100 percent.

[3] Water content is a geotechnical parameter calculated by dividing the mass of water in a sample by the mass of solids in the sample, and can, therefore, be larger than 100 percent.

PAHs

Sediment samples were analyzed for 16 distinct PAHs. The frequency of detection for all PAHs in all samples ranged from 42 to 80 percent.

Of the 16 PAHs analyzed, 12 have listed ERL, ERM, and PEL screening values. The average concentration of each of these 12 PAHs was below the ERM and PEL values. The average concentrations of four of the 12 PAHs (fluoranthene, chrysene, benzo(a)pyrene, and dibenz(a,h)anthracene) were below the ERL screening criteria. The average concentration of eight of the 12 PAHs (naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, pyrene, benzo(a)anthracene) was greater than the most conservative ERL value. Four PAHs (benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, benzo(g,h,i)perylene) had no listed ERL, ERM, or PEL screening values. For these four compounds, the alternate AET screening criteria were applied. The average concentrations of these four PAHs were well below the AET values.

In all areas with average PAH concentrations above the ERL criteria, the PAHs were found only in the upper strata of sediment, except at core location turning basin core 10 (TB-10). In this core, which is located in the turning basin near the existing pier at the proposed LNG terminal site, average PAH concentrations above the ERL criteria were found in both the upper and lower levels of sediment.

Although the majority of PAHs occurred throughout much of the proposed dredging area at concentrations above the most conservative risk-based screening criteria (ERL), average PAH concentrations were below the ERM and PEL screening criteria, and well below the AET criteria. The distribution of some PAHs was relatively uniform throughout much of the dredging area; however, the concentrations of most PAHs were higher in the area between the Braga Bridge and the north end of the turning basin.

PCBs

PCBs are a general class of compounds with a variety of chemical compositions. Sediment samples were analyzed for a total of 22 distinct PCBs. Total PCB concentrations were estimated by summing the concentration of 18 of the specific compounds analyzed and multiplying by two. This method was identified in both the COE's approval of the sediment sampling and analysis program and the COE/EPA draft Regional Implementation Manual (EPA-COE, 2002). For those samples with individual PCB concentrations below detection limits, one-half of the value of the specific PCB's detection limit was used to generate the total PCB estimate.

For all samples, the frequency of detection for individual PCB compounds ranged from 0 to 31 percent, with an average frequency of detection of 8 percent. The average concentration of individual PCBs ranged from 0.70 to 3.71 parts per billion (ppb). Nine of the 22 specific PCBs analyzed were not detected in any individual sediment sample.

The average total PCB concentration exceeds the ERL screening value, but does not exceed either the ERM or PEL screening values. The vertical and horizontal distribution of samples with average PCB concentrations exceeding the ERL screening level was relatively evenly spread throughout the proposed dredging area. However, the area between the Braga Bridge and the south end of the turning basin exhibited the highest average total PCB concentrations.

Pesticides

Sediment samples were analyzed for a total of 21 pesticides. Only dichlorodiphenyldichloroethylene (DDE) was detected, in about 5 percent of the samples.

For several of the 20 pesticides that were not detected, the ERL and ERM screening values are less than the analytical detection limits. As a result, these compounds artificially appear to exceed the screening values. A data interpretation procedure commonly accepted under these circumstances is to compare the average concentration in the sediment to the analytical method detection limit because laboratory-based toxicological research can, and often does, achieve greater accuracy than can be achieved using standard methods for the analysis of environmental media. Because these 20 pesticides were undetected across the sample set, the apparent screening criteria exceedances were disregarded and these 20 pesticides were not considered contaminants of concern (COCs).

The one pesticide that was detected, DDE, had an average concentration in the bulk sediment that was below the detection limit and below the ERM and PEL thresholds. The ERL value for DDE was less than the analytical method detection limit.

Metals

Sediment samples were analyzed for eight metals, including arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc. Individual metals were detected in 82 to 100 percent of the samples. The average concentrations of seven metals exceeded the most conservative ERL screening values; cadmium was the only metal with an average concentration below the ERL screening criterion. Seven of the metals had average concentrations below both the ERM and PEL thresholds. However, average mercury concentrations exceeded the ERM and PEL values. The concentrations of metals in samples from the turning basin and the federal channel south of the Braga Bridge were relatively similar. The highest concentrations of metals occurred between the Braga Bridge and the south end of the turning basin.

Revised Dredging Analysis

Based on comments we received from the EPA and OCZM on the draft EIS, we have reassessed the chemical characteristics of the proposed dredged sediments. Statistically based concentrations of analyzed constituents are still compared to the same ecological risk screening criteria, but we have revised our analysis to consider the sediment based on the dredging segments proposed by Weaver's Cove Energy, and incorporated the EPA's suggestions regarding the statistical comparisons. We believe the use of dredging segment analysis is appropriate because the proposed upland placement of the stabilized sediment would result in only one dredge operating in a single dredging segment at any point in time. Thus the potential impacts associated with the sediment in any single dredging segment would largely be limited to that dredging segment. We have also reassessed the dredged sediments for hotspot concentrations. The three dredging segments as described in Weaver's Cove Energy's *Dredging Program Report* are:

- the federal channel downstream of the Braga Bridge;
- the federal channel upstream of the Braga Bridge; and
- the turning basin.

Federal Channel Downstream of the Braga Bridge

The level of contaminants in the sediments within the federal channel downstream of the Braga Bridge is relatively uniform. The ratio of the maximum to mean concentration provides an indication of the variability of constituents by comparing the highest concentration for an individual compound to the average concentration of the same compound. A ratio of 1.0 indicates that the average and highest concentrations are the same and thus there is no variability; as the ratio increases above 1.0, the variability

of the data increases. This ratio ranges from 1.3 to 3.1 in the dredging segment downstream of the Braga Bridge. As shown in table 4.2.2-1, 62 percent of the constituents in this dredging segment exhibit a value of less than 2.5 for this ratio, and 31 percent exhibit a value less than or equal to 2.

TABLE 4.2.2-1

Statistical Analysis of Dredged Sediment Chemical Constituents from the Federal Channel Downstream of the Braga Bridge a/

Constituent	Statistical Results						NOAA SQUIRTS Criteria			
	Min	Max	Mean	95% UCL	95th Percentile	Max/Mean	ERL	PEL	ERM	AET
PAHs (ppb)										
Naphthalene	10	230	98	129	203	2.4	160	391	2100	
Acenaphthylene	10	200	84	113	191	2.4	44	128	640	
Acenaphthene	10	47	15	20	32.6	3.1	16	89	500	
Fluorene	10	76	27	36	52.6	2.8	19	144	540	
Phenanthrene	10	470	184	248	380	2.6	240	544	1500	
Anthracene	10	260	106	142	233	2.4	85	245	1100	
Fluoranthene	10	770	321	431	644	2.4	600	1494	5100	
Pyrene	10	1600	508	708	1240	3.1	665	1398	2600	
Benzo[a]anthracene	10	500	203	271	410	2.5	261	693	1600	
Chrysene	10	600	239	322	483	2.5	384	846	2800	
Benzo[b]fluoranthene	10	740	269	368	578	2.8	NS	NS	NS	1800
Benzo[k]fluoranthene	10	930	306	427	723	3.0	NS	NS	NS	1800
Benzo[a]pyrene	10	750	297	400	597	2.5	430	763	1600	
Indeno[1,2,3-cd]pyrene	10	170	91	115	170	1.9	NS	NS	NS	600
Dibenz[a,h]anthracene	10	61	31	39	56.5	1.9	63	135	260	
Benzo[g,h,i]perylene	10	160	84	105	151	1.9	NS	NS	NS	670
Total PCB (ppb)	18	67.6	29.7	35.6	49.2	2.3	22.7	188.8	180	
Pesticides (ppb)										
4,4'-DDE	10	25	11.4	13.4	21.4	2.2	2.2	374.17	27	
Metal (ppm)										
Arsenic	8.3	15	11.3	12.1	14.1	1.3	8.2	41.6	70	
Cadmium	0.1	1.2	0.6	0.7	1.20	2.1	1.2	4.21	9.6	
Chromium (Total)	34.0	210	97.4	123	201	2.2	81	160.4	370	
Copper	11.0	120	60.1	77.0	111	2.0	34	108.2	270	
Lead	11.0	130	64.8	83.5	130	2.0	46.7	112.2	218	
Mercury	0.024	2.6	0.95	1.31	2.06	2.7	0.15	0.696	0.71	
Nickel	19	30	23.8	25.3	28.2	1.3	20.9	42.8	51.6	
Zinc	69	280	162	194	271	1.7	150	271	410	

a/ Analysis includes all cores sampled in this segment

NS = No Standard

Although the mean concentrations for each constituent are included in the tables for each dredging segment, we have adopted the use of the 95 percent upper confidence limit (UCL) of the mean, and the 95th percentile concentrations for comparisons with the risk screening criteria. The use of the 95 percent UCL for comparisons with the risk screening criteria is appropriate because of the uncertainty associated with estimating the true average (mean) concentration of contaminants in environmental media

(EPA, 1992). The 95 percent UCL of the mean provides a *conservative estimate* [emphasis in the original document] of the average concentration of a substance, but should not be confused with the 95th percentile concentration of a substance (EPA, 1992). We have included the 95th percentile concentrations of the contaminants analyzed in our comparisons, but we would like to emphasize that their use provides a highly conservative estimate of the potential impact resulting from any particular component of the sediments.

PAHs

The 95 percent UCL concentrations of PAHs in the dredging segment downstream of the Braga Bridge were below the PEL and ERM criteria (for those 12 substances with published criteria). The four compounds without PEL or ERM criteria are all below the AET values (4 to 6 times lower). The 95 percent UCL concentrations of four of the PAHs in this dredging segment are below the ERL criteria. The remaining six compounds with published ERL criteria exceed their respective screening criteria. The 95th percentile concentrations of ten of the PAHs are below the PEL and ERM criteria. Only acenaphthylene and anthracene exceed the PEL criteria, but both compounds are below their respective ERM values. The 95th percentile concentrations of the four compounds for which only AET criteria exist are still substantially below their corresponding criteria (2.5 to 4.4 times less).

Total PCBs

The 95 percent UCL and 95th percentile concentrations of total PCBs in the dredging segment downstream of the Braga Bridge are both less than the PEL and ERM criteria, but greater than the most conservative ERL criteria.

Pesticides

As indicated in the draft EIS, the only pesticide identified at greater than the method detection limits was 4,4'-DDE. The 95 percent UCL and 95th percentile concentrations of this compound are both less than the PEL and ERM criteria in this dredging segment. Further, as noted in our original discussion above, the ERL screening criteria for DDE is less than the analytical detection limit for this compound, and the 95th percentile concentration listed in table 4.2.2-1 (21.4 ppb) is only slightly higher than the analytical detection limit (20 ppb). Therefore, we do not consider DDE to be a contaminant of concern in this dredging segment.

Metals

The 95 percent UCL concentrations of seven of the eight metals analyzed are greater than the most conservative ERL criteria in the dredging segment downstream of the Braga Bridge; only the concentration of cadmium is below the ERL criterion. The 95 percent UCL concentrations of seven of the eight metals are less than the PEL and ERM screening criteria in this dredging segment. Only the 95 percent UCL concentration of mercury exceeds all three screening criteria in this dredging segment. The 95th percentile concentrations of all eight metals exceed the ERL criterion; however, five of the eight metals have 95th percentile concentrations that are less than the PEL criterion and seven of the eight metals are below the ERM criterion when using the 95th percentile concentrations. Chromium, copper, and zinc are greater than or equal to the PEL criterion in this dredging segment; chromium is about 30 percent above the PEL, copper is about 3 percent higher than the PEL criterion, and the 95th percentile concentration of zinc in this dredging segment is equal to the PEL criterion.

Federal Channel Upstream of the Braga Bridge

The level of contaminants in sediments within the federal channel upstream of the Braga Bridge is also relatively uniform. The ratio of the maximum to mean concentration ranges from 1.3 to 3.1 in this dredging segment. As shown in table 4.2.2-2, 73 percent of the constituents in this dredging segment exhibit a value of less than 2.0 for this ratio, and 50 percent exhibit a value less than or equal to 1.5.

TABLE 4.2.2-2

Statistical Analysis of Dredged Sediment Chemical Constituents from the Federal Channel Upstream of the Braga Bridge a/

Constituent	Statistical Results						NOAA SQUIRTS Criteria			
	Min	Max	Mean	95% UCL	95th Percentile	Max/Mean	ERL	PEL	ERM	AET
PAHs (ppb)										
Naphthalene	160	390	231	282	342	1.7	160	391	2100	
Acenaphthylene	96	690	224	364	526	3.1	44	128	640	
Acenaphthene	33	82	52	63	75.6	1.6	16	89	500	
Fluorene	52	100	80	91	96.8	1.3	19	144	540	
Phenanthrene	350	630	491	552	610	1.3	240	544	1500	
Anthracene	210	560	299	378	472	1.9	85	245	1100	
Fluoranthene	730	1300	922	1052	1180	1.4	600	1494	5100	
Pyrene	1100	2900	1500	1910	2340	1.9	665	1398	2600	
Benzo[a]anthracene	450	1300	609	808	1028	2.1	261	693	1600	
Chrysene	480	1500	703	938	1204	2.1	384	846	2800	
Benzo[b]fluoranthene	400	1300	671	890	1120	1.9	NS	NS	NS	1800
Benzo[k]fluoranthene	340	1700	741	1074	1420	2.3	NS	NS	NS	1800
Benzo[a]pyrene	500	1800	783	1081	1424	2.3	430	763	1600	
Indeno[1,2,3-cd]pyrene	170	330	261	309	326	1.3	NS	NS	NS	600
Dibenz[a,h]anthracene	63	120	91	108	120	1.3	63	135	260	
Benzo[g,h,i]perylene	150	360	270	330	352	1.3	NS	NS	NS	670
Total PCB (ppb)	32.4	210	82.1	122	169	2.6	22.7	188.8	180	
Pesticides (ppb)										
4,4'-DDE	10	24	11.6	15.1	18.4	2.1	2.2	374.17	27	
Metal (ppm)										
Arsenic	14.0	22	16.6	18.4	20.4	1.3	8.2	41.6	70	
Cadmium	0.7	1.7	1.1	1.3	1.50	1.5	1.2	4.21	9.6	
Chromium (Total)	130.0	420	254.4	319.2	380	1.7	81	160.4	370	
Copper	82.0	180	129.1	150.9	168	1.4	34	108.2	270	
Lead	93.0	170	142.6	158.7	162	1.2	46.7	112.2	218	
Mercury	2.0	4.3	2.80	3.38	3.98	1.5	0.15	0.696	0.71	
Nickel	25	36	30.4	32.9	34.8	1.2	20.9	42.8	51.6	
Zinc	220	330	271.1	298.2	326	1.2	150	271	410	

a/ Analysis includes all cores sampled in this segment
NS = No Standard

PAHs

The 95 percent UCL concentrations of all 12 PAHs for which ERL criteria exist are above their respective screening concentrations in the dredging segment upstream of the Braga Bridge. The four PAHs for which only AET criteria are available are all below their respective AET concentrations (all are about 2 times less). The 95 percent UCL concentrations of 5 of the 12 PAHs are below their PEL criteria in this dredging segment, but the concentrations of seven PAHs are greater than the PEL criterion. All 12 PAHs for which ERM criteria exist exhibit 95 percent UCL concentrations less than their respective ERM criteria. Similar results are obtained if the 95th percentile concentrations are compared to each screening criterion. The 95th percentile concentrations of the four PAHs that have only AET criteria are still less than their respective AET concentrations.

Total PCBs

The 95 percent UCL and 95th percentile concentrations of total PCBs in the dredging segment upstream of the Braga Bridge are both less than the PEL and ERM criteria, but greater than the most conservative ERL criteria.

Pesticides

The maximum concentration of DDE measured in this dredging segment is 24 ppb; this is only slightly higher than the analytical detection limit for this compound. The 95 percent UCL and 95th percentile concentrations of DDE in this dredging segment are all less than the analytical detection limit. We therefore do not consider DDE to be a contaminant of concern in this dredging segment.

Metals

The 95 percent UCL concentrations of all eight metals analyzed are greater than the ERL criterion in this dredging segment (the concentration of cadmium only exceeds the ERL by 0.1 parts per million (ppm)). Three of the metals analyzed (arsenic, cadmium, and nickel) have 95 percent UCL concentrations below their respective PEL criteria in this dredging segment. The remaining five metals have 95 percent UCL values greater than the PEL criterion. Seven of the eight metals in this dredging segment have 95 percent UCL concentrations below the ERM criterion; only mercury exceeds the ERM concentration. The 95th percentile concentrations of all eight metals exceed their respective ERL criteria. The 95th percentile concentrations of arsenic, cadmium and nickel are also below the PEL criterion. The remaining five metals are all above their respective PEL criteria based on their 95th percentile concentrations. Six of the eight metals in this dredging segment are below the ERM criterion based on their 95th percentile concentrations; only mercury and cadmium exceed the ERM screening values. Cadmium is only slightly above the ERM concentration (1.03 times higher) and, as noted earlier, the 95th percentile concentrations provide highly conservative estimates of potential impacts.

Turning Basin

The level of contaminants in sediments within the turning basin dredging segment is the most variable. The ratio of the maximum to mean concentration ranges from 1.8 to 18.3 when all cores analyzed are considered. If all of the cores in this dredging segment are included, 81 percent of the constituents exhibit a value greater than 3.0 for this ratio, and 23 percent exhibit a ratio greater than or equal to 5.0 (table 4.2.2-3).

The variation reflected in the ratio of the maximum to mean concentration in the turning basin dredging segment data is primarily related to a single core, TB-10. As noted in our original discussion

above, and in Weaver's Cove Energy's *Dredging Program Report*, core TB-10 (located near the existing pier at the proposed LNG terminal site) was the only core that had average PAH concentrations above the ERL screening criteria in both the upper and lower core segments. In addition, a review of the complete data set indicates that 58 percent of the maximum concentrations for all constituents occur in core TB-10. Therefore, core TB-10 should be considered a hotspot. As a result of this finding, we have included an analysis of the turning basin sediments that excludes the results from core TB-10. We also reviewed all of the cores in close proximity to core TB-10, and the concentration gradients between core TB-10 and all of its nearest neighbors decrease rapidly, indicating that this core is an isolated location of generally high contaminant concentrations. Core TB-10 and the surrounding sediment may need to be excavated separately from the rest of the sediment in the turning basin. To avoid biasing the statistical analysis of the sediment data from the turning basin dredging segment, we have excluded the analytical results of core TB-10.

When core TB-10 is excluded from the statistical analysis of sediment from the turning basin dredging segment, the ratio of the maximum to mean concentrations drops considerably; ranging from 1.9 to 5.0. As shown in table 4.2.2-3, 85 percent of the analytes still exhibit a ratio greater than 3, but only 4 percent exhibit a ratio equal to 5.

The data in table 4.2.2-3 present statistical comparisons that include core TB-10; however, our discussion of the turning basin sediments below excludes core TB-10.

PAHs

Of the 12 PAHs for which ERL criteria are available, the 95 percent UCL concentrations of three PAHs in the turning basin segment are below the ERL. The remaining nine PAH compounds are greater than the most conservative ERL screening criterion. Of these nine, two PAHs (benzo(a)pyrene and benzo(a)anthracene) are only 5 and 7 percent greater, respectively than the ERL criterion. The four PAH compounds for which only AET criteria are available are all considerably lower than their respective AET values (3.5 to 5.5 times lower). The 95 percent UCL concentrations of all 12 PAH compounds are lower than both the PEL and ERM criteria. Based on the 95th percentile concentrations, all 12 PAHs exceed their respective ERL criteria. Seven PAH compounds have 95th percentile concentrations that exceed the PEL criterion, whereas five PAHs have 95th percentile concentrations below the PEL criterion. All 12 PAHs with available ERM values have 95th percentile concentrations below the ERM criterion. The 95th percentile concentrations of the four PAHs for which only AET criteria are available are below the AET criterion.

Total PCBs

The 95 percent UCL concentrations of total PCBs in the turning basin dredging segment are greater than the most conservative ERL criterion, but lower than both the PEL and ERM criteria. The 95th percentile concentration of total PCBs in this dredging segment is greater than all three screening criteria.

Pesticides

The concentration of DDE in all cores in the turning basin dredging segment represent values that are one-half the analytical detection limit, indicating that this compound was not detected in any segment of any core in the turning basin area (including core TB-10). Therefore, as with both previous dredging segments, DDE is not a contaminant of concern in the turning basin dredging segment.

TABLE 4.2.2-3

Statistical Analysis of Dredged Sediment Chemical Constituents from the Turning Basin Area

Constituent	Statistical Results															
	Analysis Includes all Cores in Segment						Analysis does not Include Core TB-10						NOAA SQUIRTS Criteria			
	Min	Max	Mean	95% UCL	95th Percentile	Max/Mean	Min	Max	Mean	95% UCL	95th Percentile	Max/Mean	ERL	PEL	ERM	AET
PAHs (ppb)																
Naphthalene	10	5700	311	740	479	18.3	10	290	86	129	274	3.4	160	391	2100	
Acenaphthylene	10	270	82	119	237	3.3	10	230	68	102	216	3.4	44	128	640	
Acenaphthene	10	380	42	73	152	9.0	10	110	24	34	55.8	4.7	16	89	500	
Fluorene	10	410	62	98	229	6.7	10	180	40	60	118	4.5	19	144	540	
Phenanthrene	10	1300	259	398	910	5.0	10	700	188	290	688	3.7	240	544	1500	
Anthracene	10	720	162	248	646	4.4	10	520	118	182	400	4.4	85	245	1100	
Fluoranthene	10	1800	452	690	1670	4.0	10	1700	352	559	1340	4.8	600	1494	5100	
Pyrene	10	4800	715	1143	2170	6.7	10	2200	500	779	1960	4.4	665	1398	2600	
Benzo[a]anthracene	10	1500	334	506	1100	4.5	10	1100	257	398	868	4.3	261	693	1600	
Chrysene	10	1600	346	526	1100	4.6	10	1100	266	414	956	4.1	384	846	2800	
Benzo[b]fluoranthene	10	1300	310	466	971	4.2	10	980	245	379	844	4.0	NS	NS	NS	1800
Benzo[k]fluoranthene	10	1100	264	396	784	4.2	10	790	211	325	740	3.7	NS	NS	NS	1800
Benzo[a]pyrene	10	1400	363	542	1170	3.9	10	1200	292	452	960	4.1	430	763	1600	
Indeno[1,2,3-cd]pyrene	10	510	140	205	431	3.6	10	410	113	170	346	3.6	NS	NS	NS	600
Dibenz[a,h]anthracene	10	190	50	72	151	3.8	10	130	40	58	110	3.3	63	135	260	
Benzo[g,h,i]perylene	10	470	129	187	390	3.7	10	390	104	156	328	3.7	NS	NS	NS	670
Total PCB (ppb)	18	274	54.3	84.1	244	5.1	18	274	54.7	86.8	254	5.0	22.7	188.8	180	
Pesticides (ppb)																
4,4'-DDE	10	10	10	10	10	1.0	10	10	10	10	10	1.0	2.2	374.17	27	
Metal (ppm)																
Arsenic	0.8	28	11.3	14.2	21.1	2.5	0.78	22	10.4	13.0	19.0	2.1	8.2	41.6	70	
Cadmium	0.1	1.4	0.5	0.6	1.37	3.0	0.05	1.4	0.4	0.6	1.08	3.6	1.2	4.21	9.6	
Chromium (Total)	5.5	380	101.9	151.6	310	3.7	5.5	380	92.5	143.1	310	4.1	81	160.4	370	

TABLE 4.2.2-3 (cont'd)

Statistical Analysis of Dredged Sediment Chemical Constituents from the Turning Basin Area

Constituent	Statistical Results															
	Analysis Includes all Cores in Segment						Analysis does not Include Core TB-10						NOAA SQUIRTS Criteria			
	Min	Max	Mean	95% UCL	95th Percentile	Max/Mean	Min	Max	Mean	95% UCL	95th Percentile	Max/Mean	ERL	PEL	ERM	AET
Copper	4.1	150	47.2	68.4	137	3.2	4.1	140	40.6	61.0	128	3.4	34	108.2	270	
Lead	2.9	360	70.1	104.8	195	5.1	2.9	210	54.9	81.8	158	3.8	46.7	112.2	218	
Mercury	0.0	4.2	1.11	1.69	3.90	3.8	0.01	4.2	0.9	1.50	3.72	4.5	0.15	0.696	0.71	
Nickel	5.6	30	16.2	19.6	29.7	1.8	5.6	30	15.4	18.8	29.0	1.9	20.9	42.8	51.6	
Zinc	17	330	121.6	163.9	297	2.7	17	300	106.5	145.9	268	2.8	150	271	410	

NS = No Standard

Metals

Based on the 95 percent UCL concentrations of the eight metals analyzed, three metals (cadmium, nickel, and zinc) are lower than the ERL criterion. The remaining five metals have 95 percent UCL concentrations that exceed their respective ERL criteria. However, the 95 percent UCL concentrations of seven of the eight metals are lower than both the PEL and ERM criteria; only mercury exceeds all three screening criteria in this dredging segment. All eight metals have 95th percentile concentrations that exceed the most conservative ERL criterion. Four of the metals remain below the PEL criterion when compared with their 95th percentile concentrations; however, four metals (chromium, copper, lead, and mercury) exceed the PEL criterion based on their 95th percentile concentrations. Seven of the eight metals (all but mercury) are lower than the ERM criterion compared to their 95th percentile concentrations.

Summary of COE-requested Parameters

The sediment analysis by dredging segment generally supports our original analysis, based on the arithmetic means of all constituents from all dredging segments. Most PAH concentrations exceed the most conservative ERL criterion, and most PAH concentrations are generally less than the PEL and ERM criteria, even using more conservative estimates of constituent concentrations (e.g., 95 percent UCL and 95th percentiles). However, the dredging segment analysis and use of the 95 percent UCL concentrations does demonstrate that some PAH compounds in the dredging segment upstream of the Braga Bridge exceed the PEL criteria when not mediated by lower concentrations from other segments. Conversely, PAH compounds in both the dredging segment downstream of the Braga Bridge and in the turning basin are lower than the most conservative ERL criterion - a point that is obscured when all of the samples are combined.

The dredging segment-based analysis of the total PCB concentrations generally supports our initial discussion. Based on the 95 percent UCL and 95th percentile concentrations of total PCBs, the ERL criterion is exceeded in all three proposed dredging segments (as it is for the entire dredging footprint in our earlier analysis). The more conservative 95 percent UCL estimates of total PCB concentration are below both the PEL and ERM criteria in all dredging segments. The most conservative 95th percentile estimates of total PCB concentrations are generally still less than both the PEL and ERM criteria, except in the turning basin where this estimator of PCB levels is greater than all three screening criteria.

As described in our initial analysis, DDE is the only pesticide identified above the analytical detection limit in any dredging segment. This pesticide was positively identified in only three samples from the two dredging segments farthest downstream. DDE was consistently below the PEL and ERM criteria in all dredging segments. In addition, the ERL screening criterion is lower than the analytical detection level of DDE. As a result, both our initial and revised analyses regarding the concentration of DDE in the proposed dredged sediment demonstrate that it is not a contaminant of concern in any dredging segment proposed for the project.

It is significant to note that both the 95 percent UCL and 95th percentile concentrations of mercury exceed all three screening criteria in all three proposed dredging segments. This finding is consistent with our initial analysis and clearly indicates that mercury is widespread throughout the proposed dredging footprint. Furthermore, the observed concentrations likely represent a local background condition. Given that the Taunton River and upper Mount Hope Bay are directly downwind of two coal-fired power plants, the levels of mercury observed in the sediment are not unexpected. The single largest source of atmospheric mercury deposition in the United States is coal-fired power plants (EPA, 2004b).

Our original analysis of the remaining seven metals is also generally supported by the revised, dredging segment-based review. Six to seven of the remaining metal concentrations are greater than the most conservative ERL screening criterion (the original analysis indicated that six were greater than this criterion). Only the concentration of cadmium was below the ERL criterion, but only in the segment downstream of the Braga Bridge. Based on the 95 percent UCL concentrations, seven of the remaining metals are below both the PEL and ERM criteria in the segment downstream of the Braga Bridge and the turning basin segment. Overall metal concentrations are higher in the dredging segment upstream of the Braga Bridge, where five of the seven remaining metals have 95 percent UCL concentrations that exceed the PEL criterion. Comparisons of the remaining seven metals based on their 95th percentile concentrations are similar to our original analysis for the ERM criterion (6 to 7 metal concentrations are below the ERM value), but less similar with respect to the PEL criterion, with fewer metal concentrations below their respective PEL values. Given the conservative nature of the use of the 95th percentile concentrations and the NOAA SQUIRTS tables the latter finding is not unexpected.

In contrast to our original review, this revised analysis indicates the presence of a hotspot of various contaminants. Core TB-10 contains concentrations of a number of contaminants that are considerably higher than those same constituents in nearby cores. Based on our identification of this core as a hotspot for a number of contaminants, we believe that the sediment from this core and its immediate surroundings could need to be excavated separately from the remaining sediments in the turning basin, if the dredging is approved. However, because the dredging and management of contaminated sediments is largely an issue under the COE's jurisdiction, **we recommend that:**

- **Weaver's Cove Energy consult with the COE regarding the appropriate method(s) for dredging and managing the sediment from the immediate vicinity of turning basin core 10. Weaver's Cove Energy should file copies of all correspondence and any final plan for managing dredged sediment associated with core TB-10 with the Secretary for review and approval by the Director of the OEP <u>prior to dredging</u>.**

In its supplemental draft EIR, Weaver's Cove Energy indicated that additional sediment cores have been collected from the area of the proposed Western Pipeline crossing of the Taunton River. Weaver's Cove Energy is having the cores analyzed in accordance with the existing Tier II testing protocols. These data were not available as of the publication of this document. However, the estimated volume of this material is only 33,000 cubic yards, and given the location of the proposed pipeline crossing (upstream of the turning basin), we do not expect the results of this testing to alter significantly our conclusions regarding the potential impacts from dredging.

Massachusetts Contingency Plan Constituents

In addition to the constituents requested for analysis by the COE, the DEP requested the analysis of three parameters: VOCs, EPH, and TCLP. These testing procedures are often used by the DEP in the management of contamination in upland environments under the Massachusetts Contingency Plan (MCP) which is regulated under Massachusetts General Law Chapter 21E.

Weaver's Cove Energy collected fourteen sediment subsamples from the core sites identified for the COE-approved sediment sampling and analysis program and analyzed these samples for the requested MCP parameters. The core locations and samples were identified by Weaver's Cove Energy's Licensed Site Professional (LSP) prior to the field sampling effort and represent a subset of the sediments analyzed using the COE protocols.

The MCP established a series of risk-based action levels based on site use and other factors. The analytical results for each MCP parameter were compared to the corresponding MCP Method 1

concentrations (i.e., S2/GW2, S2/GW3 and S3/GW2, S3/GW3) for the Shell Oil facility where sediment placement is proposed. The MCP Method 1 concentrations are risk-based criteria developed based on a multi-faceted combination of expected soil exposure, indoor air quality, and the protection of surface water quality. Groundwater at the site is not classified as drinking water (GW1) and thus only volatilization to structures (GW2) and groundwater discharge to surface water (GW3) were the receptors of concern. The soil categories (S-1, S-2, and S-3) describe a range of potential human exposures to those soils. Category S-1 soils are associated with the highest potential for exposure and typically represent surface soils to a depth of about 3 feet. Category S-1 is also assigned to any soils for which the current or reasonably foreseeable use is fruit and/or vegetable production for human consumption. Category S-3 soils represent the lowest potential for exposure (generally below 3 feet), and S-2 soils represent an intermediate potential for human exposure. A specific volume of soil material may only have one assigned category, but soils in different parts of a particular site may be assigned different categories, depending on the potential for human exposure (see 310 CMR 40.0930 for more details).

Toxicity Characteristic Leaching Procedure

According to 314 CMR 9.07 (2)(b)6, the "TCLP analysis is to be performed when sediment is to be managed in the upland and if the total concentrations of metals or organic compounds are equal to or greater than the theoretical concentration at which TCLP criteria may be exceeded as follows:

- > 100 mg/kg arsenic
- > 20 mg/kg cadmium
- > 100 mg/kg chromium
- > 4 mg/kg mercury"

The total concentrations of TCLP-metals in the 14 MCP samples did not exceed the screening criteria listed above. However, some of the cores collected for COE-requested analyses contained metal concentrations that slightly exceeded the TCLP screening criteria. As a result, Weaver's Cove Energy performed TCLP analyses on all 14 MCP samples. The analytical results indicated that leached constituent concentrations were below appropriate thresholds. Therefore, the leaching of measurable concentrations of TCLP-specific compounds from the stabilized dredged sediment into the groundwater below the LNG terminal site would not occur in excess of TCLP thresholds. In addition, Weaver's Cove Energy would undertake TCLP analyses of stabilized dredged material samples as part of the field testing program it has proposed to support the dredging effort (C2D, 2003). As noted in the supplemental draft EIR filed by Weaver's Cove Energy, additional testing of the stabilized dredged material using the TCLP procedure is currently being conducted. Those data were not available when this final EIS was published.

Extractable Petroleum Hydrocarbons

Sediment samples were analyzed for EPHs. The EPHs were separated into C9-C18 aliphatics, C19-C36 aliphatics, C11-C22 aromatics, and unadjusted C11-C22 aromatics. Detection frequencies for these four groups of compounds ranged from 21 percent to 57 percent. The average concentration, 95 percent UCL, and maximum values for C9-C18 aliphatics, C19-C36 aliphatics, and C11-C22 aromatics were all significantly below the appropriate S2/GW2, S2/GW3 and S3/GW2, S3/GW3 thresholds by a factor of 10 or more. No MCP criteria exist for the unadjusted C11-C22 aromatics; however, based on the MCP criteria for the other three groups of EPHs, the concentration of unadjusted C11-C22 aromatics appears to be acceptable for upland disposal.

Volatile Organic Compounds

Sediment samples were analyzed for 68 individual VOCs. Of these, 63 were not detected in any sample. Of the five remaining VOCs, three are suspected as laboratory contaminants (bromomethane, acetone, and 2-butanone (methylethylketone)) because they are common laboratory chemicals and were detected at relatively equivalent concentrations in the associated method blanks. The two remaining VOCs detected (carbon disulfide and tetrahydrofuran) had a frequency of detection of 14 and 86 percent, respectively. The average concentrations, 95 percent UCL, and maximum values of these VOCs were significantly below the most conservative MCP reporting criteria.

We received a comment on the draft EIS that the appearance of possible laboratory contaminants in some VOC analyses "calls into question the quality control at the lab and the quality assurance and accuracy of all test results analyzed by this lab." We disagree with this comment. The fact that these three compounds were identified in the method blanks indicates that the quality control/quality assurance program of the lab was working as designed. The entire purpose of analyzing method blanks, matrix blanks, and other quality assurance samples is to assess the conditions of the analyses. Levels of analytes in method blanks are routinely subtracted as 'background' from the results of analyses to account for the potential occurrence of analytes of interest in reagent-grade laboratory chemicals or potential additions from unintended laboratory sources. Further, the lab that managed and performed the analyses maintains certifications from the National Environmental Laboratory Conference, the COE, DEP, DEM, and other regulatory agencies. These certifications require regular inspections and data quality monitoring procedures. Based on these standard laboratory certification procedures and our review of the data, we do not believe that additional duplicative analyses are justified.

East Channel Sediments

The East Channel has a federally authorized depth of 30 feet below MLLW, and runs alongside the main federal navigation channel. A wedge-shaped portion of this channel falls within Weaver's Cove Energy's proposed dredging area (see figure 4.2.2-2). The proposed action would deepen this portion of the East Channel to about 37 feet below MLLW.

Weaver's Cove Energy's sediment sampling and analysis program did not include the collection of sediment samples within the East Channel. When the program was developed, Weaver's Cove Energy did not know that a portion of the East Channel would require dredging to support the navigational requirements of the project. However, in the sediment sampling program carried out by the OCZM, four sediment cores were collected from within this wedge, specifically cores EC-4, -5, -6, and -7 (see figure 4.2.2-2[4]). Due to OCZM's sample compositing scheme, these four cores yielded two sediment samples: EC-A (composited from cores EC-1, EC-3, and EC-5) and EC-B (composited from cores EC-6 and EC-7). Based on a hydrographic survey conducted in 2000, the sampling depth of EC-A was estimated by Weaver's Cove Energy to be 36.1 feet below MLLW (based on core EC-4) and the sampling depth of core EC-B was estimated to be 34.5 feet below MLLW (based on core EC-7).

To determine whether the OCZM's analytical results for the East Channel sediments were within Weaver's Cove Energy's observed ranges, the data from cores EC-A and EC-B were compared with the average and maximum concentrations obtained from Weaver's Cove Energy's sediment sampling program for cores in the dredging segment upstream of the Braga Bridge. Data for the physical properties were compared to the average of all cores from the federal navigation channel because no data regarding the physical properties of the sediment were available for individual dredging segments.

[4] In response to a comment from the OCZM, we have revised figure 4.2.2-2 to include the location of cores EC-1, EC-2, and EC-3.

Insert figure

4.2.2-2 Sediment Core Locations in the East Channel Office of Coastal Zone Management's Sampling Program

Based on this comparison, the East Channel sediments were determined to be physically similar to the sediments in the main navigation channel. The average percent fines in cores EC-A and EC-B was 84 percent, and the average percent solids in these two cores was 58 percent. The average percent fines of the cores in the federal navigation channel collected by Weaver's Cove Energy was 92 percent, and the average percent solids was 46 percent.

Although it does not appear that OCZM's chemical analysis of cores from the East Channel was as extensive as Weaver's Cove Energy's sediment analysis, the two data sets share a number of analyses that are required by guidelines specified in the Ocean Testing Manual (EPA and COE, 1991). Both studies analyzed the same eight metals. OCZM also analyzed all of the PAHs, total PCBs, and 16 of the pesticides analyzed by Weaver's Cove Energy. A comparison of these data are provided in table 4.2.2-4.

The concentration of 8 of the 16 PAHs analyzed is greater in one of the two OCZM cores than the maximum concentrations of those constituents in the adjacent dredging segment. However, the highest concentrations of these eight PAH compounds are only 1.1 to 2.5 times greater than the maximum concentration within the adjacent dredging segment. Comparing the mean concentrations of PAHs in the OCZM cores with the mean concentrations in the adjacent dredging segment yields a ratio that varies between 0.5 and 2.7, with 88 percent of the samples having a ratio less than 2. Only two PAHs (indeno(1,2,3-cd)pyrene, and benzo(g,h,i)perylene) exhibit ratios of the means greater than 2.

Weaver's Cove Energy reported detectable concentrations for two pesticides (4,4' DDE and toxaphene). The concentration of DDE in the OCZM cores was lower than the average concentration reported by Weaver's Cove Energy and the concentration of toxaphene was similar in both data sets. However, the data for toxaphene reported by Weaver's Cove Energy actually represent undetected concentrations, based on slightly elevated method reporting limits. The concentrations reported by OCZM and Weaver's Cove Energy for the 14 remaining pesticides were similar. Most of the reported concentrations of these 14 pesticides in both data sets represent values that are one-half the method detection limit (Weaver's Cove Energy's samples) or one-half the method reporting limit (OCZM's samples), indicating these compounds were not detected in either set of analyses.

The mean concentration of all eight metals in the dredging segment is greater than the mean concentrations in the OCZM cores. The ratio of the mean concentrations of individual metals in the adjacent dredging segment compared to the mean of the OCZM cores ranges from 1.1 to 2.9, with most of the metals having ratios of 1.5 or less. Only chromium and nickel are more than 2 times higher in the dredging segment.

Although there is a moderate degree of variability between the two data sets, we believe that the East Channel sediments are chemically similar to the sediments in the adjacent dredging segment of the federal channel.

TABLE 4.2.2-4

Comparison of Chemical Constituents in Proposed Dredged Sediments from the Dredging Segment Upstream of the Braga Bridge and Cores from the East Channel Segment Sampled by the OZCM

		Dredging Segment Sediment Data			East Channel Cores	
Constituent	Detection Limit	Minimum a/	Maximum	Mean	EC-A	EC-B
PAHs (ppb)						
Naphthalene	20	160	390	231	250	140
Acenaphthylene	20	96	690	224	230	140
Acenaphthene	20	33	82	52	110	50
Anthracene	20	210	560	299	670	300
Fluorene	20	52	100	80	150	100
Fluoranthene	20	730	1300	922	1000	710
Phenanthrene	20	350	630	491	700	560
Pyrene	20	1100	2900	1500	1400	920
Benzo[a]anthracene	20	450	1300	609	1300	900
Chrysene	20	480	1500	703	1300	840
Benzo[b]fluoranthene	20	400	1300	671	1600	1000
Benzo[k]fluoranthene	20	340	1700	741	420	270
Benzo[a]pyrene	20	500	1800	783	1500	1000
Indeno[1,2,3-cd]pyrene	20	170	330	261	820	590
Dibenz[a,h]anthracene	20	63	120	91	190	140
Benzo[g,h,i]perylene	20	150	360	270	750	503
Pesticides (ppb)						
4,4'-DDD	20	10	10	10	9.8	2.1
4,4'-DDE	20	10	24	12	9.3	1.4
4,4'-DDT	20	10	10	10	0.65	0.55
Aldrin	20	10	10	10	0.65	0.55
alpha-Chlordane	20	10	10	10	0.65	0.55
Dieldrin	20	10	10	10	4.4	0.55
Endosulfan I	20	10	10	10	0.65	0.55
Endosulfan II	20	10	10	10	0.65	0.55
Endosulfan sulfate	20	10	10	10	3.20	0.55
Endrin	20	10	10	10	0.53	0.24
gamma-Chlordane	20	10	10	10	0.4	0.55
Heptachlor	20	10	10	10	0.65	0.55
Heptachlor epoxide	20	10	10	10	16	0.55
Methoxychlor	20	10	10	10	7.0	5.4
trans-Nonachlor	20	10	10	10	4.2	1.9
Toxaphene	20	85	95	92	65	55
Total PCB (ppb)						
Sum of Cogeners x 2		32.4	210	82.1	129.8	72.8
Metals (ppm)						
Arsenic	0.5	14.0	22	16.6	14	8.4
Cadmium	0.1	0.7	1.7	1.1	0.99	1.0
Chromium	1	130	420	254	120	58

TABLE 4.2.2-4 (cont'd)

Comparison of Chemical Constituents in Proposed Dredged Sediments from the Dredging Segment Upstream of the Braga Bridge and Cores from the East Channel Segment Sampled by the OZCM

		Dredging Segment Sediment Data			East Channel Cores	
Constituent	Detection Limit	Minimum a/	Maximum	Mean	EC-A	EC-B
Copper	1	82.0	180	129	83	55
Lead	1	93.0	170	143	120	92
Mercury	0.02	2.0	4.3	2.8	2.7	1.8
Nickel	1	25.0	36.0	30.4	15	11
Zinc	1	220	330.0	271	270	180

a/ Concentrations for undetected samples are based on one-half the detection limit

As part of the Tier III sediment testing conducted by Weaver's Cove Energy, new sediment cores were collected and analyzed from the East Channel area. The analytical results from these cores allow an additional comparison of the East Channel sediment with sediment from the adjacent dredging segment. Four individual cores collected from the East Channel area were composited to create a single representative sample which was then analyzed (for details see appendix K). The recent Tier III sample also indicates that the East Channel sediments are similar to both the sediments in the adjacent dredging segment and the samples reported by OCZM. The concentration of PAHs ranged from 1.2 to 2.6 times the average values in the dredging segment upstream of the Braga Bridge, and 0.6 to 2.6 times the concentrations reported by OCZM. Metal concentrations ranged from 0.6 to 1.5 times those in the adjacent dredging segment, and 0.8 to 1.9 times those reported by OCZM. The majority (15 of 19) of pesticides analyzed were not detected; however, dichlorodiphenyltrichloroethane (DDT) and its daughter products DDE and dichlorodiphenyldichloroethane (DDD) were detected at relatively low concentrations, similar to those reported by OCZM. The Tier III analysis also identified cis-Nonachlor at very low concentration (about 2 times the detection limit). Total PCBs in the Tier III core were about 1.4 times the concentration reported by OCZM and 1.7 times the average in the adjacent dredging segment. Although the Tier III sediment analyses continue to suggest a moderate degree of variability between the sediments in the East Channel and the adjacent dredging segment, we still believe the sediments are not significantly different from the sediment in the adjacent dredging segment.

Elutriate Testing Results

Weaver's Cove Energy conducted a series of elutriate tests in accordance with the guidelines in the Ocean Testing Manual, Inland Testing Manual, Upland Testing Manual, and the Draft Regional Implementation Manual (COE, 2003; EPA and COE, 1991, 1998; EPA-New England and COE-New England, 2002). Elutriate testing simulates the potential transfer of chemicals from the dredged sediments into the water column during dredging or in-water disposal operations. There are two types of elutriate tests, the standard elutriate and the effluent elutriate. Both tests were developed by the COE and are applied in different dredged material disposal situations. In both testing protocols, a volume of dredged material is vigorously mixed with a larger volume of water. The solids are allowed to settle out and the resulting water is then chemically analyzed. If the COCs remain adsorbed (i.e., chemically attached) to the solids, they simply settle out of the water with the solids. However, if the COCs go into solution in the water, they could be transported in the water column.

The analytical results of the elutriate tests were compared to two data sets: the bulk sediment data and the appropriate water quality criteria. When compared to the bulk sediment chemistry, the elutriate results indicated that nearly all of the detected constituents were adsorbed to the sediment particles because the constituent concentrations in the elutriate water were identified at low and often undetectable levels. This implies that most of the constituents identified in the bulk sediments would be expected to remain attached to the sediment particles and would not be released into the water column during dredging operations. A comparison of the elutriate test results with the EPA National Recommended Water Quality Criteria (EPA, 2002b), yielded the following conclusions:

- All PAHs analyzed were not detected and thus were below the published Aquatic Life Criteria Maximum Concentration (AL-CMC), an acute exposure-based screening criteria, and the Aquatic Life Criterion Continuous Concentration (AL-CCC), a chronic exposure-based screening criteria;
- All PCB compounds analyzed, individually and in total, were not detected and thus were below the published AL-CMC and AL-CCC screening criteria;

- All pesticides analyzed were not detected and thus were below the published AL-CMC and AL-CCC screening criteria; and
- Of the 10 metals analyzed, eight were found to have average concentrations below the published AL-CMC and AL-CCC screening criteria. The two exceptions were copper and zinc.

Average copper concentrations for both the standard and effluent elutriates were greater than both water quality criteria (28 and 20 ppm versus water quality standards of 4.8 and 3.1 ppm for acute and chronic exposure criteria, respectively). However, river water also contained background concentrations of copper greater than both water quality criteria (37 ppm versus water quality standards of 4.8 and 3.1 ppm for acute and chronic exposure criteria, respectively).

Average zinc concentrations for both the standard and effluent elutriates were greater than both water quality criteria. The standard elutriate zinc compliance average was 1.4 times greater than the acute exposure criterion and 1.6 times greater than the chronic exposure criterion. The effluent elutriate zinc compliance average was 1.2 times the AL-CMC and 1.3 times the AL-CCC. Background levels of zinc in the river water were below both water quality criteria (23 ppm versus 90 and 81 ppm for acute and chronic exposure criteria, respectively).

Weaver's Cove Energy conducted additional elutriate testing as part of the Tier III sampling and analysis program; however, the results of this set of elutriate tests were not available when this final EIS was published.

Dredged Material Reuse and MCP Guidelines

Dredged material placed in uplands must meet the MCP requirements in 310 CMR 40.0000. Weaver's Cove Energy's plan for handling and stabilizing the dredged material is to increase the bearing capacity and simplify the handling of the sediments by dewatering the dredged material and then mixing with portland cement. The stabilized material then would be placed and compacted in lifts on the LNG terminal site.

In accordance with the MCP requirements, the sediments were comprehensively sampled and analyzed for COCs to evaluate potential risks from the reuse of the sediment on an upland site. We received a comment from the DEP indicating that they did not concur with our statement that the sediments had been comprehensively sampled and analyzed with respect to MCP reuse guidelines. Our review of the samples that were chosen for MCP-related analyses indicates that based on the complete dataset of COE-requested analysis for all 55 sediment core samples, the 14 cores chosen for MCP analyses include the complete range of contaminant concentrations and include sediments from portions of all three proposed dredging segments. As a result, we believe that the analytical results provided by Weaver's Cove Energy for the MCP upland reuse parameters provide a representative range of potential contaminant concentrations and allow an adequate evaluation of the potential impacts of upland reuse of the stabilized dredged material.

In this same comment, the DEP indicated that Weaver's Cove Energy should prepare a conceptual site model to demonstrate that adequate background review was undertaken, and sufficient understanding of the potential sources of sediment contamination exists, to justify the sediment sampling and analysis conducted by Weaver's Cove Energy pursuant to MCP dredged material reuse guidelines. Weaver's Cove Energy's SAP was developed using the tiered process required by the COE and EPA for characterizing proposed dredged sediments. The Tier I review identified the potential sources of point (e.g., direct spills or permitted discharges) and non-point (e.g., runoff from agricultural land and other open spaces) pollution. The Tier I review data were used to assist in the development of the list of

chemicals to be characterized in the sediments, as well as to direct the placement of core locations from which to collect samples. Decisions about the placement of sample cores were also informed by the extensive series of analyses conducted by OCZM. As noted above, our review of the sample locations and analytical results indicates that Weaver's Cove Energy has adequately characterized the sediments with respect to MCP upland reuse guidelines.

Nevertheless, Weaver's Cove Energy in response to comments on the draft EIS and to our data request of October 15, 2004, has indicated that it is preparing a report that will further demonstrate a sufficient understanding of the depositional environment of the Taunton River system and the general types of contaminant sources that were likely contributors of oil and or hazardous materials in the project area. The results of this report were not available as of publication of this final EIS.

Weaver's Cove Energy's LSP evaluated potential risks associated with the use of these sediments in a manner consistent with the August 2001 Method 3 Risk Characterization of the existing site conditions conducted by Shell Oil pursuant to the requirements of the MCP. Weaver's Cove Energy used the same conservative exposure assumptions utilized by Shell Oil to conduct its risk characterization of the site soils. The results of this risk characterization are provided in the *Method 3 Risk Assessment for Upland Placement of Dredged Material as Engineered Fill Report* (ERM, 2003b), which is available under the "Proposal" link on Weaver's Cove Energy's website at www.weaverscove.com.

The suite of analyses that was completed was based on a review of historical, commercial, and industrial practices within the vicinity of the LNG terminal site and upstream of the site. This review is consistent with MCP requirements for comprehensive assessment of contaminated sites in Massachusetts. The exposure pathways evaluated in the risk characterization include:

- incidental ingestion of dredged sediment;
- dermal contact with dredged sediment; and
- inhalation of dredged sediment particulates.

All of these exposure pathways were evaluated for a commercial worker, a utility worker, and a trespasser involved with disturbing the dredged sediment. Exposure of utility workers to VOCs in utility trenches was not analyzed, because no risk for this pathway was concluded from the risk assessment performed by Shell Oil, and VOC concentrations in the proposed dredged sediment were significantly lower than in existing soils on the proposed LNG terminal site (less than 1 percent of existing concentrations in soils at the site). Exposure to groundwater was not assessed because the risk to a utility worker associated with VOCs in groundwater is ten times less than the cumulative site-wide risk for this receptor, indicating the risk from inhalation of VOCs in groundwater is insignificant relative to the other exposure pathways evaluated.

Weaver's Cove Energy's LSP concluded that the concentrations of oils and hazardous material in the proposed dredged sediment would pose no significant risk to human health. The analysis indicates that the non-cancer risks for each receptor considered are less than the risk limit of 1.0 and the cancer risks are less than the risk limit of $1x10^{-5}$. In addition, none of the exposure point concentrations exceed Upper Concentration Limits.

A construction worker scenario was also evaluated using an MCP Method 1 Risk Screening for exposure to dredged sediment and soil during construction on the site. Method 1 was used for the construction worker evaluation for added conservatism and because a number of constituents in the dredged sediment were not included in Shell Oil's earlier analysis of soils on the site. All of the sediment exposure point concentrations were below Method 1 S-3 standards, which indicates that the dredged sediment would not pose a significant risk to a construction worker. However, hotspots for lead and petroleum presently exist in the soils on the proposed LNG terminal site and these would require health

and safety controls to mitigate potential risks to workers on the site (in keeping with the current deed restrictions).

A comparison of Shell Oil's previous risk evaluation with Weaver's Cove Energy's sediment risk evaluation described above indicates the following:

- The sediment does not pose a risk to any of the receptors evaluated in the Shell Oil risk assessment or to construction workers; and
- levels of some contaminants in the sediments are lower than levels of similar contaminants in the soils at the LNG terminal site (see figure 4.2.2-3).

Table 4.2.2-5 provides a comparison of the 90th-percentile concentrations of COCs in the sediment with background concentrations of PAHs and metals in soils, as determined by the DEP (2002), as well as the MCP S-1 (residential) standards for soil constituents. This comparison, which includes data from all 55 samples analyzed for PAHs, indicates that none of the 90th percentile concentrations of PAHs in the sediment exceed the most conservative MCP-defined background concentrations, and only three PAHs exhibited 90th percentile concentrations that exceed the MCP S-1 standard. Although the 90th percentile concentrations of these three PAHs (benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene) exceed the MCP S-1 standard, they are still below the most conservative background concentration.

More than half of the metals quantified in the sediment are below background concentrations, as defined by the DEP. The metal COCs in the sediment that exceed DEP-defined background levels are beryllium, total chromium, chromium (VI), mercury, selenium, and silver. Of these six metals, only beryllium was identified at higher concentrations than the MCP-defined residential standard (see table 4.2.2-5). However, beryllium may still be consistent with background conditions based on historical industrial practices upstream, atmospheric deposition, and emissions and/or discharges from nearby power plants and sewer outfalls.

We received comments from Shell Oil during both the scoping process and on the draft EIS that suggested the dredged material does not conform with current use restrictions on the site. Upland placement of stabilized dredged material at the proposed LNG terminal is controlled by both the regulatory authority of the DEP and the use restrictions specified in the Quitclaim Deed for the property.

The DEP has the regulatory authority to decide that materials may be used as a substitute for clean fill. Therefore, the DEP could approve the use of the stabilized dredged material as a substitute for clean fill on the site. However, actual use of the stabilized dredged material on the site would be governed by the additional regulatory guidelines of the MCP and the private contractual provisions of the Quitclaim Deed.

Shell Oil further indicated that the presence of arsenic and mercury in the sediment samples was a potential concern. However, the highest concentrations observed for these metals are below MCP S-1 standards (meaning soils with the same concentrations of these metals would be suitable for use in residential settings). Shell Oil also commented about the potential impact of upland placement of dredged sediments on the existing groundwater remediation system. Weaver's Cove Energy would implement modifications to the existing groundwater remediation system necessary to maintain the present site remediation program. These modifications would minimize any impacts on light non-aqueous phase liquid (LNAPL) recovery and site remediation (see section 4.3.1 for further discussion of groundwater remediation issues).

TABLE 4.2.2-5

Background Concentrations and MCP Residential Standards for PAHs and Metals Relative to the Dredged Sediment

	Dredged Sediment	DEP Background Concentrations a/		
	90th Percentile Concentrations	Natural Soil	Soils Associated with Fill	DEP S-1 Standard b/
PAHs (concentrations in ppb)				
Acenaphthene	110	500	2,000	20,000
Acenaphthylene	225	500	1,000	100,000
Anthracene	365	1,000	4,000	1,000,000
Benzo(a)anthracene	775	2,000	9,000	700
Benzo(a)pyrene	900	2,000	7,000	700
Benzo(b)fluoranthene	835	2,000	8,000	700
Benzo(g,h,i)perylene	340	1,000	3,000	100,000
Benzo(k)fluoranthene	900	1,000	4,000	7000
Chrysene	845	2,000	7,000	7000
Dibenz(a,h)anthracene	118	500	1,000	700
Fluoranthene	1050	4,000	10,000	600,000
Fluorene	113	1,000	2,000	400
Indeno(1,2,3-cd)pyrene	325	1,000	3,000	700
Naphthalene	275	500	1,000	700
Phenanthrene	655	3,000	20,000	100,000
Pyrene	1,800	4,000	20,000	500,000
Metals (concentrations in ppm)				
Antimony c/	0.3	1	7	10
Arsenic	19	20	20	30
Barium	46	50	50	1000
Beryllium	1.2	0.4	0.9	0.7
Cadmium	1.2	2	3	30
Chromium (total)	302	30	40	1000
Chromium (VI)	166	30	40	200
Copper	136	40	200	None Listed d/
Lead	150	100	600	300
Mercury	3.1	0.3	1	20
Nickel	30	20	30	300
Selenium	2.1	0.5	1	400
Silver	6.7	0.6	5	100
Thallium	0.2	0.6	5	8
Zinc	280	100	300	2500

a/ Values from DEP Technical Update: *Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil.* http://www.state.ma.us/dep/ors/files/backtu.pdf

b/ DEP standard based on S-1/GW-1 values listed in 310 CMR 40.0975(6)(a).

c/ Concentrations for metals indicated in bold-face type were calculated from the 14 MCP core samples. All other metals are based on the 55 COE-parameter core samples.

d/ DEP currently has no standard for copper.

The placement and reuse of dredged sediment at the proposed LNG terminal site could potentially improve the current site conditions by effectively isolating any soil hot spots for lead and LNAPL from potential receptors. In its comments on the draft EIS, the DEP indicated that the volume of sediment

necessary to isolate potential receptors from LNAPL and hotspots of lead contamination should be discussed along with requisite calculations.

As indicated in table 4.2.2-6, the maximum concentration of lead in the dredged materials is 360 mg/kg (62 times less than the highest lead concentration in the existing site soils). The maximum concentration in the dredged sediments is below the RCS-2 reportable concentration of 600 mg/kg and below the DEP background level of lead in soils associated with fill (table 4.2.2-6). Therefore, the risk from exposure to the stabilized dredged sediments would be significantly lower than the risk from the existing site soils.

The proposed LNG terminal site would be covered by between 5 and 25 feet of stabilized dredged material (see figure 2.4.1-1). The LNG spill containment area would be covered by about 5 feet of stabilized sediment. Because access to this area would be restricted to occasional maintenance of stormwater control and LNG spill control pumping equipment, and because excavation below the depth of emplaced fill would be minimal, the volume of stabilized fill present in this area would generally isolate any lead contamination from potential receptors. However, this thickness of fill may not be adequate to isolate potential receptors from LNAPL vapor contact. The remainder of the site would be covered by between 15 and 25 feet of stabilized fill material. This thickness of fill would isolate potential receptors from all hotspots for lead, and would likely isolate all potential receptors from LNAPL contaminants. However, because the calculations necessary to make a final determination of the potential for isolation of hotspots for lead and LNAPL must be carried out by an LSP, **we recommend that**

- **Weaver's Cove Energy provide all appropriate grading plans, cross section drawings, and risk assessments required to demonstrate the degree of isolation provided by the upland reuse of stabilized dredged materials. The required documentation should be filed with the Secretary for review and approval by the Director of the OEP <u>prior to construction</u>.**

Based on our analysis, we believe the upland placement of the dredged sediment on the LNG terminal site could be accomplished without impeding current LNAPL recovery efforts (also see section 4.3.1). However, the MCP at 310 CMR 40.0032 (3)b prohibits the disposal or reuse of soils containing oil or hazardous materials "at locations where existing concentrations of oil and/or hazardous material at the receiving site are significantly lower than levels of those oil and/or hazardous materials present in the soil being disposed or reused." This is in keeping with the statutory preference contained in Chapter 21E to maintain or achieve background levels of oil or hazardous materials at sites proposed for placement or reuse of soils or sediments from offsite sources. In order to make a final determination of compliance with the MCP, a complete comparison of all constituents identified in the dredged material and the soils at the proposed LNG terminal site needs to be completed. Based on comments we received from the DEP (DEP, 2004), we indicated in the draft EIS that additional testing of the soils at the proposed LNG terminal site was necessary to complete the comparison of the dredged sediment and existing site soils.

Weaver's Cove Energy maintains that the above provision of the MCP does not apply to sediment and, therefore, does not apply to the project. Nevertheless, in September 2004, Weaver's Cove Energy conducted sampling and analysis of soils at the proposed LNG terminal site to supplement the data previously collected by Shell Oil. Ten cores were collected from locations in the northern half of the southern parcel and one location in the southern portion of the northern parcel (figure 4.2.2-4). The cores were collected by continuous split spoon sampling from the ground surface down to the water table. All cores were field screened for contamination using visual inspection and instrumental photo-ionization detector analysis. One sample from each core was submitted for analysis of some or all of the following compounds: VOCs, PAHs, PCBs, MCP-required metals, and physiologically available cyanide.

TABLE 4.2.2-6

Comparison of Proposed Dredged Sediment with Existing Soils at the Proposed LNG Terminal Site and DEP Reportable Concentrations and Accepted Background Concentrations for Urban Fill Material

	Dredged Sediment		Site Soils		Site Soils		Massachusetts DEP	
	Tier II Data		Shell Data		September 2004 Data		Reportable Concentration RCS-2	Back-ground Fills
	Mean	Max	Mean	Max	Mean	Max		
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Volatile Organics								
2-Butanone (MEK)	0.15	0.22	NA	NA	4.1*	29*	40	NS
Acetone	0.20	0.33	2.6	55	4.1*	29*	60	NS
Benzene	0.038*	0.055*	0.7	54	0.50*	2.9*	60	NS
Bromomethane	0.05	0.12	NA	NA	0.83*	6.0*	3	NS
Carbon disulfide	0.07	0.42	NA	NA	4.1*	29*	1,000	NS
Ethyl benzene	0.038*	0.055*	7.2	430	17	160	500	NS
p/m-Xylene	0.076*	0.105*	25	527	24	250	500	NS
Methyl tert-butyl ether (MTBE)	0.038*	0.055*	0.26	0.837	0.83*	6.0*	200	NS
o-Xylene	0.038*	0.055*	6	245	0.42*	2.9*	500	NS
Tetrahydrofuran	0.09	0.14	NA	NA	8.3*	60*	5,000	NS
Toluene	0.038*	0.055*	4.51	350	0.61*	4.3*	500	NS
Total Xylenes	NA	NA	27	1700	NA	NA	500	NS
Semi-Volatile Organics								
1,2,4-Trichlorobenzene	0.12	0.22	NA	NA	2.2*	10*	500	NS
1,4 Dichlorobenzene	0.10	0.12	NA	NA	2.2*	10*	60	NS
1-Methylnaphthalene	NA	NA	1.6	55	2.2*	10*	NS	NS
2-Methylnaphthalene	0.16	0.64	7.6	597	2.2*	110	1,000	NS
4-Methylphenol	0.12	0.23	NA	NA	2.2*	10*	NS	NS
Acenaphthene	0.05	0.38	0.8	90	2.2*	10*	2,500	2
Acenaphthylene	0.12	0.69	0.3	26	2.2*	10*	1,000	1
Anthracene	0.17	0.86	0.2	15	2.2*	10*	1,000	4
Benzo[a]anthracene	0.38	3.3	0.2	7	2.2*	10*	1	9
Benzo[a]pyrene	0.44	2.5	0.2	5	2.2*	10*	0.7	7
Benzo[b]fluoranthene	0.39	2.8	0.1	3	2.2*	10*	1	8
Benzo[k]fluoranthene	0.41	2.9	0.1	2	2.2*	10*	2,500	3
Benzo[g,h,i]perylene	0.14	0.47	0.2	2	2.2*	10*	10	4
Benzoic Acid	0.11	0.17	NA	NA	2.2*	10*	10,000	NS
Biphenyl	0.10	0.12	NA	NA	2.2*	10*	100	NS
bis(2-Ethylhexyl)phthalate	0.63	1.4	NA	NA	2.2*	10*	300	NS
Carbazole	0.10	0.12	NA	NA	2.2*	10*	NS	NS
Chrysene	0.41	3.3	0.24	11	2.2*	10*	10	7
Dibenzo[a,h]anthracene	0.06	0.19	0.08	0.25	2.2*	10*	0.7	1
Dibenzofuran	0.11	0.18	NA	NA	2.2*	10*	NS	NS
Dibutyl phthalate	NA	NA	1.4	1.7	2.2*	10*	500	NS
Fluoranthene	0.51	2.7	0.3	12	2.2*	10*	1,000	10
Fluorene	0.06	0.41	1.6	121	2.5*	4.2	2,000	2
Indeno[1,2,3-cd]pyrene	0.15	0.51	0.12	1.6	2.2*	10	1	3
Naphthalene	0.23	5.7	6.66	216	6.4*	48	1,000	1

TABLE 4.2.2-6 (cont'd)

Comparison of Proposed Dredged Sediment with Existing Soils at the Proposed LNG Terminal Site and DEP Reportable Concentrations and Accepted Background Concentrations for Urban Fill Material

	Dredged Sediment		Site Soils		Site Soils		Massachusetts DEP	
	Tier II Data		Shell Data		September 2004 Data		Reportable Concentration RCS-2	Back-ground Fills
	Mean	Max	Mean	Max	Mean	Max		
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Phenanthrene	0.28	1.3	1.36	102	2.6*	2.6	100	20
Phenol	0.10	0.15	NA	NA	2.3*	10*	500	NS
Pyrene	0.84	7.1	0.54	9.8	2.2*	10*	2,000	20
Total PCBs	0.13	0.30	NA	NA	0.5	1.8	2,000	NS
Metals								
Arsenic	12	28	NA	NA	8	53	30	20
Barium	35	52	NA	NA	7	14	2,500	50
Beryllium	1.0	1.2	NA	NA	0.2	1.0	0.8	0.9
Chromium	123	420	NA	NA	5	10	2,500	40
Copper	65	180	NA	NA	11	48	10,000	200
Lead	80	360	221	22,500	138	1,300	600	600
Mercury	1.3	4.3	NA	NA	0.1	0.2	60	1
Nickel	21	36	NA	NA	7	14	700	30
Selenium	1.5	2.2	NA	NA	1.1*	1.2*	2,500	1
Silver	3.5	8.3	NA	NA	0.3	1.1	200	5
Zinc	157	330	NA	NA	23	99	2,500	300
Physiologically Available Cyanide	3	8	NA	NA	0.5	0.6	100	NS
Volatile Petroleum Hydrocarbons								
C10-C22	NA	NA	40	950	NA	NA	NS	NS
C5-C8 Aliphatics	5.6*	7.5*	205	4,820	NA	NA	500	NS
C9-C10 Aromatics	3.8*	5.0*	141	2,800	NA	NA	500	NS
C9-C12 Aliphatics	5.6*	7.5*	313	6,300	NA	NA	2,500	NS
Extractable Petroleum Hydrocarbons								NS
C9-C18 Aliphatics	7	46	999	53,800	NA	NA	2,500	NS
C19-C36 Aliphatics	39	210	386	30,800	NA	NA	5,000	NS
C11-C22 Aromatics	19	55	958	23,700	NA	NA	2,000	NS

* Value is based on one half the detection limit

NA = Not Analyzed
NS = No Standard

As shown on figure 4.2.2-3 for total VOCs, all individual VOCs in the existing site soils occur at higher concentrations than in the proposed dredged sediments. This is also true for all SVOCs except benzo(k)fluoranthene (table 4.2.2-6). The maximum concentration of benzo(k)fluoranthene in the dredged sediments is 2.9 mg/kg, whereas the maximum detectable concentration observed in the existing site soils is 2 mg/kg. Therefore, upland reuse of the stabilized dredged sediments could result in a slight increase in the concentration of benzo(k)fluoranthene in the site soils but it would not result in a reportable concentration. Also, it would be unlikely to result in a final concentration in site soils that exceeds DEP-defined background levels for this compound in soils associated with fill materials. The maximum concentrations of four SVOCs in the existing site soils currently exceed the RCS-2 reportable concentrations (table 4.2.2-6). However, the mean concentrations of these compounds are well below the RCS-2 criteria. Additionally, the maximum concentrations of these compounds are less than the DEP-defined background level, and upland reuse of the stabilized dredged sediment would not result in a reportable concentration, nor would it be likely to create new concentrations of these compounds that exceed DEP-defined background levels.

The concentrations of both volatile and extractable petroleum hydrocarbons in the existing site soils currently exceed the MCP reportable concentrations. The mean concentrations of these compounds in the proposed dredged sediments range from 0.7 percent to 10 percent of the mean concentrations in the existing site soils. In addition, the maximum concentrations of these compounds in the dredged sediments are far lower than the mean concentrations in the existing site soils (table 4.2.2-6).

The mean and maximum concentrations of total PCBs in the dredged sediments are much lower than the corresponding concentrations in the existing site soils. In addition, the maximum concentration of total PCBs in the sediment is lower than the mean concentration in the existing site soils. Both the sediments and the site soils are substantially below the RCS-2 reportable concentration of 2,000 ppm.

Upland placement of the stabilized dredged sediment would result in an increase in the concentration of most metals in the existing site soils. However, increases in the concentrations of most metals would not result in the exceedance of a reportable concentration (table 4.2.2-5). The increase in the concentration of beryllium could potentially result in the exceedance of a reportable concentration for that metal. However, it seems probable that the range of beryllium concentrations demonstrated by both the dredged sediments and the existing site soils represents a local background condition given the location of the dredging footprint and the terminal site, directly downwind of two coal-fired power plants. The principal source of atmospheric beryllium dust in the United States is smoke stack emissions from coal- and oil-fired power plants (EPA, 2004c; Agency for Toxic Substances and Disease Registry, 2004). An additional source of beryllium derives from ash waste from coal-fired power plants. The background concentration of beryllium in table 4.2.2-6 is based on published DEP values (DEP, 2002). However, that technical note indicates that the values published therein "… do not obviate the need to establish location-specific background conditions for other purposes, such as compliance with the anti-degradation provisions of the MCP" (DEP, 2002). As a result, the local background concentration of beryllium may be higher in the Fall River area than the published value of 0.9 mg/kg. Furthermore, the presence of beryllium in the existing site soils at maximum concentrations similar to those in the dredged sediment means that the proposed reuse of the stabilized sediment would not introduce a contaminant to the site that is not already present.

Insert figure

4.2.2-3 Comparisons of Average Concentrations in Sediment and Soil Samples

Weaver's Cove Energy conducted a revised Method 3 Risk Assessment using both Shell Oil's existing soil data and the data recently acquired by Weaver's Cove Energy that included the same constituents found in the proposed dredged sediments. The results of this assessment indicated that exposure to the existing site soils does not pose a risk for commercial workers, trespassers, or utility workers, but based on the additional data, the new risks from existing site soils are slightly higher than the original site risk calculated by Shell Oil. The same analysis, including Shell Oil's existing data, the new site soil data, and the data for the dredged sediment, indicates that total site risk is below the MCP carcinogenic risk criterion (1×10^{-5}), and the MCP non-carcinogenic risk criterion (i.e., less than 1). Total site risk is below these criteria for commercial workers, trespassers, and utility workers. Our analysis of the risk assessment conducted by Weaver's Cove Energy suggests that it conservatively overestimates the risk to the chosen receptors. Because the data collected in September 2004 do not represent entirely separate exposure points from those used in the original Shell Oil risk assessment, combining separately calculated risks from data collected from the same exposure points overestimates the risk to the chosen receptors, thereby producing a conservative estimate of potential site risk.

The MCP at 310 CMR 40.0032 requires that the DEP evaluate the types and extent of contamination within the proposed dredged sediment compared to the contaminant profile in the soil at the proposed reuse location to prevent the occurrence of a release condition at the site that would require remediation, or significantly increase contamination at the proposed reuse site. Our analysis indicates that except for those contaminants in the existing site soils that currently exceed reportable concentrations, upland reuse of the stabilized dredged sediment would not result in an increase in the concentration of any additional contaminants that would exceed a reportable concentration. For those contaminants that already exceed a reportable concentration, use of the stabilized dredged sediment at the site would not likely result in additional remediation requirements because the incremental increase in these substances would be minimal. Upland reuse of the dredged sediment would result in an increase in the concentration of most metals in the existing site soils; however, none of the increased concentrations would result in a release condition. It does not appear that the increased concentrations of metals would pose a significant environmental impact because all of the metals in the dredged material also occur in the existing site soils (some at higher maximum concentrations), and except for selenium and mercury, the increased metal concentrations would remain below DEP-published background levels. The published background concentration for mercury is 1 mg/kg; however, given the proximity of the site and the dredging footprint to the coal-fired Brayton Point Power Plant, it is likely that the local background level of mercury is higher than 1 mg/kg, and reuse of the sediments may not pose a significant impact on existing site soils. Information in a recent lawsuit against the Brayton Point Power Plant indicates that 240 pounds of mercury per year are emitted from the plant (Conservation Law Foundation, 2005). We note, however, that the DEP has not made a final determination on this issue.

Because the DEP has not made a final determination regarding the upland placement of sediments on the LNG terminal site with respect to either the anti-degradation provisions or potential impacts on the existing remediation system, and because upland reuse of the stabilized dredged sediment is a critical aspect of the proposed project design**, we recommend that:**

- **Weaver's Cove Energy file documentation with the Secretary <u>prior to construction</u> to verify that placement of the stabilized dredged material on the LNG terminal site is consistent with the MCP. If Weaver's Cove Energy is unable to verify the consistency of the proposed use of the sediment with the MCP, it should file a revised sediment placement plan that identifies alternative location(s) for use of the sediments. This alternative use plan, if necessary, should be developed in consultation with the relevant agencies and include a detailed assessment of the environmental impacts associated with the alternative location(s) and demonstrate that the alternative location(s) are in compliance with applicable regulations.**

Weaver's Cove Energy should file the plan, if necessary, with the Secretary for review and approval by the Director of OEP <u>prior to construction</u>.

We received a comment from the DEP indicating that the proposed upland reuse of stabilized dredged sediment is regulated under the provisions of 314 CMR 9.00 (Water Quality Certification). The DEP also indicated that to be considered a valid reuse proposal, the amount of material proposed for reuse must be "reasonable and consistent with the project's design, construction, and operation." The volume of material used should be the minimum amount necessary to accomplish the project. Any volume of material larger than the minimum necessary to accomplish the project would be "considered solid waste, if proposed to be disposed upland" and be subject to management under MGL c. 111, §150A and 150A1/2 as well as 310 CMR16.00 and 19.000.

In its comments on the draft EIS, Weaver's Cove Energy provided information regarding the volumes of stabilized sediment required to construct each of the site features. This information shows that a large portion of the fill (41 percent) would be used to bring the site grade from its present elevations (generally 20 to 25 feet above MSL) to 40 feet above MSL. This would bring the entire facility above the 100-year floodplain elevation, a required safety feature. More importantly, this volume of stabilized dredged material would allow the installation of sumps, berms, process piping, drains, and other systems necessary for site operation without disturbing the underlying contaminated site soils. An additional 5 percent of the stabilized fill material would be used to construct auxiliary facilities and the approach berms for the railroad crossing between the southern and northern parcels. The remaining volume would be used to construct a perimeter retaining wall and a landform for visual screening and noise attenuation. Our analysis indicates that the volume of stabilized dredged sediments appears reasonable and consistent with the project's design, construction, and operation. In addition, because the sediments are an environmental media that would be stabilized and reused as engineered fill, and would not be discarded or abandoned, they do not appear to meet the definition of solid waste under 310 CMR 16.00. Therefore, we do not believe that a site assignment would be required for the site.

During the scoping process, we received a comment expressing concern about the potential interaction of an intense fire with the LNAPL contamination in the existing site soils. The LNAPL at the site currently exists as a plume floating on the top of the groundwater. Current groundwater elevations at the site range from 2 to 15 feet below the existing ground surface. Upland placement of dredged sediments would cover the majority of the site with a thick layer of material that would further isolate the LNAPL contaminants from direct exposure to any fire. The use of other forms of structural fill in areas of the site not directly covered by stabilized dredged material would also result in isolation of the LNAPL contaminants. In addition, most of the heat from a fire would be directed up into the atmosphere, minimizing the risk of LNAPL-fire interaction and any potential for a release of LNAPL from the site.

Sediment Stabilization Testing

The physical characterization of the bulk sediment indicated that the dredged material is predominantly fine-grained with a highly plastic behavior. These physical characteristics are not optimal for time-efficient material handling and offloading, drying, and upland placement as structural fill. To improve the material handling and mechanical properties of the dredged material, some form of stabilization would be required.

Weaver's Cove Energy conducted a laboratory testing program to evaluate the application of several admixtures, in differing percentages and under differing conditions, to identify a soil stabilization method that could produce improved physical characteristics (additional details on the testing can be found in the *Dredging Program Report* under the "Proposal" link on Weaver's Cove Energy's website at www.weaverscove.com). The objective of the dredged material admixture testing program was to obtain

a general understanding of the behavior of typical fine-grained sediments when treated with varying percentages of lime, portland cement, and a combination of both lime and cement. This program did not evaluate the effects of admixtures on the more coarse-grained 'parent material' sediments found in distinct areas within the turning basin. It is anticipated that these coarse-grained materials would be easier to dewater and stabilize than the fine-grained materials that were tested.

Based on the results of the sediment stabilization testing program, the addition of lime, portland cement, and mixtures of lime and cement in combination improved the strength of the fine-grained dredged material. The magnitude of strength gained, however, varied significantly with respect to the type and percentage of admixture used. The addition of an 8 percent (mass basis) portland cement admixture to the fine-grained dredged material yielded the greatest short-term (1 day) and long-term (28 day) gains in material compressive strengths. The resulting product was a material with improved workability and handling characteristics and suitable for structural applications.

In addition to the mechanical properties of the stabilized dredged material, the permeability of samples from the two cement admixtures was measured to evaluate the potential movement of water, and therefore potential contaminants, through the stabilized materials after on site placement as structural fill. The results for both cement admixtures were similar. When compacted to 90 percent of maximum dry density, both 4 and 8 percent cement-stabilized sediment had a saturated permeability of 0.03 inch per day. Similarly, both 4 and 8 percent cement-stabilized sediment compacted to 95 percent of maximum dry density had saturated permeabilities of 0.02 inch per day. By comparison, a natural soil such as heavy clay, with very slow permeability (as described by the NRCS) has a saturated permeability of about 1.4 inches per day, which is nearly 50 times faster than the fastest permeability measured for the stabilized dredged material.

The saturated permeabilities measured for the stabilized dredged material represent the fastest flow rate for water moving through this material. These permeabilities assume that the entire mass of sediment is saturated and that a constant source of ponded water exists at the ground surface. Neither of these assumptions would be valid for the stabilized sediments placed at the LNG terminal site, thus our analysis is highly conservative. Rainfall reaching the surface of the LNG terminal site would run off the steeply sloping portions of the land surface and be contained in sedimentation ponds constructed for stormwater management. Much of the water standing in these ponds would be lost to evaporation before it could recharge the groundwater. Rainwater that soaked into those portions of the site with low slope gradients would largely be evapotranspired by vegetation, further limiting groundwater recharge. The limited amount of water that would be available for groundwater recharge would have to move through a minimum of 15 feet of stabilized material before reaching the preconstruction land surface. Existing groundwater at the site is generally 2 to 15 feet below that elevation. Assuming the permeabilities measured for the stabilized sediment could be realized, it would take between 16 and 25 years for water moving through the stabilized sediments to reach the preconstruction land surface. By comparison, water moving through 15 feet of low permeability natural soil (as described above) would move through that distance in 129 days.

The primary impact from construction of the LNG terminal site would result from erosion and sedimentation of stabilized dredged material during placement and grading of the sediments. The low permeability of the stabilized dredged material could result in large amounts of runoff from rainfall during construction. High runoff rates are also likely during operation of the LNG terminal due to the low permeability of the stabilized fill. To mitigate the impacts associated with erosion and sedimentation during construction and operation of the LNG terminal site, Weaver's Cove Energy would implement both a site-specific erosion and sedimentation control plan pursuant to its application for a section 401 Water Quality certification and section 404 and Massachusetts Wetland Protection Act (WPA) wetlands permits, and a stormwater management plan pursuant to EPA and DEP stormwater management policies and regulations. A summary of the measures contained in these plans is presented in section 4.3.2.

4.3 WATER RESOURCES

4.3.1 Groundwater

Regional Groundwater Quality and Quantity

Groundwater resources in the project area include unconsolidated sand and gravel aquifers underlain by crystalline bedrock aquifers. The sand and gravel aquifers are comprised primarily of ice-contact, outwash, and lake-bottom sediments, which were deposited in pre-glacial bedrock valleys and water-filled depressions. Water well depths in the sand and gravel aquifers typically range between 10 and 100 feet and yield between 10 to 400 gpm. The quality of water is adequate for most uses, but may contain high concentrations of iron and manganese (USGS, 1995). In general, groundwater within theses aquifers follows topographic contours and discharges to surface waterbodies, such as the Taunton River.

Water well depths in the crystalline bedrock aquifers range between 100 to 400 feet and yield between 1 to 20 gpm, primarily from joints, fractures, faults, and bedding planes. The groundwater quality from the crystalline bedrock is generally suitable for most uses but may cause corrosion of pipes and appliances (USGS, 1995).

There are no EPA-designated sole-source aquifers (EPA, 2003) or state or locally protected aquifers or wellhead protection areas in the project vicinity (MassGIS, 2003). Also, based on 2003 MassGIS data, review of USGS topographic maps, and field surveys, there are no springs within 200 feet of any of the proposed project facilities or work areas**.**

Public Water Supply

Information on drinking water wells registered by the DEP was collected using 2003 MassGIS data. Groundwater and surface water supply information was also compiled through personal communications with state and local agencies. This information indicates that most drinking water in the project area comes from municipal sources. The nearest community water supply well to the proposed project is located approximately 2.2 miles northeast of the proposed interconnect between the Northern Pipeline and the existing Algonquin G-20 lateral. The nearest community water supply well to the proposed LNG terminal is approximately 4 miles northwest of the site. The nearest community surface water supply to the proposed project is the Somerset Reservoir, approximately 1.4 miles northwest of MP 2.5 of the Northern Pipeline.

Hydrostatic testing of the LNG storage tank would require an estimated 32 million gallons of water to be obtained either from the municipal water system or the Taunton River (see section 4.3.2 for a discussion of the Taunton River as a potential source of test water). An estimated 760,000 gallons of municipal water or Taunton River water is proposed for hydrostatic testing of the two pipelines. Weaver's Cove Energy would coordinate with the City of Fall River to ensure that water requirements for hydrostatic testing from municipal sources would not impact public water availability.

Private Water Supply

According to MassGIS data, there are no private drinking water wells within 150 feet of the LNG terminal site or either pipeline route. The nearest DEP-registered private water well is more than 1.4 miles from any of the proposed facilities.

Groundwater Quality at the LNG Terminal Site

A petroleum product storage and distribution terminal operated on the site from the 1920s through the 1990s. Historical operations at the site resulted in contamination of soil and groundwater by petroleum products, including kerosene, xylene, gasoline, No. 2 fuel oil, No. 6 fuel oil, and jet fuel. Releases were documented from aboveground storage tanks (ASTs), underground storage tanks (USTs), loading racks, pipelines, and ship loading areas.

Contaminated sites in Massachusetts are regulated by the DEP under the MCP, 310 CMR40.0000. The MCP process involves the following five phases. According to Weaver's Cove Energy, Phases I through IV have been completed and the site is now in Phase V of the MCP process.

- Phase I - Initial site investigation (January 1989 - November 1991). During Phase I, initial investigations were performed and short-term measures were implemented to contain petroleum contamination. The site was classified as a Tier IB site, requiring the DEP to issue a permit for the responsible party (i.e., Shell Oil) to conduct response actions at the site.

- Phase II - Comprehensive site assessment (February 1997). Extensive investigations including numerous groundwater monitoring wells and soil borings were conducted to delineate the source, magnitude, and extent of contamination at the site. A site-specific risk assessment was conducted by Shell Oil in accordance with MCP protocol and concluded that a condition of significant risk existed at the site due to petroleum products and lead in the subsurface.

  A northern plume and a southern plume of LNAPL petroleum product were found floating on the groundwater table at the site. Figure 4.3-1 shows the approximate location of the two plumes on the LNG terminal site. The northern plume covers a larger area and is characterized by less viscous petroleum than the southern plume. As much as 4.9 feet of LNAPL has been reported in the northern plume, and as much as 1 foot of LNAPL has been reported in the southern plume. Contaminated soil was also documented in areas where historic aboveground petroleum storage and handling equipment existed, and near the groundwater table due, in part, to diurnal tidal-induced variation of approximately 0.5 to 1.0 foot in the groundwater elevation at the site.

  Completion of Phase II also included placement of a deed restriction on the site, with the following main elements:

  - future residential or agricultural use of the site is prohibited;
  - a cap or other barrier must be constructed prior to any permitted reuse or development;
  - a Soil and Groundwater Management Plan and a Health and Safety Plan must be prepared and implemented for soil excavation activities at the site;
  - an LSP must be used for relocation or off site shipment of contaminated soils; and
  - new occupied buildings must be constructed slab-on-grade with active sub-slab ventilation systems.

Insert Figure

4.3-1 Groundwater Plume of Light Non-Aqueous Phase Liquid Petroleum Product

- Phase III - Remedial action plan (September 1989 - August 2001). Remedial alternatives were evaluated in Phase III. The remedial action selected for the site involved groundwater gradient control, LNAPL recovery, and groundwater removal and treatment.

- Phase IV - Remedial action plan implementation (August 2001). The remedial action plan selected in Phase III was implemented in Phase IV and included installation and operation of groundwater monitoring wells, an interceptor trench, automated and manual LNAPL recovery wells, and groundwater depression wells. The groundwater depression wells were located and designed to enhance LNAPL recovery and prevent LNAPL from migrating to the Taunton River. In general, the impact of the groundwater pumping on groundwater flow is confined to the site.

  LNAPL is currently being recovered from the northern plume by automated pumping, collected in aboveground tanks, and periodically trucked off-site for disposal. LNAPL recovery wells in the southern plume are inspected on a predetermined schedule, and any accumulated LNAPL is recovered manually and disposed of off-site. Contaminated groundwater is pumped to an onsite water treatment building for processing via activated carbon before being discharged to the Taunton River under a NPDES permit. As reported to the DEP in May 2004, 1,000,000 gallons of free-phase product has been recovered from the site to date.

- Phase V - Operations and maintenance. The site entered Phase V of the MCP process after submittal of the Phase IV Final Inspection Report to the DEP in November 2002. In Phase V, the remedial systems at the site continue to be operated and modified as warranted by system performance and site monitoring. Progress reports are submitted to the DEP every 6 months, and the site will remain in Phase V until remediation is determined to be complete.

Because the placement of dredge spoils onsite and the construction of the proposed infrastructure have the potential to interfere with or exacerbate on-going response actions, the DEP has stated that any significant modifications to the existing groundwater remediation system may require a revised Phase IV, Phase V, and Remedial Operation Status submittal.

Impacts of LNG Terminal Construction and Operation on Groundwater Quality

As discussed in section 4.1.4.1, Weaver's Cove Energy proposes to install stone columns beneath the LNG tank. The purpose of the stone columns would be to improve the static load bearing capacity of site soils and to mitigate the potential effects of soil liquefaction in the unlikely event of a significant earthquake.

Utilizing stone columns would result in fewer environmental issues related to existing soil and groundwater contamination at the site than other alternatives. One advantage of stone columns is that they would not result in a significant amount of potentially contaminated spoil that may be brought to the surface during installation. Stone column construction could temporarily increase pore water pressure in subsurface soils, which could cause short-term changes in the shallow groundwater flow regime. Although no shallow groundwater contamination LNAPL was observed in any of the geotechnical soil borings installed in the LNG tank area, Weaver's Cove Energy would implement proactive measures to monitor and control groundwater levels during construction. These measures would include:

- monitoring groundwater levels in existing monitoring wells in the area and implementing methods, such as limited pumping, to maintain water levels in acceptable ranges;

- varying the stone column installation sequence so that a significant number of columns are not installed consecutively in a small area;

- if necessary, installing temporary dewatering sumps near the center of the proposed treatment area to allow for groundwater withdrawal to prevent groundwater flow out of the proposed treatment area; and

- handling any potentially contaminated soils or groundwater that is removed or handled as a result of the stone columns construction in accordance with the MCP under the direction of an LSP.

Once installed, the stone columns would have minimal or no long-term effect on the existing groundwater flow regime and would not impact any plans for groundwater remediation. Based on the physical setting of the site, surrounding major topographical elevations, and proximity to the Taunton River, vertical groundwater gradients at the LNG terminal site are most likely upward. Therefore, installation of the stone columns would not be expected to result in downward migration of shallow groundwater contamination to deeper, uncontaminated zones. Additionally, the installation of stone columns would reduce the overall permeability of fine-grained materials relative to native uniform fine sands, further reducing the potential for vertical contaminant migration at the site.

As part of the proposed LNG terminal construction, Weaver's Cove Energy has proposed to install sheet piling along the shoreline. We received comments expressing concern that installation of the sheet piling would adversely impact the operation of the existing LNAPL remediation system and that removal of the existing timber bulkhead could allow LNAPL to flow to the Taunton River. Except for a relatively small section along the northern edge of the southern parcel, Weaver's Cove Energy would not remove the existing timber bulkhead. Rather, the proposed sheet piling would be constructed upland of the old timber bulkhead, and should supplement the existing timber bulkhead as a physical barrier to LNAPL migration toward the Taunton River. Weaver's Cove Energy contends that installation of the sheet piling could potentially increase the rate of LNAPL recovery by limiting the flow of river water toward LNAPL recovery wells. In its final design phase, Weaver's Cove Energy would take steps to ensure that LNAPL does not flow to the Taunton River during or after construction of the proposed sheet piling system. These steps could involve installation of additional monitoring wells, water extraction wells, and LNAPL recovery wells, or other adjustments to the existing groundwater remediation system. Any modifications to the existing groundwater remediation system would be based on further hydrogeologic tests at the site and the development of a groundwater model that would predict how groundwater would react to changes to the system. Any such tests and changes to the remediation system would be prepared under supervision of Weaver's Cove Energy's LSP, would require approval by Shell Oil under the provisions of its Quitclaim Deed, and must comply with the MCP (M.C.L.c.21E and 310 CMR 40.000).

Other construction activities at the LNG terminal site, including grading, excavation, and construction of footings, foundations, and pilings could potentially cause minor fluctuations in shallow groundwater levels and/or increase turbidity within shallow groundwater adjacent to the construction activity. These impacts would be expected to be localized and would not significantly impact groundwater quality. Most potential impacts would be avoided or minimized by use of standard construction techniques as set forth in the FERC Plan and Procedures. Potential impacts on groundwater associated with the use of oils, lubricants, and other hazardous substances during construction and operation of the LNG terminal would be minimized by Weaver's Cove Energy's compliance with federal regulations related to fuel transport, handling, and spill response procedures and its implementation of a project-specific onshore SPCC Plan. These measures would ensure that:

- employees who handle fuels and other hazardous materials are properly trained;
- equipment used during construction is in good operating order and inspected on a regular basis;
- each construction crew has on hand sufficient supplies of absorbent and barrier material to allow the rapid containment and recovery of spilled materials, and knows the procedure for reporting spills;
- each construction crew has on hand sufficient tools and materials to stop leaks;
- contractors know the contact names and telephone numbers for all local, state, and federal agencies that must be notified of a spill;
- contractors follow the requirements of those agencies in cleaning up the spill and collecting and disposing of waste generated during spill cleanup;
- fuel trucks transporting fuel to on site equipment travel only on approved access roads;
- all onshore equipment is parked overnight and/or fueled at least 100 feet from wetlands and waterbodies;
- refueling and maintenance of offshore equipment is conducted in accordance with procedures designed to minimize the risk or impact of a spill; and
- hazardous materials, including chemicals, fuels, and lubricating oils, are not stored within 100 feet of a waterbody or wetland.

Impacts of Dredged Material Placement on Groundwater Quality and the Existing Remediation System

Weaver's Cove Energy proposes to reuse up to approximately 2.6 million cubic yards of dredged material from the Taunton River on the LNG terminal site as fill material. We received numerous comments expressing concern that placement of the dredged material could adversely affect groundwater quality and operation of the existing groundwater remediation system at the site. As described in section 4.2.2, Weaver's Cove Energy conducted detailed studies and analyses to characterize the physical and chemical nature of the dredged material and to evaluate the potential environmental and health risks associated with placing the dredged material on the site. The results of these studies are summarized in the *Dredging Program Report* (C2D, 2003) and the *Method 3 Risk Assessment for Upland Placement of Dredged Material as Engineered Fill Report* (Environmental Resource Management, 2003b), which are both available under the "Proposal" link on Weaver's Cove Energy's website (www.weaverscove.com).

As discussed in section 4.2.2, Weaver's Cove Energy determined that the COCs in the sediments are primarily select PAHs and metals, as expected in industrialized waterways like the Taunton River. In the original Method 3 risk assessment, Weaver's Cove Energy compared the results of its dredged material chemical analysis to previous Shell Oil soil analytical data and concluded that the average sediment contaminant concentrations were lower than site concentrations for all comparable classes of compounds. Weaver's Cove Energy also concluded that the concentrations of oil and hazardous materials (OHM) in dredged sediment pose no significant risk to human health, public welfare, safety, or the environment, and that the sediment would not introduce significantly higher concentrations of OHM to the site when compared to OHM concentrations currently in soil and groundwater at the site. In

September 2004, Weaver's Cove Energy sampled and analyzed additional soils from the proposed LNG terminal site. As discussed in section 4.2.2, the additional data appear to support our initial finding that use of the dredged material at the site would not pose a significant environmental impact. Therefore, upland placement of the stabilized dredged material on the site would not be expected to have an adverse effect on the chemistry of the groundwater underlying the site.

In a report entitled *LNAPL Plume Response to Upland Placement of Dredge Material* (Environmental Resource Management, 2003c), Weaver's Cove Energy's LSP evaluated the potential impacts that placement of the dredged material could have on groundwater quality and remediation efforts at the site. One potential impact that was considered was whether placement of stabilized dredged material on the site could influence the existing groundwater flow regime and LNAPL plume configuration. The analysis indicates that adding the weight of 100 feet of stabilized dredged materials would reduce the porosity in existing soils by about 1 percent. However, this reduction in porosity would not result in a substantial reduction in hydraulic conductivity, and any pore pressure increases would dissipate quickly due to the relatively high conductivity of existing materials. Therefore, although the placement of fill may result in localized pore pressure build-ups and localized LNAPL mobilization, it is not expected to substantially mobilize large portions of the LNAPL plumes at the site.

Soil moisture present in the dredged material may have more impact on site hydrology than a potential porosity reduction. Depending on the water content of the dredged material at the time it is placed, the water table under the fill may mound as water drains naturally from the dredged material. However, stabilization with Portland cement would tie up much of the free water in the dredged material which would reduce the potential for groundwater mounding to occur. The high permeability of the underlying soils should result in rapid pore pressure dissipation and thus any mounding should be short-lived.

We received a comment suggesting that the potentially high pH of leachate from the stabilized dredged material could adversely affect the existing groundwater remediation system. Our analysis indicates that the effect of the leachate on groundwater pH would not be significant and would not exceed the current NPDES permit threshold. The pH of leachate from pulverized Portland cement paste is approximately 11 (Spalding, 2000). A mixture of equal parts leachate from the cement and groundwater with a pH of 7.1 yields a solution with pH 7.4. Even a mixture of 95 percent leachate with 5 percent native groundwater with a pH of 7.1 would yield a mixture with a pH of 8.4, which would still be under the permit threshold. The optimal pH range for natural degradation of hydrocarbons is between 5.0 and 9.0; therefore, the potential increase in groundwater pH that may be associated with placement of stabilized dredged material would have minimal effect on natural degradation of hydrocarbons.

Salinity and total dissolved solids are not among the discharge criteria for the NPDES permits at the site. Shell Oil has expressed concern regarding the potential for increased salinity to occur in groundwater as a result of placing the stabilized dredged material at the site. Laboratory test results of the stabilized dredged material indicate that the material would have a very low permeability of about 10^{-7} centimeter per second (0.03 inch per day). Recharge through the fill to the groundwater should be minimal (see section 4.2.2), affording infiltration water little opportunity to carry substantial amounts of dissolved ions to the water table. In addition, any discharge of saline water from the groundwater remediation system would not have a significant impact because the Taunton River contains saline estuarine waters (salinity range of 18 to 28 parts per thousand).

In summary, based on studies completed to date, we do not expect the physical effects associated with placement of a large volume of dredged material on the proposed LNG terminal site to have a significant impact on the groundwater flow regime at the site or the configuration of existing LNAPL plumes. We agree with Weaver's Cove Energy that the placement of the dredged material at the site has

the potential to improve site conditions because it would effectively serve as a barrier, which would isolate existing soil hotspots and LNAPL from potential receptors. However, we also agree with the DEP that prior to initiation of the project, groundwater modeling of the site, incorporating the proposed construction and placement of the dredged materials, must be completed to assure that the site remains in compliance with the MCP (M.C.L.c.21E and 310 CMR 40.000).

It appears that reuse of stabilized dredged material on the proposed LNG terminal site would not degrade existing groundwater quality. Weaver's Cove Energy is conducting additional TCLP analysis of the stabilized dredged sediment to confirm this (the results of the TLCP analyses were not available when this final EIS was published). Except for temporary shut-downs that may be necessary in order to relocate, modify, or improve the existing groundwater remediation system, the system would remain in operation during and after construction, and the base remediation plan would remain substantially the same: to prevent LNAPL from migrating to the Taunton River; to remove LNAPL from the ground for proper disposal; and to comply with the MCP.

The DEP has stated that any construction at the site must be completed to maintain compliance with the MCP (M.C.L.c.21E and 310 CMR 40.000). Either the existing response action must be maintained at its current operational compliance status, or a plan must be developed that identifies an alternative remedial approach to achieve an acceptable Response Action Outcome. The DEP has also stated that if Weaver's Cove Energy conducts the response actions, they must be included on the Tier 1B Permit as a responsible party, potentially responsible party, or other party prior to undertaking response actions pursuant to the MCP. As noted in the Phase II Site Assessment, the approved response action includes institutional controls that are also reflected in Shell Oil's Quitclaim Deed for the property. We agree with the DEP that Weaver's Cove Energy would need to provide a plan to the DEP that specifies measures that would maintain response action compliance during all phases of construction at the site, and it must detail the financial assurance measures that would be in place to ensure compliance in the event of a release that results from the construction activities. Weaver's Cove Energy has stated that it plans to conduct additional hydrogeologic testing and analyses, as well as development of a groundwater model, to evaluate how groundwater would respond to changes to site modifications. Weaver's Cove Energy's LSP would ensure that any response actions taken at the site would meet the performance standards of the MCP. Weaver's Cove Energy and its LSP are in discussions with Shell Oil regarding the appropriate response actions that could be needed, including possibly the addition of more monitoring wells, water extraction wells, and LNAPL recovery wells. As stated by Weaver's Cove Energy, any required modifications to the site and the groundwater remediation system would be implemented by Weaver's Cove Energy at its sole expense.

Impacts of Pipeline Construction and Operation on Groundwater Quality

Weaver's Cove Energy searched federal and state databases to identify contaminated sites that could be encountered during construction of the proposed pipelines. Databases accessed for this review included, but were not limited to the following: National Priority List; EPA Resource Conservation and Recovery Information System; EPA Comprehensive Environmental Response, Compensation and Liability Information System; hazardous waste treatment, storage and disposal facilities; PCB generators; registered USTs; and DEP hazardous waste sites.

As indicated in table 4.3.1-1, several known and potential sources of contamination were identified within approximately 0.25 mile of the proposed pipeline routes.

TABLE 4.3.1-1

Contaminated Sites and Underground Storage Tanks Located Within 0.25 Mile of the Pipeline Facilities

Facility/Site Name	Milepost	Type of Site	Distance and Orientation from Pipeline Facility	Comments
Western Pipeline Route				
Sunoco	0.8	UST - gasoline	730 feet north	Registered UST
Sewage Pumping Station	0.8	UST - diesel	1,300 feet south	Registered UST
Northern Pipeline Route				
Lot II - Plat X3	1.3	DEP hazardous waste site	120 feet east	Petroleum contaminated soil and/or groundwater
Fall River Country Club	1.4	UST - contents unknown	425 feet east	Registered UST
Cumberland Farms 4	1.9	UST - gasoline	940 feet east	Registered UST
Polaroid Corporate Facility	3.0	DEP hazardous waste site	600 feet south	Trichloroethene, 1,1-dichloroethene and chloroethene detected in soil and/or groundwater
Borges Bros., Inc.	3.0	UST - gasoline	1,340 feet south	Registered UST
Borges Bros., Inc.	3.4	UST - diesel	160 feet east	Registered UST

Weaver's Cove Energy reviewed DEP files pertaining to the Lot II-Plat X3 Site and the Polaroid Corporate Facility to further evaluate the potential to encounter contaminated soil or groundwater during construction near these known release sites. Based on its review of the files, Weaver's Cove Energy determined that petroleum-contaminated soil and groundwater would likely be encountered during pipeline construction at the Lot II-Plat X3 Site, and groundwater, primarily contaminated with trichloroethene, could be encountered at the Polaroid site. To address the potential to encounter contaminated soil and/or groundwater, we have recommended that Weaver's Cove Energy prepare a plan for the discovery and management of contaminated soils and groundwater prior to pipeline construction (see recommendation in section 4.2.1).

According to the USDA (1981), there are no areas of near surface (less than 5 feet) bedrock along either pipeline route. Consequently, blasting and potential blasting impacts on groundwater are not anticipated for construction of either pipeline. In the unlikely event that blasting would be necessary, it would be conducted according to applicable Massachusetts regulations. Because there were no public or private water supply wells identified within 150 feet of the project, any blasting that may be required would not impact wells in the area.

Other pipeline construction activities could result in minor, temporary impacts to shallow groundwater resources in proximity to the proposed pipelines. These impacts could include increased turbidity, groundwater level fluctuations, short-term disruption of recharge, localized flow along the pipeline trench, contamination from a spill or leak of hazardous substances, and decreased water yield. There are no federal or state protected aquifers in the project area and, therefore, these potential impacts would not have a significant adverse effect on groundwater quality. Most potential impacts would be avoided or minimized by the use of standard construction methods and measures set forth in the FERC Plan and Procedures and the appropriate hazardous materials management and spill response procedures

contained in Weaver's Cove Energy's SPCC Plan. Specific methods and measures would include discharging groundwater removed during trench dewatering in the immediate vicinity of where it is removed to allow for localized resource recharge; backfilling the trench with native material to promote aquifer equilibrium and minimize preferential groundwater flow along the trench; reestablishing preconstruction surface contours and drainage; as well as measures to minimize the risk of spills and procedures to contain, clean up, and report any spills that may occur. Implementation of these measures would ensure to the extent practicable that the potential impacts to groundwater quality along the proposed pipeline routes are localized to the immediate area of the disturbance and do not have a significant impact on overall groundwater quality in the area.

4.3.2 Surface Water

Regulatory Permits

Pipeline installation, LNG terminal construction, and dredging in waters of the United States would be regulated by the COE under section 10 of the Rivers and Harbors Act and section 404 of the CWA. Section 10 of the Rivers and Harbors Act prohibits the creation of any obstruction to the navigable capacity of any waters of the United States without specific approval of the COE. Section 404 of the CWA regulates the discharge of dredged or fill material into waters of the United States.

In addition to the COE permitting requirements, Weaver's Cove Energy's proposed pipeline installation, LNG terminal development, and dredging activities would need to comply with section 401 of the CWA and the CZMA. Weaver's Cove Energy would be required to obtain a section 401 water quality certificate from Rhode Island and Massachusetts demonstrating that the proposed discharge of dredged material complies with each state's water quality standards. Weaver's Cove Energy would also need to certify that its project is consistent with the enforceable policies of Rhode Island's and Massachusetts' CZMPs.

Massachusetts also regulates activities located within flowed tidelands, filled tidelands, and non-tidal rivers and streams through its Chapter 91 licensing requirements. Specific activities regulated under the Chapter 91 licensing program include:

- Structures - Placement or construction of any structure, regardless of size, whether permanent or seasonal. Examples of typical structures include, but are not limited to piers, wharves, dams, seawalls, weirs, booms, breakwaters, bulkheads, ripraps, revetments, jetties, piles, lines, groins, roads, culverts, bridges, buildings, parking lots, cables, pipes, conduits, tunnels, wires, floats, etc.

- Filling - Placement of any unconsolidated materials that is confined or expected to remain in place in a waterway, except for material placed by natural processes. Such placement includes material placed for the purposes of shoreline protection, beach nourishment, or subaqueous disposal of dredged material.

- Dredging - Removal of materials, including, but not limited to, rocks, bottom sediments, debris, sand, refuse, plant or animal matter, in any excavating, cleaning, deepening, widening, or lengthening of any waters in the Commonwealth. The DEP must also know the location where the removed material would be disposed.

- Change in Use - Any use of the authorized premises or structures for a purpose unrelated to the authorized use, whether express or implied. An example of such a change in use would be the conversion of a commercial fishing establishment to an office building.

- Structural Alteration - Any change in the dimensions of a structure or fill from the specifications contained in the existing authorization.

- Demolition/Removal of Structures - Approval is required for removal of any unauthorized structure or fill that was previously not authorized or for which there is not a current and valid grant or license.

Watershed Descriptions

The LNG terminal, Northern Pipeline, and most of the Western Pipeline (between MPs 0.0 and 1.8) would be located within the Taunton River drainage basin, which drains approximately 530 square miles of southeastern Massachusetts. The remainder of the Western Pipeline, from MP 1.8 to its terminus, would be located within the Narragansett Bay and Mount Hope Bay drainage basin, which is approximately 112 square miles in size (USGS, 1992).

Waterbody Classifications

The project would require dredging of the federal navigation channel and turning basin in the Taunton River and Mount Hope Bay. The ship unloading facility would also be constructed in the Taunton River. The Northern and Western Pipelines would cross 15 waterbodies, including the Taunton River. The other 14 waterbodies crossed by the pipeline routes include 3 perennial and 11 intermittent streams. Table 4.3.2-1 lists the location (by milepost), waterbody name, flow regime, approximate crossing width, surface water classification, fishery type, and proposed crossing method for each waterbody. Descriptions of the fishery resources in the waterbodies are provided in section 4.6.2.

Outstanding Resource Waters

The Taunton River and the other waterbodies crossed by the pipeline routes are not classified as Outstanding Resource Waters (Massachusetts Surface Water Quality Standards Program, 1995).[5] However, the Taunton River is currently being evaluated by the National Park Service (NPS) for inclusion into the Wild and Scenic Rivers System (see section 4.8.6.1).

Contaminated Sediments

Based on contacts with state agencies in Massachusetts and Rhode Island and a review of existing published information (e.g., fish consumption advisories, section 305(b) and section 303(d) water quality reports), none of the waterbodies, except the Taunton River and Mount Hope Bay, are suspected of containing contaminated sediments (see section 4.2.2).

[5] The DEP defines Outstanding Resource Waters as waterbodies that exhibit outstanding socioeconomic, recreational, ecological, and/or aesthetic values.

TABLE 4.3.2-1

Waterbodies Crossed by the Northern and Western Pipeline Routes

Facility/ Milepost	Waterbody Name	Flow Regime	Crossing Width (feet)	State Water Quality Classification a/	Fishery Classification	Proposed Crossing Method
Northern Pipeline						
0.7	Steep Brook	Perennial	N/A b/	B	Warmwater	N/A
0.8	Unnamed Ditch (Tributary of Taunton River	Intermittent	3	B	Warmwater	Open Cut
1.3	Unnamed Tributary of Taunton River	Intermittent	3	B	Warmwater	Open Cut
1.5	Unnamed Tributary of Taunton River	Intermittent	6	B	Warmwater	Open Cut
1.6	Unnamed Tributary of Taunton River	Intermittent	≤ 10	B	Warmwater	Open Cut
2.3	Unnamed Tributary of Taunton River	Intermittent	3	B	Warmwater	Open Cut
2.4	Unnamed Tributary of Taunton River	Intermittent	≤ 10	B	Warmwater	Open Cut
2.8	Unnamed Tributary of Taunton River	Intermittent	4	B	Warmwater	Open Cut
3.3	Mother Brook	Perennial	12	B	Warmwater	Open Cut
3.3	Unnamed Tributary of Mother Brook	Intermittent	3	B	Warmwater	Open Cut
3.6	Unnamed Tributary of Taunton River	Intermittent	3	B	Warmwater	Open Cut
Western Pipeline						
0.1	Taunton River	Perennial	2,200	SB	Warmwater c/	Open Cut
1.2	Unnamed Tributary of Taunton River	Perennial	6	B	Warmwater	Open Cut
1.2	Unnamed Tributary of Taunton River	Intermittent	4	B	Warmwater	Open Cut
2.4	Unnamed Tributary of Lee River	Intermittent	4	B	Warmwater	Open Cut

a/ Class SB - These waters are designated as habitat for fish, other aquatic life and wildlife and for primary and secondary contact recreation. In approved areas they shall be suitable for shellfish harvesting with depuration (Restricted Shellfish Areas). These waters shall have consistently good aesthetic value.

Class B - These waters are designated as habitat for fish, other aquatic life, and wildlife, and for primary and secondary contact recreation. Where designated they shall be suitable as a source of public water supply with appropriate treatment. They shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value.

b/ Steep Brook is contained within a culvert at the proposed crossing location that is below the elevation of the proposed pipeline.

c/ The fisheries in the Taunton River include shellfish and anadromous and catadromous fish.

Mount Hope Bay and the Taunton River

The Taunton River begins at the confluence of the Matfield and Town Rivers just east of Bridgewater and flows south for approximately 36 miles before it empties into Mount Hope Bay at Fall River. The Taunton River has an average discharge of 1,050 cubic feet per second (cfs), although this flow varies seasonally with monthly mean values ranging from a low of 332 cfs in August to a high of 2,090 cfs in March (Ries, 1990). Approximately 23 miles of the Taunton River is affected by tides, and the lower 8 miles of the river is a tidal estuary (USGS, 1992).

Mount Hope Bay is a shallow estuary located in the northeast corner of Narragansett Bay. The bay is situated in both Rhode Island (to the south and west) and Massachusetts (to the north and east). Mount Hope Bay is connected to the East Passage of Narragansett Bay to the southwest and to Rhode Island Sound through the Sakonnet River to the south. The bay has a total surface area of 13.6 square miles and a total volume of 53 billion gallons at mean low water (Chinman and Nixon, 1985). The average water depth is 18.8 feet and about 70 percent of the bay is less than 20 feet deep at mean low water.

About 90 percent of the freshwater inflow into Mount Hope Bay comes from the Taunton River. In addition to the inflow from the Taunton River, water circulation in Mount Hope Bay is influenced by tidal flow and wind. Tidal currents are generally between 0.3 and 0.8 feet per second (ft/sec) within Mount Hope Bay, but can exceed 6 ft/sec in the narrows at Sakonnet. Tidal fluctuations range from 3.3 feet at neap tide to 5.5 feet at spring tide with a mean tidal range of 4.4 feet (Spaulding and White, 1990). Tides are the primary source of circulation in Mount Hope Bay with 7.9 billion gallons of water being flushed through the bay twice a day (USGen, 2001).

The state water quality classifications for the Taunton River and Mount Hope Bay are shown on figure 4.3.2-1 and described in table 4.3.2-2. Because Mount Hope Bay is located on the state boundary between Rhode Island and Massachusetts, it has a unique water quality classification in each state.

TABLE 4.3.2-2

Water Quality Classifications of Mount Hope Bay and the Lower Taunton River

Waterbody	State Water Quality Classification a/
Taunton River	
From mouth to Route 24 bridge (21.2 miles upstream)	MA-SB
Mount Hope Bay (MA)	
West of line from Brayton Point to Buoy R4	MA-SA
East of line from Brayton Point to Buoy R4	MA-SB
Mount Hope Bay (RI)	
South and west of the MA-RI border and north of a line from Borden's Wharf, Tiverton to Buoy R4 and east of a line from Buoy R4 to Brayton Point in Somerset, MA.	RI-SB1
South of a line from Borden's Wharf, Tiverton to Buoy 4 and west of a line from Buoy R4 to Brayton Point, Somerset, MA, and east of a line from the end of Gardiner's Next Road in Swansea to Buoy N2 through Buoy C3 to Common Fence Point, Portsmouth; and north of a line from Portsmouth to Tiverton at the railroad bridge at "The Hummocks" on the northeast point of Portsmouth.	RI-SB
West of the SB zone described above to the Narrows at the entrance to the Kickamuit River and east of a line from shore to shore passing through the most westerly points of the two center piers of the Mount Hope Bridge.	RI-SA

a/ Class MA-SA: These waters are designated as an excellent habitat for fish, other aquatic life and wildlife and for primary and secondary contact recreation. In approved areas they shall be suitable for shellfish harvesting without depuration (Open Shellfish Areas). These waters shall have excellent aesthetic value.

Class MA-SB: These waters are designated as a habitat for fish, other aquatic life and wildlife and for primary and secondary contact recreation. In approved areas they shall be suitable for shellfish harvesting and depuration (Restricted Shellfish Areas). These waters shall have consistently good aesthetic value.

Class RI-SA: These waters are designated for shellfish harvesting for direct human consumption, primary and secondary recreational activities, and fish and wildlife habitat. They shall be suitable for aquacultural uses, navigation and industrial cooling. These waters shall have good aesthetic value.

Class RI-SB: These waters are designated for primary and secondary contact recreational activities; shellfish harvesting for controlled relay and depuration; and fish and wildlife habitat. They shall be suitable for aquacultural uses, navigation, and industrial cooling. These waters shall have good aesthetic value.

Class RI-SB1: These waters are designated for primary and secondary contact recreational activities and fish and wildlife habitat. They shall be suitable for aquacultural uses, navigation, and industrial cooling. These waters shall have good aesthetic value. Primary contact recreational activities may be impacted due to pathogens from approved wastewater discharges. However, all class RI-SB criteria must be met.

Insert figure

4.3.2-1 Lower Taunton River / Mount Hope Bay State Surface Water Quality Classifications

Section 303(d) of the CWA requires states to identify waterbodies that are not expected to meet surface water quality standards. The Taunton River and Mount Hope Bay do not currently meet the designated water quality standards established by Massachusetts or Rhode Island. Table 4.3.2-3 provides a list of the section 303(d) waters in the project area and identifies the cause of impairment within each section of these waters. The segments are depicted on figure 4.3.2-2.

TABLE 4.3.2-3

List of 303(d) Waters in the Project Area

State/Waterbody	Segment a/	Causes of Impairment
Massachusetts		
Taunton River a/	1	Organic enrichment, low dissolved oxygen, pathogens
Taunton River b/	4	Organic enrichment, low dissolved oxygen, pathogens
Mount Hope Bay a/	2 and 3	Nutrients, organic enrichment, low dissolved oxygen, pathogens
Rhode Island		
Mount Hope Bay	5 and 6	Biodiversity impacts, thermal impacts c/ Pathogens, hypoxia, nutrients d/
Mount Hope Bay	7	Biodiversity impacts, thermal impacts c/ Hypoxia, nutrients d/

a/ Segments of waterbodies that continue to exhibit impairment of one or more uses and will require additional control measures for point- and/or non-point sources before the waterbody is expected to meet applicable standards (see figure 4.3.2-2).

b/ Segments of waterbodies or pollutants/stressors that have been listed in the past and should be targeted for monitoring or other information gathering to confirm whether they should remain on the section 303(d) list.

c/ Segments of waterbodies not meeting water quality standards where the Total Maximum Daily Load (TMDL) development is currently underway for the cause of impairment.

d/ Segments of waterbodies not meeting water quality standards where the TMDL is planned for the future for the cause of impairment.

Surface Water Resources Impacts and Mitigation

Construction of the Weaver's Cove LNG Project could adversely affect surface water quality due to activities within Mount Hope Bay and the Taunton River (i.e., dredging, pipeline installation, ship unloading facility construction, and hydrostatic test water discharge) and activities located at the LNG terminal (i.e., clearing, grading, and dredged material reuse).

Dredging Activities

The primary impact on water quality associated with dredging would be the resuspension of sediment into the water column. The suspended sediment could reduce light penetration and lower the rate of photosynthesis and aquatic productivity of an area; introduce organic material and/or nutrients which could lead to an increase in biological oxygen demand and reduce dissolved oxygen; and release chemical constituents, such as metals, PCBs, pesticides, and PAHs. Surface water quality could also be adversely affected by a spill, leak, or other release of hazardous materials during construction activities. Weaver's Cove Energy would minimize potential impacts associated with spills or releases of hazardous materials by implementing both onshore and offshore SPCC Plans and complying with federal regulations related to fuel transport, handling, and spill response procedures. These measures would minimize impacts of potential spills on surface waters to the extent practicable and reduce the potential degradation of surface waters.

Insert figure

4.3.2-2 Massachusetts and Rhode Island 303(d) Listed Waters

To predict water circulation in the Taunton River and Mount Hope Bay and to determine the potential effects of dredge-induced suspended sediment, Weaver's Cove Energy conducted computer-based modeling of the dredging operations using a three-dimensional, boundary-fitted hydrodynamic (BFHYDRO) model and a Suspended Sediment Fate (SSFATE) model, respectively. The results of these models are discussed below. Weaver's Cove Energy used a Suspended Sediment Dose (SSDOSE) model to assess potential impacts on aquatic organisms that could result from exposure to suspended or deposited sediments. The results of the SSDOSE modeling are discussed in section 4.6.2. Additional details on all of these models are provided in Weaver's Cove Energy's modeling report entitled *Modeling Dredge-induced Suspended Sediment and the Environmental Effects in Mt. Hope Bay and the Taunton River for the Proposed Weaver's Cove Energy, LLC, Liquefied Natural Gas Import Terminal* (Applied Science Associates (ASA), 2003), which is available under the "Proposal" link on Weaver's Cove Energy website (www.weaverscove.com).

The area evaluated using the BFHYDRO model included the Taunton River, Mount Hope Bay, the Sakonnet River, portions of the Providence, Kickamuit, Cole, and Lee Rivers, and Narragansett Bay as far south as Newport, Rhode Island. Parameters that were incorporated into the model to characterize water circulation patterns included:

- bathymetry measurements obtained from historical digitized survey data and recent high resolution surveys;
- surface water elevation at the three entrance locations to Narragansett Bay;
- wind data obtained from the NOAA Physical Oceanographic Real-Time Systems (PORTS) data collection station located at Borden Flats; and
- river flow data from gaging stations located on the Taunton, Threemile, and Segregansett Rivers.

The BFHYDRO model was calibrated to the field measured water level and current data collected from the PORTS stations and run using three tidal conditions (spring, mean, and neap) and three river flow regimes (high, low, and mean river flow, defined further below). The modeling results indicated that the major force driving water circulation in the Taunton River and Mount Hope Bay is the astronomical tides, with the predominant flow occurring along the river channel. The results also indicated that velocities decrease from the water surface to the bottom of the water column for all tidal forcing conditions and that at a given location within the water column, spring tides result in the greatest velocities, while neap tides result in the smallest velocities.

Using the SSFATE model, Weaver's Cove Energy then simulated the distribution and deposition of suspended sediment plumes under the following river flow and tide conditions:

- mean tide with mean river flow (1050 cfs);
- spring tide with high river flow (2090 cfs); and
- spring tide with low river flow (332 cfs).

The SSFATE model was run multiple times to reflect four similarly situated reaches within the dredging limits. Each reach represents a dredging area with similar hydrodynamic conditions, physical sediment characteristics, dredge cut thickness, dredging equipment components, and resulting estimated dredge production rates. The four distinct reaches included:

- Mount Hope Bay Federal Navigation Channel - located at the Rhode Island and Massachusetts state line and characterized by shallow cuts of maintenance silts;

- Taunton River Federal Navigation Channel - located upstream of the Braga Bridge at the "S" bend and characterized as predominantly moderate cuts of maintenance silts;

- Turning Basin (Silt) - characterized as deep cuts of maintenance silts; and

- Turning Basin (Native Material) - characterized as moderate to deep cuts of glacially deposited consolidated parent sediments.

The SSFATE modeling results indicated that the maximum total suspended solids (TSS) concentration would occur near the river bottom in close proximity to the dredging operation and would decrease both upstream and downstream of the dredge operation. This suggests that suspended sediments and increased turbidity associated with dredging would be a short-term effect limited primarily to the time periods and areas when and where dredging would be conducted, which would not impair designated uses assigned under Massachusetts' and Rhode Island's respective surface water quality standards. Based on other studies completed for similar dredging projects, sediment concentrations would be expected to return to background levels within about 1,600 to 2,300 feet of the dredging operations (Bohlen et al., 1979; Bohlen et al., 1996).

We received comments from agencies that the modeling results do not take into account natural background levels of suspended sediment, particularly during peak runoff periods, and consequently may underestimate actual TSS levels during some periods of the proposed 3-year construction period. Our review of the modeling report indicates that the SSFATE modeling used to determine biological effects did take into account a background TSS concentration of 11 milligram/liter. This TSS concentration was derived from an analysis of river water collected on March 24, 2003 at three depths slightly downstream of the Braga Bridge, during slack high tide. Recognizing that data collected on a single day may not represent all background conditions, we agree that background TSS levels may be higher than predicted by the model on some days. However, based on review of monthly TSS concentration data collected within the Taunton River during a study completed between 1988 and 1990, we believe a TSS concentration of 11 mg/L is a reasonable estimate of background conditions. The mean TSS concentration for all of the stations sampled during this study period was 7.7 mg/L. Two of the stations located closest to the turning basin (approximately 5 kilometers and 7 kilometers upstream of the turning basin, respectively) reported a mean TSS concentration of 8.3 mg/L, and minimum and maximum concentrations of 2 mg/L and 19 mg/L, respectively (Boucher, 1991) While the TSS concentrations may vary over the course of the proposed dredging operations, we do not believe this alters the general conclusion that suspended sediments and increased turbidity associated with dredging would be a short-term effect limited primarily to the time periods and areas when and where dredging would be conducted.

To minimize suspended sediment concentrations and the potential impacts on water quality and aquatic species, Weaver's Cove Energy has committed to the following mitigation measures during dredging:

- allowing no significant scow overflow during all seasons and at all dredge locations;

- reducing bucket loss rates by using a closed or "environmental" bucket in areas where depositional sediments would be dredged; and

- minimizing the extent of suspended sediments across the width of the river during the anadromous fish runs by sequencing dredging operations to occur in a line parallel with the river flow (as opposed to across the river channel).

To measure the sediment plume distribution and concentration, Weaver's Cove Energy is proposing to implement a monitoring program during dredging operations. The dredge monitoring program would include:

- Collecting water samples up-current and down-current of dredging activities to quantify TSS concentrations resulting from the dredging operations. Sampling would be conducted near the surface, middle, and bottom of the water column.

- Establishing a monitoring frequency to achieve water quality objectives. The dredge monitoring program would include provisions to increase or decrease the frequency of the sampling effort depending on the specified monitoring criteria.

We received comments regarding the potential for dredging of the federal navigation channel and turning basin and construction of the marine terminal to affect water circulation and tidal flow patterns in Mount Hope Bay and the Taunton River. An analysis conducted by Weaver's Cove Energy estimated that the maintenance and improvement dredging of the turning basin would reduce the velocity of the currents in the turning basin area by up to 18 percent. This decrease in current velocity would likely increase the settling rate of suspended sediments, which could in turn necessitate more frequent maintenance dredging in the future. Similar analyses conducted for the federal navigation channel estimate that the proposed dredging would reduce current velocities in the navigation channel by approximately 0.6 percent and have little effect on water circulation. The marine terminal is also expected to have minimal impact on water circulation because it would be constructed using pile-supported structures, similar to the existing pier.

Weaver's Cove Energy completed elutriate tests on sediment samples collected from the proposed dredging area to assess the potential for pollutants to be released into the water column during dredging (see section 4.2.2). This testing was conducted by mixing the sediment samples with water obtained from the Taunton River and then analyzing the water for selected organic and inorganic compounds. A comparison of the elutriate test results with the bulk sediment analytical results indicate that:

- most pollutants identified in sediments would remain tightly adsorbed to the sediment particles and would not be released into the water column; and

- copper and zinc would be released into the river during dredging in concentrations that exceed EPA-published acute (AL-CMC) and chronic exposure-based screening criteria (AL-CCC) (EPA, 2002b).

Analytical test results of background water samples collected from the Taunton River, near the LNG terminal site indicate that the copper concentration in the river is 37 ppb, 7 times the EPA acute criterion (which is 4.8 ppb) and 12 times the EPA chronic exposure value (which is 3.1 ppb). This suggests that elevated copper levels are normal in this area of the Taunton River. Standard elutriate tests indicate that dredging could result in localized copper concentrations of 28 ppb. Analytical test results of background water samples collected from the Taunton River, near the project site indicate that zinc concentrations in the river water are currently 23 ppb, which is below the EPA acute and chronic criteria (90 ppb and 81 ppb, respectively). Standard elutriate tests for zinc indicate that dredging could result in localized zinc concentration of 127 ppb, which is approximately 1.4 times higher than the EPA acute criterion and 1.5 times higher than the EPA chronic criterion. In interpreting these results, it is important to recognize that elutriate testing simulates a greater level of sediment mixing and aeration than mechanical dredging. This is supported by a study conducted by the COE to evaluate the release of chemical constituents at the point of dredging, which found elutriate test results are a conservative

predictor of chemical concentrations within the water column (COE, 1988). Therefore, actual concentrations of copper and zinc released to the water column would be expected to be less than the elutriate test results indicate. Moreover, the effect of the elevated concentrations of zinc would be localized and diluted downstream of the dredging activities.[6] Based on a study by Tramontano and Bohlen (1984), the elevated concentrations of dissolved contaminants could be expected to return to background levels within 600 feet of the dredging operation. Weaver's Cove Energy conducted additional elutriate testing as part of the Tier III sampling and analysis program; however, the results of this elutriate testing were not available when this final EIS was published.

We received a comment regarding the potential for dredging activities to decrease dissolved oxygen (DO) levels and potentially increase the toxicity of copper and zinc on aquatic organisms. Based on a study of mechanical dredging operations completed by the COE Waterways Experiment Station in the Hudson River Estuary, near-field monitoring results indicate that dredge-induced DO reduction was minimal. Dissolved oxygen reduction was generally less than 0.1 mg/L (COE, 1989). While elutriate test results indicate that copper and zinc would be released from the sediments during dredging and would increase concentrations in the water column, the effects of a slight reduction in DO levels would not be expected to measurably increase the toxicity of copper and zinc (Rand and Petrocelli, 1985).

The DEP conducted a preliminary review of Weaver's Cove Energy's sediment modeling and elutriate test results and had the following comments. The DEP noted, as described above, that the elutriate test results indicate that copper and zinc would be released into the water column at levels exceeding the Ambient Water Quality Criteria. The DEP acknowledged that while the elutriate test results indicate that the contaminants in the sediments other than copper and zinc would not exceed Ambient Water Quality Criteria, some of these compounds would still dissolve in the water at low levels and may be of concern if hot spots are encountered during dredging. The DEP also noted that Weaver's Cove Energy's modeling did not evaluate the potential effects of chemical toxicity resulting from the deterioration of water quality during testing. As a result, the DEP indicated that barge/scow overflow is unlikely to be permitted by the state. In addition, the DEP indicated that it would require Weaver's Cove Energy to develop a water quality monitoring program to evaluate whether or not excessive amounts of sediment are suspended in the water column; determine if elevated levels of suspended sediments extend beyond the mixing zone; and ensure that Massachusetts' state surface water quality standards and criteria are met at the edge of the mixing zone. In accordance with DEP's requirements, this monitoring program must:

- describe the proposed monitoring/sampling locations and frequency;
- list the monitoring/sampling parameters;
- describe the proposed mixing zone;
- identify the conditions under which modifications to dredging operations would be made to minimize the levels of suspended sediment;
- describe what the modifications would entail; and
- demonstrate the effectiveness of the proposed modifications.

[6] A similar dilution is not expected for copper since the background concentration of copper in river water was higher than the concentration of copper in measured elutriate test results.

LNG Terminal Construction and Operation

Construction of the proposed LNG terminal would involve clearing and grading of land adjacent to the Taunton River and filling within the river to construct the shoreline stabilization structures. Stormwater runoff from the cleared and graded construction site as well as the placement of fill material directly into the river could affect water quality by increasing suspended sediment and turbidity levels in the river near the construction activities. Erosion and sedimentation at the site would be controlled and mitigated through implementation of the measures specified in the FERC Plan and in a site-specific erosion and sedimentation control plan and stormwater management plan.

The removal of the existing pier and the construction of the ship unloading facility in the Taunton River could also affect water quality. The removal of the old pilings for the pier and the installation of the new pilings for the ship unloading facility would disturb bottom sediments and could result in increased suspended sediment and turbidity levels in the river. These impacts would be temporary and would be limited to the immediate area around the existing and proposed piers.

In addition to the construction-related impacts discussed above, the Taunton River could be affected during operations of the proposed facilities. During operation of the LNG terminal, prop wash from LNG ships and tugs would temporarily increase suspended sediments and turbidity within the navigation channel and turning basin. Impacts associated with prop wash would occur more frequently than dredging since as many as 70 LNG ships may travel to and from the terminal annually. The LNG ships would also take on ballast water from the Taunton River during the offloading of LNG. Each LNG ship would withdraw up to 14 million gallons of river water for ballast. Assuming up to 70 LNG ships offload at the terminal each year, about 980 million gallons of water could be removed from the Taunton River by LNG ships annually. According to Weaver's Cove Energy, ballast water would be withdrawn over a roughly 12- to 16-hour period using intakes located approximately 25 to 30 feet below the water surface. The ballast water would be pumped at a maximum rate of about 16,000 gpm and an average rate of about 12,000 gpm. The potential impacts of prop wash and these water withdrawals on aquatic resources are discussed in section 4.6.2.

An LNG spill on the water of the river is another potential impact that could occur during operations of the terminal. Although we consider the potential for a spill of LNG on the Taunton River unlikely, if a spill were to occur on the river, the cryogenic liquid would vaporize rapidly upon contact with the warm air and water. Being less dense than water, the LNG would float on the surface before vaporizing. Because LNG is not soluble in water and the LNG would completely vaporize shortly after being spilled, there would be no liquid left that could mix with and/or contaminate the water. Therefore, water quality would not be affected by an LNG spill.

Weaver's Cove Energy would utilize several techniques to minimize erosion and sedimentation during placement of fill material as described in its Stormwater Management Report. This report was originally submitted to the DEP in May 2004 with Weaver's Cove Energy's application for a section 401 Water Quality Certification, and subsequently revised on June 28, 2004. The erosion and sedimentation control measures would include: installing the sheetpile bulkhead along the shoreline of the southern parcel prior to the placement of the dredged material; controlling the stabilization process and placement of the dredged material; constructing temporary retaining walls and earthen berms as necessary to control sediments; and using the existing berms and dikes areas to contain dredged material.

Weaver's Cove Energy would install the sheetpile bulkhead along the riverfront during the first stage of site development prior to placing the dredged material on the site. Once the sheetpiling is installed, Weaver's Cove Energy would begin dewatering and stabilizing the dredged material with cement. Weaver's Cove Energy would adjust the amount of stabilizer added to the dredged material and

the amount of time the material sits in a barge or processing pile as necessary to control erosion and achieve the desired physical properties. Water discharged during sediment dewatering would be regulated under the NPDES permitting program.

Weaver's Cove Energy would also minimize erosion and sedimentation by controlling the placement and production rates of the dredged material. During dredged material placement, temporary and existing berms and dikes would be used on the LNG site to prevent sediment-laden water from entering the Taunton River. Water that accumulates behind these structures would be pumped through temporary stormwater treatment units (STUs) to remove sediment, oil, and other floatables prior to discharge.

There are currently four permitted outfalls located on the LNG site: two stormwater outfalls, one groundwater remediation outfall, and one combined sewer outfall. To operate the terminal, Weaver's Cove Energy proposes to modify the existing site drainage system by extending or relocating three of the existing outfalls and other stormwater control devices to collect and treat stormwater runoff prior to discharge to the Taunton River, as shown on figure 4.3.2-3.

Stormwater runoff on the southern parcel would be treated using swales, deep sump catch basins, and STU's prior to discharge. Based on an impervious area of about 10.4 acres on the southern parcel, Weaver's Cove Energy determined that 10 STU's would provide effective sediment removal and sufficient capacity to treat stormwater generated on the LNG terminal site. During larger storm events, a control structure installed at the head of the inline STU system would allow larger design events to overflow the control weir. The control structure would be fitted with an internal oil baffle to prevent floatables from being discharged during an extreme storm event.

Runoff from the developed portions of the northern parcel would be directed through swales and a series of catch basins to a deep sump catch basin before being routed to a wet pond. The wet pond would be used for pretreatment prior to conveying the flow to an infiltration trench. Before entering the infiltration trench, the outflow from the pond would pass through a control structure and STU, which would direct water to one of two locations: 1) the infiltration trench located along the railroad property boundary for the purpose of groundwater recharge or 2) the existing pipe passing under the railroad property to accommodate storm events larger than the 2-year event (i.e., emergency overflow). Pretreatment through the wet pond would be required to maintain the effectiveness of the infiltration trench. Based on an impervious area of about 6.3 acres on the northern parcel, Weaver's Cove Energy estimates that the wet pond would be approximately 6 feet deep and approximately 0.25 acre in size to comply with DEP guidelines.

Weaver's Cove Energy estimates that the proposed stormwater facilities would remove at least 80 percent of the total suspended sediment from stormwater runoff during operation of the LNG facility.

Pipeline Construction and Operation

Steep Brook, one of the perennial waterbodies crossed by the Northern Pipeline, is contained within a culvert pipe at the proposed crossing location. According to Weaver's Cove Energy the pipeline would be installed above the culvert pipe and would not impact the stream. Pipeline construction across the Taunton River and the other perennial and intermittent streams using the open-cut method could adversely affect surface waters. Potential impacts from clearing and grading, in-stream trenching, trench dewatering, and backfilling could modify aquatic habitat, increase sedimentation rates and turbidity, decrease dissolved oxygen concentrations, increase water temperature, and introduce fuels and oils from accidental spills.

Insert figure

4.3.2-3 Proposed Stormwater Management System

The construction of the Western Pipeline across the Taunton River would involve dredging a trench across the river upstream of the turning basin, installing the pipe, and backfilling with native material or other suitable material. The impacts of dredging on the river are discussed above. Weaver's Cove Energy is proposing to use the coarse-grained native sediments dredged from the deeper depths of the turning basin for backfilling the trench. Because these coarse-grained sediments would settle out faster, the sediments would be resuspended for a shorter duration and the extent of the downstream sediment plume would be reduced.

We received a comment that the HDD construction technique should be considered to reduce impacts of the pipeline crossing on the Taunton River. Our analysis of the feasibility of installing the Western Pipeline using the HDD method is presented in section 3.5.4. This analysis indicates that while there appears to be sufficient space on both sides of the Taunton River for drilling equipment, neither side of the river seems to have sufficient space near the proposed terminal site to fabricate a pipestring long enough for the entire crossing. Additionally, borings conducted at the proposed LNG tank site and the experience of the contractor responsible for installing the piers for the new Brightman Street Bridge indicate that the subsurface geology may not be suitable for HDD. In weighing these factors against the potential environmental benefits of a successful HDD crossing, we concluded that an HDD crossing of the Taunton River for this project is not a practicable alternative to the open-cut crossing proposed by Weaver's Cove Energy.

The impacts of the open-cut construction method on the minor and intermediate streams located along the pipeline routes would generally be localized and short term. The degree of impact would depend, in part, on the flow volume in the streams during construction. As described above, most of the streams that would be crossed are intermittent and have minimal to no flow during drier periods of the year. If construction occurs during a dry period, most of the impacts on these streams would be avoided. If the streams are flowing during construction, clearing, grading, and trenching within and adjacent to these streams could affect water quality. Sediments would be resuspended by in-stream construction activities or by erosion of cleared stream banks and riparian areas. Turbidity resulting from the resuspended sediments could reduce light penetration and the corresponding photosynthetic oxygen production. Resuspension of deposited organic material and inorganic sediments could cause an increase in consumption of biological and chemical oxygen, decreasing available dissolved oxygen. Weaver's Cove Energy would be required by the FERC Procedures to complete most in-stream work in the minor waterbodies within 24 hours and to stabilize and restore the stream banks after construction is completed. Therefore, the impacts would be temporary and suspended sediment and turbidity levels would be expected to return to pre-construction levels soon after the stream crossing is completed.

We received a comment regarding impacts on the navigability of the 14 minor and intermediate stream crossings (i.e., those waterbodies less than 10 feet and 100 feet in width, respectively) located along the Western and Northern Pipeline routes. The 14 waterbodies vary in width from 3 feet to 12 feet and include 11 intermittent waterbodies and three perennial waterbodies (see table 4.3.2-1). Due to the narrow width and lack of baseflow for the majority of these waterbodies, it is unlikely that the waterbodies would be navigable by any vessel, including canoe, kayak, raft, or rowboat. As required by 310 CMR 9.37(4) and our Procedures, pipeline installation would require burying the pipelines below the stream bed and restoring bottom contours following installation. Therefore, pipeline construction and operation would not be expected to result in a navigational hazard in any of these waterbodies.

To minimize impacts on surface waters, Weaver's Cove Energy would adhere to the protective measures specified in the FERC Procedures and would implement its onshore and offshore SPCC Plans. Other federal, state, or local agencies may require Weaver's Cove Energy to implement additional protective measures.

Hydrostatic Testing

Weaver's Cove Energy is currently planning to obtain water from the City of Fall River for hydrostatic testing of the LNG storage tank, LNG plant piping, and the sendout pipelines. If the City denies the use of its water or otherwise is unable to provide the water, Weaver's Cove Energy indicated that hydrostatic test water would be obtained directly from the Taunton River. We received a comment from the EPA recommending that Weaver's Cove Energy be prohibited from using river water for hydrostatic testing in order to minimize impact on winter flounder (further discussed in section 4.6.2). While we agree that this recommendation could reduce impacts on aquatic resources, we do not believe a prohibition on using river water is warranted without knowing whether the use of City water would be permitted. If river water is needed for testing, we believe that impacts of water withdrawals from the river would be minimized by implementing the mitigation measures described below.

Weaver's Cove Energy indicated that approximately 32 million gallons of water would be needed to test the LNG tank, approximately 315,000 gallons would be needed to test the Western Pipeline, and approximately 445,000 gallons would be needed to test the Northern Pipeline. Appropriation rates would vary depending on whether the water is obtained from the City of Fall River or from the Taunton River. Based on current plans to obtain water from the City of Fall River, Weaver's Cove Energy estimates that filling the LNG storage tank would take between 5 to 11 days at a withdrawal rate of between 2,000 to 4,000 gpm. Due to the much smaller volume of water required to fill and test the Northern and Western Pipelines, water would be withdrawn at a rate of approximately 2,000 gpm over a period of several hours. If water is appropriated from the Taunton River to hydrostatically test the LNG storage tank, Weaver's Cove Energy would attach a temporary 12- to 14-inch-diameter pipe to the newly constructed pier. The intake pipe would be set at a depth of 5 feet below MLLW and would be fitted with a fine mesh screen to minimize potential entrainment and impingement of aquatic organisms. If water is appropriated from the Taunton River, Weaver's Cove Energy estimates that the appropriation rate would need to be increased by approximately 3,000 gpm (i.e., a withdrawal rate of between 5,000 to 7,000 gpm) to reduce the residence time in the LNG tank and the potential for microbiologically influenced corrosion, a condition that could lead to the corrosion of the tanks and piping from the presence and interaction of bacteria, fungi, and algae, if the water was not treated.

Based on these sources and withdrawal rates, the hydrostatic test water would not require pre-treatment and no chemical additives (e.g., biocides or neutralizing agents) would be mixed with the water during the test or prior to discharge. After the hydrostatic testing is completed, Weaver's Cove Energy is proposing to discharge the test water directly into the Taunton River over a period of several days. The water would be filtered prior to discharge and would be returned at a rate and location that would minimize bottom disturbance and potential impacts on aquatic resources. The discharge of hydrostatic test water would be conducted in accordance with the FERC Procedures and the NPDES permit(s) issued by the DEP and/or EPA. The discharge of water would also be controlled, as necessary, to prevent erosion or scouring of the banks or bed of the river. Weaver's Cove Energy would coordinate with the City of Fall River to ensure that water requirements for hydrostatic testing from municipal sources would not impact public water availability.

4.4 WETLANDS

Regulatory Permits

Wetlands in the project area are regulated at the federal, state, and local level. As discussed in section 4.3.2, the COE has authority under section 404 of the CWA to review and issue permits for activities that would result in the discharge of dredged or fill material into waters of the United States. In Massachusetts, wetlands are also regulated at the state level by the DEP and the local level by the Conservation Commissions of each city and town. The DEP has authority under G.L.c. 21 and 314 CMR 9.00 to issue, condition, or deny a section 401 Water Quality Certification for the discharge of dredged or fill material, dredging, and dredge material disposal in waters of the United States within the Commonwealth. In addition to the section 401 Water Quality Certification program, wetlands in Massachusetts are also regulated under the WPA (G.L.c. 131 § 40). This law states that "no person shall remove, fill, dredge, or alter the bank riverfront area, fresh water wetland, coastal wetland, beach, dune, flat, marsh, meadow or swamp bordering on the ocean or any estuary, creek river, stream, pond, or lake, or any land under said waters or any land subject to tidal action, coastal storm flowage, or flooding without filing written notice of his intentions with the Conservation Commission or its authorized representative, including such plans as may be necessary to describe such proposed activity and its effect on the environment, and without receiving and complying with an order of conditions."

Construction within wetlands would require compliance, at a minimum, with the COE's section 404 and DEP's section 401 permit conditions. In order for the COE to determine whether practicable alternatives have been taken, Weaver's Cove Energy is required to avoid wetland impacts to the maximum extent possible. Weaver's Cove Energy must also demonstrate that it has taken appropriate and practicable steps to minimize wetland impacts in compliance with the COE's section 404(b)1 guidelines that restrict discharges of dredged or fill material where a less environmentally damaging alternative exists. When unavoidable wetland impacts are proposed, the COE and the DEP would require that all practicable actions be taken to mitigate those impacts. We believe this is consistent with the CEQ's Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR 1508.20), which defines mitigation to include the following criteria:

- avoiding the impact altogether by not taking a certain action or parts of an action;
- minimizing impacts by limiting the degree or magnitude of the action and its implementation;
- rectifying the impact by repairing, rehabilitating, or restoring the affected environment;
- reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and
- compensating for the impact by replacing or providing substitute resources or environments.

Wetlands Resources at or Near the LNG Terminal Site

Weaver's Cove Energy conducted wetland delineations at the proposed LNG terminal site using the methods specified in the *1987 COE Wetlands Delineation Manual* (Environmental Laboratory, 1987) and the DEP's *Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act* (DEP, 1995). Both the COE and DEP methodologies require the identification of wetlands based on the presence of three parameters: hydrophytic vegetation, hydric soils, and wetland hydrology.

Vegetated Wetlands on the LNG Terminal Site

A total of 4.64 acres of vegetated wetlands, comprising seven palustrine and estuarine wetland areas, were delineated within the boundaries of the LNG terminal site. Palustrine wetlands are defined as nontidal wetlands dominated by trees, shrubs, and emergent vegetation. Estuarine wetlands consist of deepwater tidal habitats and adjacent tidal wetlands that are typically semi-enclosed by land but have access to the ocean and are periodically diluted by freshwater runoff from land. Table 4.4-1 identifies the location, unique wetland identifier, Cowardin classification, size, and impact area on each wetland at the LNG terminal site. The location of each wetland on the LNG terminal site is shown on figure 4.4-1. Vegetated wetland areas permanently affected by the proposed facilities are shown on figure 4.4-2. A description of vegetation types in these wetlands is provided in section 4.5.

TABLE 4.4-1

Vegetated Wetlands Located on the LNG Terminal Site

Location/Wetland Identification	Wetland Classification a/	Size (acres)	Construction and Operation Impact Area (acres)
Northern Parcel			
Flag Series 2 b/	PEM	0.3	0.3
Flag Series 3 b/	PEM/PSS	1.6	1.6
Subtotal		1.9	1.9
Southern Parcel c/			
Flag Series 1	PEM/E2EM	2.3	0.0
Flag Series 4	PEM/E2EM	0.4	0.0
Salt Marsh A	E2EM	0.03	0.03
Salt Marsh B	E2EM	0.01	0.01
Salt Marsh C	E2EM	< 0.01	< 0.01
Subtotal		2.74	0.04
Project Total		4.64	1.94

a/ Cowardin Classification System:
PEM Palustrine Emergent
PSS Palustrine Scrub-shrub
E2EM Estuarine Intertidal Emergent

b/ The COE has determined that these wetlands are isolated wetlands and are not subject to the COE's jurisdiction. However, these wetlands are under the FERC's jurisdiction and would be subject to the mitigation measures contained in the FERC's Procedures.

c/ PEM and E2EM wetlands located on the southern parcel would be regulated under the Massachusetts Wetlands Protection Act as Bordering Vegetated Wetland and Salt Marsh, respectively.

Intertidal and Subtidal Habitats Bordering the LNG Terminal Site

In addition to the vegetated wetlands described above, the project would also affect intertidal and subtidal areas. The most common intertidal habitats bordering the terminal site are beaches, consisting of coarse sands; rocky shoreline, consisting of naturally rocky areas; and structured shorelines such as rip-rap, sheet pile, and bulkhead. Mudflats, which consist of finer grain material than beaches, are also present along a portion of the shoreline of the terminal site. Subtidal areas occupy the permanently flooded areas seaward of the intertidal habitats. The proposed shoreline modifications (sheet pile, rip rap, and fill, and the pile-supported ship unloading facility) would permanently fill 0.94 acre of intertidal habitat and 0.19 acre of subtidal habitat. Another 0.23 acre of intertidal habitat and about 191 acres of subtidal habitat would be impacted by the proposed dredging for the construction access channel, turning basin, and federal navigation channel.[7]

[7] Acreage of permanently filled intertidal and subtidal habitats was derived from Weaver's Cove Energy's COE application.

Insert figure

4.4-1 Field-Delineated Wetlands and Other State Wetland Resource Areas

Insert figure

4.4-2 Vegetated Wetland Areas Affected by the Proposed LNG Terminal

Other State Wetland Resource Areas at or Near the LNG Terminal Site

In addition to the vegetated wetlands and intertidal and subtidal habitats described above, the following state-designated wetland resource areas located on the southern parcel are regulated under 310 CMR 10 of Massachusetts' WPA:

- designated port area (DPA);
- coastal beach (including tidal flats);
- coastal dune;
- coastal bank;
- land containing shellfish;
- 25-foot riverfront area;
- land under the ocean;
- land subject to coastal storm flowage; and
- banks of or land under the ocean, ponds, streams, rivers, lakes, or creeks that underlie an anadromous/catadromous fish run.

The locations of these resource areas in the vicinity of the LNG terminal site are shown on figure 4.4-1. The boundaries of the resources are not necessarily mutually exclusive from each other or from the subtidal and intertidal habitats described above. In many cases the boundaries overlap. Each of these state wetland resource areas is discussed below.

Designated Port Area - There are currently 11 DPAs in Massachusetts, which were established to promote marine industrial development in port areas with key industrial attributes, such as deepwater channels, established rail and transportation links, and public utility services conducive to industry. The Fall River/Mount Hope Bay DPA encompasses the federal navigation channel, existing turning basin, and about 47 acres of the land-based portion of the proposed LNG terminal site.

Coastal Beach (including Tidal Flats) - Coastal beach is defined in the WPA regulations (310 CMR 10.27) as "unconsolidated sediment subject to wave, tidal and coastal storm action that forms the gently sloping shore of a body of salt water and includes tidal flats. Coastal beaches extend from the mean low water line landward to the dune line, bank line or the seaward edge of an existing man-made structure." Coastal beaches include areas designated as tidal flats, which are situated in intertidal areas (between mean high water and mean low water) with a gradual slope composed of coarse-grained marine sediments.

An area of coastal beach, including tidal flats, is located in the embayment behind the existing pier adjacent to the City of Fall River combined sewer outfall location. Weaver's Cove Energy has indicated that, including salt marsh, about 1.1 acres of coastal beach area would be permanently filled as a result of the proposed shoreline modifications and fill for the LNG terminal.

Coastal Dune – Coastal Dune is defined under the WPA regulations (310 CMR 10.28) as any natural hill, mound, or ridge of sediment landward of a coastal beach deposited by wind action or storm overwash. Coastal dunes can also include artificially deposited sediment that functions as storm damage prevention or flood control.

Coastal dune habitat is located on the northern end of the southern parcel. Weaver's Cove Energy has modified its proposed shoreline stabilization measures in this area to avoid impacting the coastal dune. While no permanent impacts on the coastal dune are anticipated, installation of the Western Pipeline across the Taunton River would temporarily affect approximately 0.05 acre of the dune.

Coastal Bank - Coastal bank is defined under the WPA regulations (310 CMR 10.30) as "the seaward face or side of any elevated landform, other than a coastal dune, which lies at the landward edge of a coastal beach, land subject to tidal action, or other wetland." A particular coastal bank may serve both as a sediment source and as a vertical buffer to storm waters, or it may serve only one role.

We estimate that approximately 3,935 feet of shoreline along the proposed LNG terminal site would be classified as coastal bank. This coastal bank currently consists primarily of rip rap and/or earthen berms. Development of the facility and the proposed shoreline modifications would alter the location of the coastal bank but would not appreciably change its length.

Land Containing Shellfish - Land containing shellfish is defined under the WPA regulations (310 CMR 10.34) as "land under the ocean, tidal flats, rocky intertidal shores, salt marshes and land under salt ponds when any such land contains shellfish."

The proposed dredging and the construction of the ship unloading facility would occur within areas designated as land containing shellfish. Maintenance and improvement dredging would not preclude the reestablishment of shellfish, but the filling associated with shoreline stabilization and the ship unloading facility would permanently impact about 0.19 acre[8] of land containing shellfish.

25-Foot Riverfront Area - Riverfront area is defined in the WPA Regulations (310 CMR 10.58) as "the area of land between a river's mean annual high water line and a parallel line 200 feet away measured horizontally outward from and parallel to the river except that the parallel line is located 25-feet away in Chelsea, Everett, Fall River...." The riverfront area may include or overlap other resource areas or their buffer zones. About 1.4 acres of the proposed LNG terminal site are designated as riverfront area. The proposed site development would not appreciably alter the size of the riverfront area but could alter the elevation of some riverfront areas.

Land Under the Ocean - Land under the ocean is defined in the WPA regulations (310 CMR 10.25) as "land extending from the mean low water line seaward to the boundary of the municipality's jurisdiction, including land under estuaries. The nearshore LUO [land under ocean] designation includes areas closest to the shore that do not exceed a depth of 80 feet at MLW."

The proposed dredging and the construction of the ship unloading facility and Western Pipeline crossing would be located within areas designated as land under the ocean. About 158 acres of land under the ocean would be directly affected by construction of the proposed project. The proposed shoreline stabilization measures and ship unloading facility would permanently impact about 0.19 acre[9] of land under the ocean.

Land Subject to Coastal Storm Flowage - The DEP uses the 100-year coastal flooding event as defined and mapped on Flood Insurance Rate Maps prepared by the Federal Emergency Management Agency, National Flood Insurance Program, as the maximum flood elevation associated with land subject to coastal storm flowage, unless recorded storm data reveal a higher flood elevation (which is the storm of

[8] Acreage of land containing shellfish was assumed to be equal to the amount of subtidal habitat impacts reported in Weaver's Cove Energy's COE application.

[9] Acreage of land under the ocean was assumed to be equal to the amount of subtidal habitat impacts reported in Weaver's Cove Energy's COE application.

record). About 14.1 acres of the proposed LNG terminal site meet the criteria for land subject to coastal storm flowage. This land would be permanently affected by site development activities to raise the site above the elevation of a 100-year coastal flooding event.

Banks of or Land Under the Ocean, Ponds, Streams, Rivers, Lakes, or Creeks that Underlie an Anadromous/Catadromous Fish Run (Fish Run) - Fish Run area is defined under the WPA Regulations (310 CMR 10.35) as "that area within estuaries, ponds, streams, creeks, rivers, lakes or coastal waters, which is a spawning or feeding ground or passageway for anadromous or catadromous fish and which is identified by DMF or has been mapped on the Coastal Atlas of the Coastal Zone Management Program."

The dredging activities and the construction of the ship unloading facility and Western Pipeline crossing would occur within an area of the Taunton River designated as Fish Run. Construction of the proposed project would affect about 158 acres of area designated as Fish Run. The proposed shoreline stabilization measures and ship unloading facility would result in the permanent loss of about 1.1 acres[10] of Fish Run area.

Summary of Wetland Impacts at or Near the LNG Terminal Site

Shoreline stabilization and construction of the trestles for the ship unloading facility would result in the filling of about 0.04 acre of salt marsh,[11] 0.94 acre of intertidal habitat and 0.19 acre of subtidal habitat. These activities would also impact several other state-designated wetland resource areas. Dredging would impact another 191 acres of subtidal habitat and about 0.23 acre of intertidal habitat (see sections 4.3.2 and 4.6.2 for a discussion of dredging impacts on surface waters and aquatic resources, respectively). Construction activities would also alter the location of the coastal bank and reduce the area of land subject to coastal storm flowage. The filling of these resource areas would reduce the amount of habitat available to aquatic resources, decrease the amount of sediment available for the replenishment of coastal beaches, and alter sediment transport processes. However, the sheet pile used to armor the shoreline would also provide certain benefits, such as protecting the upland areas from storm damage and flooding.

The placement of stabilized dredged material for site fill and construction of the administrative building, parking lot, and stormwater management system on the northern parcel would affect 1.9 acres of palustrine emergent/scrub-shrub wetlands identified as Wetland Flag Series 2 (0.3 acre) and Wetland Flag Series 3 (1.6 acres). In the draft EIS, we requested that Weaver's Cove Energy provide a revised site plan for the facilities on the northern parcel to avoid impacting these wetlands or provide an analysis demonstrating that alternative layouts to avoid wetland impacts are not practicable or feasible. Based on current plans, Weaver's Cove Energy indicates that avoiding the two wetlands would not be practicable due to the space required to place dredged material, stage equipment, store material, and construct the administrative facilities and stormwater management system. While certain activities could be moved further north to minimize impacts on these two wetlands, doing so would require additional tree clearing along the perimeter of the northern parcel and would decrease the separation distance of project activities from residences located adjacent to the northern boundary of the site. The COE has determined that these two wetlands are not waters of the United States and, therefore, not subject to regulation under section 404 of the CWA. In addition, Weaver's Cove Energy contends that these areas are also not regulated as wetland resources under the WPA because they are isolated (i.e., they are not located adjacent to a stream, creek, pond, or lake) and do not meet the definition of isolated land subject to flooding. Even though Wetland Flag Series 2 and 3 may not be jurisdictional wetlands, Weaver's Cove Energy indicated in its

[10] Acreage of fish run was assumed to be equal to the amount of permanent subtidal and intertidal impacts reported in Weaver's Cove Energy's COE application.

[11] We received a comment from the EPA requesting that alternative LNG terminal designs be considered to avoid impacts on these estuarine wetlands. A discussion of alternative terminal layouts that would avoid these wetlands is presented in section 3.4.

Wetland Mitigation Plan (see discussion below and Appendix L) that it would mitigate for impacts on these wetlands.

The EPA expressed particular concern about the filling of the three small salt marshes bordering the southern shore of the southern parcel (see section 3.4 for an evaluation of potential alternative LNG terminal layouts to avoid these salt marsh wetlands). Weaver's Cove Energy conducted a functional assessment of these salt marsh areas using the procedures described in *The Highway Methodology Workbook* (COE, 1993) and *The Highway Methodology Workbook Supplement* (COE, 1999). The assessment evaluated the following functions and values: groundwater recharge/discharge, floodwater alteration, fish and shellfish habitat, sediment/toxicant retention, nutrient removal, production export, sediment/shoreline stabilization, wildlife habitat, recreation, education/scientific value, uniqueness/heritage, visual quality aesthetics, and endangered species habitat. The assessment also evaluated whether any of the functions and values of the wetlands could be deemed principal functions and values. To be considered a principal function or value, the function or value must be deemed an important component of the wetland ecosystem and/or considered of special value to society from a local, regional, and/or national perspective. The assessment concluded that these salt marshes do not provide any of these values but do provide groundwater recharge/discharge, fish and shellfish habitat, sediment/toxicant retention, nutrient removal, production export, sediment/shoreline stabilization, and wildlife habitat functions. However, due primarily to the small size and disturbed nature of the wetlands as well as the surrounding industrial environment and the location of the wetlands in a DPA, none of these seven functions are principal functions.

The DEP indicated that altering salt marshes is not allowed except where the DEP determines that the salt marshes do not contribute to the protected interests identified in the WPA. Because the salt marshes are located within a DPA, they are presumed significant to the protection of wildlife habitat and prevention of pollution and are likely to be significant to groundwater supply. Weaver's Cove Energy evaluated the salt marshes with respect to these interests and concluded that they do not contribute to these three interests for the following reasons:

- The WPA defines wildlife habitat as those areas, which due to their plant community composition and structure, hydrologic regime or other characteristics, provide important food, shelter, migratory or overwintering areas, or breeding areas for wildlife. The three areas of salt marsh consist of narrow bands of *Spartina alterniflora* growing on a substrate of cobble and rip rap. Because the plant composition and distribution are so limited, narrow, and fragmented, these areas do not provide important food, shelter, or migratory, over-wintering, or breeding areas for wildlife. In addition, due to their location within an existing industrial site, freshwater exchange via groundwater and surface water is limited.

- Prevention of pollution is defined as the prevention or reduction of contamination of surface or groundwater. The characteristics that contribute to the prevention of pollution include the growth, composition, and distribution of salt marsh vegetation; the flow and level of tidal and freshwater; and the presence and depth of peat. Salt marsh vegetation and the underlying substrate can be effective at removing sediments and pollutants from the water. However, the three areas of salt marsh are underlain by cobbles and rip rap and are relatively small in size, and thus do not play a significant role in preventing pollution.

- Groundwater supply is defined as the water below the earth's surface in the zone of saturation. The presence and depth of peat is considered a characteristic necessary for the protection of groundwater. As described previously, the salt marshes are underlain by

primarily cobble and rip rap and, as a result, would not be expected to contribute to the protection of groundwater supply.

Wetlands Along the Pipeline Routes

Weaver's Cove Energy conducted wetland delineations along the Northern and Western Pipeline routes where access could be obtained using the methods specified in the *1987 COE Wetlands Delineation Manual* (Environmental Laboratory, 1987) and the DEP's *Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act* (DEP, 1995). Where field access was denied, wetlands were identified through a review of MassGIS data, National Wetland Inventory (NWI) maps, and aerial photography. Table 4.4-2 identifies the location (by milepost), wetland identifier, wetland classification, crossing length, and acreage of each wetland that would be affected by construction and operation of the Northern and Western Pipelines.

Based on field delineations and other available wetland resource data, construction of the Northern Pipeline would result in the temporary alteration of about 2.14 acres of scrub-shrub and emergent wetland vegetation. Construction along the Western Pipeline would result in temporary alteration of about 0.68 acre of mostly scrub-shrub and emergent wetland vegetation. Construction of the two pipelines would affect a total of about 0.1 acre of forested wetland. Clearing, trenching, and other activities in wetlands could also affect wetland hydrology and water quality. Operating heavy equipment could compact wetland soils, create ruts, and result in increased sedimentation and turbidity. In addition, the pipeline trench could act as a conduit for subsurface water flow which could impact wetland hydrology. These effects would be greatest during and immediately following construction. The impact on emergent wetlands would be relatively brief, and herbaceous vegetation would likely regenerate within one or two growing seasons following restoration of the right-of-way. The impact on forested wetlands would be of longer duration due to the longer period of time required for the reestablishment of woody vegetation.

Following construction, Weaver's Cove Energy would maintain a portion of the vegetation on the permanent right-of-way to operate the pipeline. The Procedures allow Weaver's Cove Energy to maintain a 10-foot-wide herbaceous strip centered over the pipeline and periodically remove from the right-of-way trees greater than 15 feet in height that are growing within 15 feet of the pipeline centerline. These practices would result in the permanent alteration of about 0.32 acre of scrub-shrub wetland vegetation along the Northern Pipeline and the permanent alteration about 0.15 acre of wetland vegetation, less than a third of which consists of forested wetland, along the Western Pipeline.

In addition to wetlands identified within the proposed construction right-of-way, Weaver's Cove Energy has proposed to use an existing access road located at the terminus of the Western Pipeline route. This access road currently crosses portions of three wetlands identified in Weaver's Cove Energy's COE permit application (i.e., Wetlands W3, W8, and W9). The FERC Procedures currently allow the use of existing access roads that cross wetlands, provided that appropriate erosion and sedimentation controls are installed and maintained. However, Weaver's Cove Energy could not make improvements to any existing access road that would impact a wetland without first requesting and receiving FERC's approval for a site-specific variance from the Procedures.

TABLE 4.4-2

Wetland Crossings Along the Pipeline Routes

Beginning Milepost	Wetland Identifier	Wetland Classification a/	Wetland Crossing Length (feet)	Acreage Affected by Construction (acres) b/	Acreage Affected by Operation (acres)
Northern Pipeline					
0.3	Flag Series 3	PEM/PSS	265	0.00 c/	0.00
0.4	N4 d/	E2EM/E2BB d/	0	0,.00	0.00
0.8	N11 e/	PEM	0	0.00	0.00
1.2	N5/N6	PEM/PSS/POW	450	0.69	0.10
1.5	N7	PSS	85	0.09	0.02
1.6	N8 f/	PSS	0	0.00	0.00
2.3	N9 f/	PSS	0	0.00	0.00
2.3	N9A g/	PSS	27	0.05	< 0.01
2.4	N12 h/	PSS	12	0.02	<0.01
2.8	N13	PSS	23	0.06	<0.01
3.2	N2/N14	PSS	733	1.23	0.17
Subtotal			1,595	2.14	0.32
Western Pipeline					
0.0	W10	E2BB	6	0.01	<0.01
0.5	W11 d/	E2EM/E2BB	14	0.03	<0.01
1.2	W5/W6/W7	PSS/PEM	249	0.33	0.06
1.5	W4	PSS/PEM	140	0.16	0.03
1.9	W1A	PSS/PEM	0	0.05	0.00
2.0	W1	PSS/PEM	0	0.00	0.00
2.4	W2	PFO	62	0.10	0.04
NA i/	W8	PEM	0	0.00	0.00
NA i/	W3 j/	PFO/PSS/PEM	0	0.00	0.00
NA i/	W9	PSS/PEM	0	0.00	0.00
Subtotal			471	0.68	0.15
Total			2,066	2.82	0.47

a/ Cowardin Classification System:
- PEM Palustrine Emergent
- PSS Palustrine Scrub-shrub
- PFO Palustrine Forested
- E2EM Estuarine Intertidal Emergent

b/ Acreage based on GIS calculations of the intersection of the wetland polygon with the proposed construction right-of-way. A 75-foot-wide construction right-of-way would generally be used in wetlands.

c/ The Northern Parcel Variation, which was adopted by Weaver's Cove Energy after publication of the draft EIS, crosses this wetland. Impacts on this wetland are not included in this table because they have been accounted for in the summary of wetland impacts on the LNG terminal site (see table 4.4-1).

d/ Weaver's Cove Energy adopted the Northern Parcel Variation after the draft EIS to increase the distance between the pipeline and this salt marsh, which borders the Taunton River

e/ Weaver's Cove Energy adopted the River Street Variation after the draft EIS, which avoids this wetland.

f/ Weaver's Cove Energy adopted the Golf Course Variation after the draft EIS, which avoids this wetlands.

g/ The Golf Course Variation, which was adopted by Weaver's Cove Energy after publication of the draft EIS, crosses this wetland but reduces overall wetland impacts by 0.11 acre.

h/ Weaver's Cove Energy was unable to gain access the properties containing these wetland areas and, therefore, could not verify the wetland boundaries. In accordance with the Procedures, Weaver's Cove Energy must field delineate the boundaries of these wetlands prior to construction.

i/ These wetlands are adjacent to an existing access road that Weaver's Cove Energy proposes to use to construct and operate the meter and regulation station at the terminus of the Western Pipeline.

j/ Wetland W3 is hydrologically connected to Wetland W2 but was delineated separately.

Measures to Avoid, Minimize, Rectify, Reduce, or Compensate for Wetland Impacts

During the development of the proposed project, Weaver's Cove Energy examined alternative terminal locations that would avoid or minimize wetland impacts but determined that none of these sites were practicable or feasible. Weaver's Cove Energy then took steps to avoid wetland impacts during the development of the LNG terminal design and the selection of the pipeline routes. For example, the LNG terminal facilities and dredge disposal areas were configured to avoid several wetlands bordering the Taunton River on the southern parcel of the terminal site. In addition, Weaver's Cove Energy revised shoreline stabilization measures on the north end of the southern parcel to avoid permanently impacting an area of coastal dune. Weaver's Cove Energy originally proposed to install a rip rap revetment that would have permanently impacted 0.25 acre of coastal dune but now proposes to install a sheetpile bulkhead on the landward side of the dune in lieu of the rip rap revetment. In its comments on the draft EIS, Weaver's Cove Energy also agreed to adopt our recommended Northern Parcel Variation for the Northern Pipeline (see section 3.5.3), which would result in the realignment of a portion of the Northern Pipeline route to increase the distance between the construction right-of-way and the Taunton River. This route variation would avoid indirect impacts on the wetlands bordering the river.

Weaver's Cove Energy would construct and operate the project in accordance with the FERC Procedures, which specify mitigation to be implemented during the construction of pipelines and aboveground facilities in or adjacent to wetlands and waterbodies to minimize impacts or restore wetlands to pre-construction conditions. Specific measures of the Procedures relevant to wetlands include the following:

- limiting the construction equipment operating in the wetland to that necessary to complete construction;
- facilitating revegetation by leaving existing root systems in place except over the trench and where safety considerations require their removal;
- segregating topsoil from the trench in unsaturated wetland soils;
- installing and maintaining sediment barriers across the entire construction right-of-way and along the edges of the right-of-way as necessary to prevent sediment from entering wetlands;
- installing trench breakers as necessary to prevent the draining of wetlands; and
- limiting vegetation maintenance in wetlands to annual mowing of a 10-foot-wide strip centered over the pipeline and the periodic cutting of trees greater than 15 feet in height that are located within 15 feet of the pipeline centerline.

In addition to these measures, OCZM recommended that Weaver's Cove Energy be required to avoid construction during seasonally wet periods. We do not believe such a restriction is needed, particularly because, as discussed in section 4.2.1, the soils that would be disturbed by pipeline construction do not have soil textures or drainage characteristics that would make them highly susceptible to compaction. Additionally, the FERC Procedures already contain measures to minimize the impact of construction on saturated wetland soils, including operating equipment on construction mats or using low ground weight equipment in saturated wetlands to minimize the rutting and compaction of wetland soils.

Weaver's Cove Energy developed and would implement a Wetland Mitigation Plan to mitigate for the filling of 0.04 acre of salt marsh on the southern parcel and the 1.9 acres of permanent impacts on

the freshwater wetlands (i.e., palustrine emergent/scrub-shrub wetlands) on the northern parcel. The Plan was submitted to the COE and other agencies on March 4, 2005. The Wetland Mitigation Plan is attached in Appendix L and includes the following mitigative measures:

- About 0.74 acre of salt marsh would be created and restored within the limits of Wetland Flag Series 1 (see figure 4.4-3), including the restoration of about 0.29 acre of degraded salt marsh dominated by common reed (*Phragmites australis*) and the creation of about 0.35 acre of salt marsh in early successional uplands. About 0.13 acre of tidal creek would be constructed in the restored and created salt marsh to connect this area with the Taunton River. The mitigation area would be excavated to a lower elevation, covered with 100 percent biodegradable erosion control blanket, and planted with *Spartina alterniflora* plugs.

- About 0.18 acre of freshwater wetland would be created in an upland area adjacent to Wetland Flag Series 4 (see figure 4.4-3). The mitigation area would be excavated to a lower elevation and then planted with wetland shrubs and tree saplings to create a palustrine scrub-shrub wetland.

- Both wetland mitigation areas would be maintained and monitored in accordance with procedures specified in the Plan.

Because this Wetland Mitigation Plan does not include mitigation for the loss of intertidal and subtidal habitats (see section 4.6.2) and the COE has not approved this Wetland Mitigation Plan, **we recommend that:**

- **Weaver's Cove Energy consult with the COE and NOAA Fisheries regarding mitigation of wetlands as well as intertidal and subtidal habitats and file with the Secretary the results of these consultations and the COE-approved Wetland Mitigation Plan <u>prior to construction</u>.**

Insert Figure

4.4-3 Proposed Wetland Mitigation Areas

4.5 VEGETATION

LNG Terminal

The proposed LNG terminal site includes a 55-acre southern parcel and an 18-acre northern parcel. The vast majority of the southern parcel consists of industrial/commercial land which is generally devoid of vegetation. The vegetated areas of the southern parcel include both terrestrial and aquatic types. The terrestrial vegetation includes a small area of forest land bordered by open land at the northern end of the parcel and isolated pockets of open land along the southern boundary of the parcel adjacent to the Taunton River. The aquatic vegetation on the southern parcel consists of a variety of intertidal communities including coastal beaches and salt marsh. In contrast to the southern parcel, most of the northern parcel is vegetated with forest land and open land vegetation.

Forest land on the LNG terminal site covers about 3.0 acres of the southern parcel and 8.7 acres of the northern parcel. The forest land on the southern parcel is dominated by oak and maple trees with an understory of shrubs such as smooth sumac and honey locust. The forest land on the northern parcel is dominated by oak, maple, black cherry, and aspen trees. Herbs and grasses are common beneath the trees in both areas.

Open lands (including non-forested wetlands) cover about 3.7 acres of the southern parcel and 5.8 acres of the northern parcel. The vegetated open land on the southern parcel includes terrestrial upland dominated by multiflora rose, grasses, and woody saplings on the north end; various intertidal aquatic communities vegetated by beach rose, seaside goldenrod, ragweed, and a variety of algal species along the edge of the river; and five wetlands. Four of these five wetlands are located along the southern edge of the parcel. These include: 1) three small isolated salt marsh areas (Salt Marshes A, B, and C), which are dominated by cord grass; and 2) a larger wetland area (Wetland Flag Series 1) consisting of a fringe of salt marsh dominated by cord grass along the edge of the river and a scrub-shrub wetland dominated by common reed, buckthorn, and willow further up the bank. The fifth wetland (Wetland Flag Series 4) on the southern parcel is located along the edge of the river at the north end of the parcel. This wetland consists of a fringe of salt marsh dominated by cord grass along the edge of the river and a mixture of woody and herbaceous vegetation including common reed, black grass, switch grass, honey locust, and swamp dock further up the bank.

The open land located on the northern parcel includes terrestrial uplands covered by multiflora rose, woody saplings, grasses, and forbs, and two wetlands (Wetland Flag Series 2 and 3). The smaller of these two wetlands (Wetland Flag Series 2) is dominated by common reed; the other (Wetland Flag Series 3) is dominated by soft rush, tussock sedge, wool-grass, tall goldenrod, poison ivy, and a variety of shrub species.

Construction of the proposed LNG terminal would permanently disturb most of the existing vegetation on the LNG terminal site. Table 4.5-1 summarizes the vegetation types that would be affected by construction of the LNG terminal facilities. A more detailed discussion of wetland and intertidal community impacts and a map showing the locations of the wetlands (figure 4.4-1) are included in section 4.4.

TABLE 4.5-1

Acreage of Vegetative Communities Affected by Construction of the Proposed LNG Terminal

Facility Component	Open Land	Forest Land
Northern Parcel	4.1	7.7
Southern Parcel	1.0	3.0
Total	5.1	10.7

Following construction, portions of the southern and northern parcels that are not covered by buildings, roads, gravel, or other hard surfaces would be restored according to a site-specific landscaping plan. This plan would include grass and ornamental shrub plantings to minimize visual impacts and to enhance the aesthetic appearance of the site.

Pipeline Facilities

The vegetation communities crossed by the Northern and Western Pipeline routes primarily include forest lands and a mix of open fields and shrub lands.

Upland forest comprises about 1.2 acres of the land that would be cleared for the Northern Pipeline facilities and 4.2 acres of the land that would be cleared for the Western Pipeline facilities. The forest land along the Northern Pipeline route is dominated by black locust, white ash, birch, and maple species with an understory of witch hazel, alternate-leaved dogwood, and mountain laurel. The forest land along the Western Pipeline route consists of red oak, American beech, red maple, and white pine with an understory of witch hazel, sweet pepperbush, black huckleberry, lowbush blueberry, ferns, and princess pine.

Upland shrub lands and open areas, including upland fields, existing utility rights-of-ways, and landscaped residential areas are located along the proposed pipeline routes. About 39.6 acres of upland shrub lands and 6.6 acres of open upland areas would be affected by construction of the Northern and Western Pipelines. A pipe storage yard, approximately 4 acres in size, is proposed near the Northern Pipeline interconnect in an open area characterized by an upland field with scattered shrubs. Vegetation typical of these shrub lands and open areas includes gray birch, red cedar, common juniper, asters, goldenrod, poison ivy, bracken fern, multiflora rose, and various forbs and woody saplings.

The majority of the wetlands crossed by the Northern and Western Pipeline routes are narrow riparian areas bordering streams. Wetland W2, the only forested wetland that would be crossed, is dominated by red maple and tupelo with an understory of highbush blueberry and cinnamon fern. Dominant woody vegetation in the scrub-shrub wetlands includes red maple, highbush blueberry, willows, winterberry holly, silky dogwood, sweet pepperbush, arrow-wood, multiflora rose, and Asiatic bittersweet. Dominant herbaceous species in the wetlands along the pipeline routes include common reed, cattail, sedges, and rushes. Cordgrass is the dominant vegetation in the salt marshes bordering the Taunton River.

Table 4.5-2 summarizes the temporary and permanent impacts on each vegetation community as the result of pipeline construction and operations.

During construction, the existing vegetation would be temporarily removed from within the construction rights-of-way, pipe storage yard, and other necessary workspaces to facilitate the installation of the pipelines. Trees and other vegetation on the meter and regulation station sites would be permanently removed. The impact of clearing and the amount of time required for complete recovery of vegetation to pre-disturbance levels would depend on the size and age of the pre-existing vegetation. In general, impacts would be greatest in forest lands because they are more structurally complex than other vegetation types and take longer (perhaps 30 to 40 years) than other vegetation types to become reestablished to preconstruction conditions. In addition, as discussed below, trees would be prevented from growing on the permanent rights-of-way by pipeline maintenance activities.

TABLE 4.5-2

Acreage of Vegetative Communities Affected by Construction of the Proposed Pipeline Facilities

Facility	Upland Forest Lands		Upland Shrub Lands		Wetland a/		Upland Open Field		Landscaped Lawn		Totals	
	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.
Northern Pipeline												
Pipeline Right-of-way	1.2	0.8	23.3	16.8	2.1	0.3	1.1	0.8	2.2	1.4	29.9	20.1
Pipe Storage Yard	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	4.0	0.0
Aboveground Facilities	0.0	0.0	0.9	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.9
Northern Pipeline Subtotal	1.2	0.8	24.2	17.7	2.1	0.3	5.1	0.8	2.2	1.4	34.8	21.0
Western Pipeline												
Pipeline Right-of-way	2.5	1.7	15.2	8.0	0.7	0.2	1.5	1.2	0.0	0.0	19.9	11.1
Temporary Extra Workspace	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
Aboveground Facilities	1.4	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	1.4
Access Road	<0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<0.1	0.0
Western Pipeline Subtotal	4.2	3.1	15.4	8.0	0.7	0.2	1.5	1.2	0.0	0.0	21.8	12.5
Pipeline Facilities Total	5.4	3.9	39.6	25.7	2.8	0.5	6.6	2.0	2.2	1.4	56.6	33.5

a/ Includes forested, scrub-shrub, and emergent wetlands.
Const. Construction
Oper. Operation
Note: The totals shown in this table may not equal the sum of addends due to rounding.

The loss of vegetation could also have secondary impacts, including forest fragmentation and the loss of wildlife habitat (see section 4.6.1) and the loss of visual screening between residences and existing utility and railroad rights-of-ways (see section 4.8.7.2). Other secondary impacts could include increased erosion and solar radiation, which could dry the soil and stimulate the growth of adjacent vegetation. The removal of trees on the rights-of-way could also expose trees growing adjacent to the newly cleared areas to higher levels of wind, which may increase the risk of blow downs. The majority of these effects would be minor and temporary and would diminish upon restoration and revegetation of the rights-of-way. The portions of the construction rights-of-way that are not maintained during pipeline operations (i.e., the temporary right-of-way, extra workspaces, temporary access road, and the pipe storage yard) would be allowed to revert to their previous preconstruction conditions through natural succession or would be restored in accordance with site-specific landscape plans.

Operation and maintenance of the proposed pipeline facilities would have additional effects on vegetation after site clearing and rights-of-way restoration are completed. The pipeline rights-of-way would be maintained in accordance with the FERC Plan and Procedures. These plans only allow annual maintenance of a 10-foot-wide strip centered over the pipeline. Other than that, routine vegetation maintenance across the entire the permanent rights-of-way could occur only once every 3 years in uplands and would be restricted in wetlands to the periodic clearing of trees greater than 15 feet in height that are within 15 feet of the pipeline centerlines.

4.6 WILDLIFE AND AQUATIC RESOURCES

4.6.1 Wildlife Resources

Most of the project area is developed and provides limited wildlife habitat. Wildlife species in the project area are typical for the predominantly urban landscape. Remnant habitats in this landscape include forest lands and open lands, including wetlands. Because the project area is a mosaic of these habitat types, the species in the project area are typically habitat generalists.

The forested areas on the LNG terminal site and along the pipeline routes include primarily hardwoods with an understory of grasses, legumes, and herbaceous plants. Wildlife attracted to forested areas include white-tailed deer, raccoon, opossum, gray squirrel, eastern chipmunk, bats, pine vole, wood thrush, summer tanager, red-eyed vireo, blue-gray gnatcatcher, and woodpeckers. Common raptors include barred owl, great-horned owl, and red-shouldered and broad-winged hawks. Characteristic reptiles include the box turtle, garter snake, and timber rattlesnake.

The open land habitat consists primarily of commercial/industrial land on the southern parcel of the proposed LNG terminal site, old fields and wetlands on portions of the southern and northern parcels of the site, and maintained lawns or rights-of-way along the pipeline routes. Typical wildlife attracted to open land habitat include cottontail rabbit, coyote, red fox, raccoon, opossum, common crow, pigeon, European starling, common grackle, field sparrow, Carolina wren, brown-headed cowbird, red-tailed hawks, and many species of rodents. With the exception of the salt marsh and intertidal habitats, the wetlands that would be affected by the project consist primarily of vegetated areas with emergent wetland plants and without standing water during most of the growing season. These types of wetlands typically provide habitat for ducks, geese, herons, shore birds, muskrat, mink, beaver, bullfrog, snapping turtle, painted turtle, and salamanders during times when standing water is present.

The proposed project area also includes the salt marsh, intertidal, and open water habitats of the Taunton River and Mount Hope Bay. Game and commercial finfish and shellfish known to inhabit the river are described in section 4.6.2. Common mammals using the open water or coastal habitats of the river include muskrat, mink, and raccoon. The shoreline habitats associated with the river also support a diverse assemblage of avian species including shorebirds, wading birds, and waterfowl. Osprey use the area and were observed nesting on a utility pole within the LNG terminal site in 2003. Some of these bird species are year-round residents, but most are migratory and spend only a portion of the year in the area.

In addition to the common terrestrial mammal species in the project area, six marine mammal species may occur in Narragansett Bay or Mount Hope Bay. These include the harbor porpoise, harbor seal, gray seal, harp seal, hooded seal, and ring seal. The Marine Mammal Protection Act of 1972 (Amended 1994; MMPA) established a moratorium on taking marine mammals. The MMPA prohibits harassing, hunting, capturing, or killing, or attempting to harass, hunt, capture, or kill marine mammals. The MMPA provides that the moratorium on taking may be waived, however, when the affected species or population stock is within its optimum sustainable population range and will not be disadvantaged by the authorized taking.

The harbor seal is the only MMPA-protected species that may occur regularly within the project area. These seals are found in the waters off of northern North America, Russia, and Asia. In Narragansett Bay, harbor seals are present most frequently from October through April. Individuals may also enter Mount Hope Bay during this period. The major causes of harbor seal mortality can be attributed to human-related incidents, either intentional (e.g., hunting) or by disturbance (e.g., habitat loss) (Ronald et al., 1982).

Wildlife Resources Impacts and Mitigation

Construction and operation of the proposed LNG terminal and pipeline facilities would result in both short-term and permanent alteration of wildlife habitat, directly impacting wildlife through disturbance, displacement, and mortality.

Vegetation clearing would reduce cover, nesting, and foraging habitat for some wildlife; however, because most of the project area is highly developed and fragmented, the area is not likely to support abundant wildlife populations. The forest land at the western end of the Western Pipeline route likely contains the most diverse and abundant terrestrial wildlife populations. Construction and operation of the pipeline in this forest would result in short- and long-term impacts on wildlife habitat.

Of the wildlife species present in the project area, more mobile species would be temporarily displaced from the construction areas to similar adjacent habitats, where available. The developed nature of the project area limits the habitat value both within the construction area of the proposed project and adjacent to the project area. Some wildlife displaced by construction would return to the newly disturbed areas and adjacent, undisturbed habitats soon after completion of construction. Less mobile species, such as small mammals, reptiles, and amphibians, as well as nesting birds located in the construction areas, could be killed or injured by construction activities.

Construction of the LNG terminal and pipelines would require the clearing of trees and other forest vegetation, which would result in a permanent change of forested wildlife habitats to commercial/industrial, herbaceous, and shrub cover types. About 10.7 acres of forest land would be lost as the result of constructing the LNG terminal facilities. Because forested areas at the LNG terminal site are relatively small and isolated from larger forest stands, they are unlikely to support substantial wildlife populations. As such, we do not expect the loss of this forest habitat to have long-term or population level effects on wildlife in the area. Forest habitat within the permanent pipeline rights-of-way (about 3.9 acres) would also be lost and permanently converted to herbaceous and shrub covered habitats. Forest habitat on the temporary construction rights-of-way and extra workspaces for the pipelines (about 1.6 acres) would be allowed to reestablish to preconstruction conditions following construction. However, it could take several years to regenerate tree saplings and many decades to develop mature trees on the restored rights-of-way.

Generally, forest clearing can contribute to fragmentation, which has been shown to have an adverse impact on forest interior species. Due to the small amount of forest land that would be affected by the proposed project and the large amount of forest fragmentation already in the project area, we consider there to be only a small potential for this impact to occur as a result of the project.

Non-forested habitats that would be affected by construction and operation of the proposed facilities include wetlands, open land, and open water. The impact of the proposed project on most of these habitats and associated wildlife species would generally be relatively minor and short-term. Some non-forested habitat would be permanently lost on the LNG terminal site to accommodate buildings, roads, and other facilities, although the majority of the permanently affected area is currently devoid of vegetation and provides only marginal habitat. The temporary disturbance of areas that would not be occupied by buildings, road, or other facilities would not have a significant or permanent impact on wildlife because non-forested habitat would be reestablished as part of the site landscaping plan.

Impacts of the proposed project on birds and mammals using the shoreline and open water habitats of the Taunton River and Mount Hope Bay are expected to be minor and temporary. Although some shoreline habitat, including small areas of salt marsh, would be filled, Weaver's Cove Energy would consult with all applicable resource agencies to develop a plan to mitigate for these impacts. Birds would

be expected to avoid the project area during construction and return after site restoration. The osprey nest on the site, which was occupied in 2003, would be removed while unoccupied, and no longer available for nesting osprey. No other known nesting areas would be disturbed.

Substrate disturbance, especially in nearshore areas, may temporarily reduce the availability of prey for many bird species. Weaver's Cove Energy's suspended sediment modeling indicated that sediments would return to a quasi-steady state after about four tide cycles or two days. Following sediment settling, we expect that the affected areas would eventually be recolonized and return to a preconstruction state. Also, although an increase in localized turbidity would occur because of dredging in the Taunton River and Mount Hope Bay, this increase is not expected to have adverse impacts on marine mammals as these species have the ability to disperse and vacate areas undergoing disturbance.

Long-term impacts on wildlife resources along the pipeline routes would be minimized by Weaver's Cove Energy's adherence to the FERC Plan and Procedures. As discussed in section 4.5, these plans only allow annual maintenance of a 10-foot-wide strip centered over the pipeline. Other than that, routine vegetation maintenance across the entire the permanent right-of-way could occur only once every 3 years in uplands and would be restricted in wetlands to the periodic clearing of trees greater than 15 feet in height that are within 15 feet of the pipeline centerline. To further protect nesting birds, the FERC Plan and Procedures specify that routine vegetation maintenance should be conducted between August 1 and April 15, which is outside of the typical nesting season for most bird species.

4.6.2 Aquatic Resources

Taunton River and Mount Hope Bay

The Taunton River and Mount Hope Bay provide habitat for a diverse community of shellfish and finfish. These species either provide forage for other predatory fish or are directly sought by recreational and commercial fishermen in the project area.

Shellfish - The Massachusetts DMF has characterized the area of the Taunton River that would be affected by the project as a "Significant Shellfish Habitat" which provides productive habitat for quahogs, American oysters, and soft shelled clams (DMF, 2003).

Northern quahog live in waters up to 15 meters deep and are distributed in deeper subtidal habitat throughout the lower Taunton River as well as near the mouth of the Taunton River in Mount Hope Bay. DMF (1997) surveys show quahog occurring in the Taunton River north and south of the proposed LNG terminal site. Since 1997, the DMF has contracted with shell fishermen to harvest quahogs from biologically contaminated areas in Mount Hope Bay and the Taunton River. Harvested quahogs are then offered to other coastal towns for relocation, or "relay," to clean sites where they remain for a suitable depuration period before they are harvested for consumption. Although not comprising a significant portion of the relay harvest, quahogs are consistently harvested from the channel edges and shoal areas in the project area. Quahogs are generally not harvested from the main navigation channel in the Taunton River because the fine-grain mud in the channel is not suitable quahog habitat.

Soft-shelled clam beds are present in limited areas of the Taunton River near the project area. These beds are generally located in shallow intertidal and nearshore subtidal flats along the shore of the river. The closest soft-shelled clam habitat is in the small cove south of the LNG terminal site.

Oyster shells were found near the proposed terminal site during recent surveys (Vine Associates, 2002 unpublished), but viable eastern oyster populations are restricted to areas located approximately 1

mile upstream of the site. Higher turbidity and salinity levels limit the suitability of the area near the terminal site for oysters.

Blue crabs, lady crabs, green crabs, and spider crabs have also been identified near the LNG terminal site (Vine Associates, 2002 unpublished). Blue crab and lady crab are harvested as a recreational fishery in the project area while green crab is an exotic invasive species from Europe that has established populations throughout the coastal waters in North America.

Finfish - Numerous fish species use the various habitats found within the river, turning basin, and Mount Hope Bay at different times throughout their life cycles. Many of the species that use estuarine wetlands along the river system begin their life cycles in the open water of the Atlantic Ocean as demersal or pelagic eggs and/or larvae. Larvae and post-larvae are then transported by wave currents into the estuaries where they occupy muddy bottoms or find food and protection from predators amongst the vegetation of the brackish marshes. The Taunton River also serves as a migratory pathway for anadromous species such as alewife, rainbow smelt, striped bass, and blueback herring. NOAA Fisheries (2003) also reported that the catadromous American eel grows to maturity within the Taunton River before migrating to a marine environment to spawn.

Marine Research, Inc. (MRI) conducts annual surveys in Mount Hope Bay and the lower Taunton River to determine finfish species and life stage occurrence in the area as required under permit stipulations for the Brayton Point Power Plant. The eggs and/or larvae of several fish species have been collected in Mount Hope Bay and the Taunton River during these surveys, including winter flounder, windowpane flounder, scup, Atlantic silverside, bay anchovy, tautog, cunner, weakfish, menhaden, and butterfish.

Based on 1998 survey data (MRI, 1999), 31 finfish species were recorded in the standard otter trawl. Winter flounder, windowpane flounder, bay anchovy, butterfish, and alewife comprised the five most commonly collected species. Thirty-nine species were collected using the Wilcox trawl with bay anchovy, winter flounder, butterfish, scup, and alewife as the five most commonly collected species. The nearshore seine sampling effort collected 19 species. Atlantic silverside was the most commonly collected of the 19 species by a wide margin, but striped killifish, mummichogs, and bluefish were also relatively abundant (MRI, 1999).

Other Waterbodies

The other 10 waterbodies that would be crossed by the proposed pipelines are narrow freshwater streams. Although all of these streams have the potential to contain warmwater fisheries (i.e., waters unsuitable for the propagation of trout and not capable of supporting a stocked trout population), the majority are intermittent and thus are incapable of supporting a year round fishery and none support commercial fisheries. Fish species potentially present in these waterbodies include largemouth bass, chain pickerel, and yellow perch. The Massachusetts Division of Fish and Wildlife (DFW) also reported that the American eel could also be found in these waterbodies (DFW, 2003c).

Aquatic Resources Impacts and Mitigation

Dredging Activities

Dredging of the federal navigation channel and turning basin may adversely affect fish and fish habitat. Potential adverse effects on fish and fish habitat include impairment of water quality, destruction of benthic habitat, and direct and indirect effects on fish and their prey species. The extent of these

effects depends on project timing and duration, sediment texture and composition, and fish life stage and behavior.

The water quality of the Taunton River and Mount Hope Bay is currently degraded by upstream discharges and runoff. The proposed dredging would contribute to further degradation of water quality through increases in turbidity, releases of chemical and nutrient pollutants from sediments, and introduction of chemical contaminants, such as fuel and lubricants from the dredge vessels. Turbidity resulting from the resuspension of sediments would reduce light penetration and the corresponding primary production of aquatic plants, algae, and phytoplankton. Additionally, resuspension of organic materials and sediments could cause an increase in biological and chemical use of oxygen, resulting in a decrease of dissolved oxygen concentrations in the affected area. Lower dissolved oxygen concentrations could cause a temporary displacement of motile organisms and may stress or kill sessile benthic organisms within the affected area (see section 4.3.2 for more discussion of dissolved oxygen impacts).

Although specific information regarding the condition of the benthic communities in the federal navigation channel and turning basin has not been collected, such communities may be well established because the channel has not been dredged since the 1970s. These benthic invertebrates provide a food source for demersal species of finfish during part or all of their life cycles. Direct alteration of the benthic substrate via dredging would remove the existing benthic community and may adversely affect prey species, suitable cover, settlement structure, and/or nursery and spawning areas. Pioneering benthic invertebrates would likely recolonize the dredged area soon after completion of dredging. The character of this recolonizing community would depend on the nature of the available substrate (e.g., grain size distribution and hardness) and resident species in adjacent areas.

Based on DMF data (DMF, 1997), the dredging of the federal navigation channel and turning basin could directly impact up to 84 acres of quahog habitat. Although as previously stated, much of this 84-acre area comprises the existing navigation channel and turning basin, which have bottoms consisting of fine-grained muds that are not suitable for quahog. Taking this into account, we estimated that about 21 acres of the area to be dredged for the turning basin should be considered suitable quahog habitat that would be directly affected during construction of the project. The impact on some and perhaps all of this 21-acre area would be permanent because LNG ships would continue to disturb the benthic substrate which in turn would preclude the reestablishment of quahogs. Dredging could also have indirect impacts on quahogs. NOAA Fisheries reported that quahogs redirect residual and newly acquired food energy towards producing reproductive products prior to initiating spawning, which begins in May. NOAA Fisheries expressed concern that constant stress, including processing and discarding unusual levels of suspended sediment, can prevent quahogs from beginning the energy transfer to reproduction or cause them to reverse the process if already begun. Thus, quahogs in the vicinity of dredging activities during the pre-reproductive through post-spawning periods would be at risk for reduced productivity. To mitigate impacts on quahogs and other shellfish from the development of the turning basin, Weaver's Cove Energy has indicated that it would:

- coordinate with federal and state resource agencies to harvest and relay quahogs from the proposed dredging footprint prior to commencement of dredging activities; and

- coordinate with federal and state resource agencies to develop and fund a plan to reseed quahogs in those areas where quahogs were harvested prior to commencement of dredging activities.

We received several comments on the draft EIS regarding the appropriateness of Weaver's Cove Energy's proposed quahog mitigation measures. NOAA Fisheries, however, indicated that the proposed mitigation measures could adequately offset permanent impacts on quahogs. Thus in accordance with

NOAA Fisheries comments and to ensure that potential impacts are accounted for in the mitigation plans, **we recommend that:**

- **Weaver's Cove Energy complete the coordination with applicable federal and state resource agencies regarding development and funding of mitigation measures to offset impacts on quahogs resulting from the expansion of the turning basin and provide the results of that coordination, including copies of agency approval, to the Secretary prior to dredging.**

Dredging also has the potential to re-introduce deleterious compounds currently in the bottom sediments into the water column. In addition to behavioral responses by fish to exposure to resuspended sediments, certain chemical contaminants could cause various acute and chronic growth and physiological effects. To evaluate these risks, Weaver's Cove Energy performed elutriate tests and undertook a sediment characterization study that analyzed a number of organic and inorganic chemicals associated with the potential dredged sediments. As discussed in section 4.2.2, these chemical analyses of sediments included PAHs, PCBs, pesticides, and metals. To assess the potential hazards posed to the aquatic environment by the dredged sediment, statistically based average concentrations of the various organic and inorganic compounds detected in the sediments were compared to commonly accepted, ecological risk-based screening criteria. These analyses, which are described in more detail in section 4.2.2, indicated that:

- The 95 percent UCL concentrations of most PAHs are less than the PEL and ERM criteria; however, some PAH compounds in the area between the Braga Bridge and the lower end of the turning basin exceed the PEL criterion, but are less than the ERM criterion.

- The 95 percent UCL concentrations of total PCBs are less than the PEL and ERM criteria in all portions of the dredging footprint.

- Only one pesticide, DDE, was detected. DDE was identified in only three samples from the entire dredging footprint; the concentration of DDE was low and is not a contaminant of concern in any part of the dredging footprint.

- Mercury concentrations exceed all three screening criteria in all portions of the dredging footprint.

- The 95 percent UCL concentrations of the other metals are below both the PEL and ERM criteria, except in the area between the Braga Bridge and the lower end of the turning basin. In this portion of the river, five of the seven metals exceed the PEL criterion.

Elutriate tests conducted to determine if deleterious compounds in the sediments could be released into the water indicated that most of the tested chemicals and metals would remain tightly adsorbed to the sediments. However, the results of the elutriate tests indicated that copper and zinc would be released from the sediments into the water in concentrations that exceed published EPA water quality criteria (see discussion of elutriate test results in section 4.2.2). Uptake of these chemicals by aquatic organisms could alter behavior affecting foraging success and increasing susceptibility to predation, could lower reproduction, or could have physiological responses that result in predisposition to disease and other forms of stress (Peterle, 1991). However, the potential for these effects is limited. As discussed in sections 4.2.2 and 4.3.2, the concentration of copper in the river water is greater than EPA-recommended water quality criteria. Moreover, a study by Tramontano and Bohlen (1984) indicated that elevated concentrations of dissolved contaminants resulting from dredging activities would be expected to return

to background levels within about 600 feet of the dredging operation. Therefore, the effect of these metals being released into the water would be localized and quickly diluted.

We also do not expect that there would be a long-term impact on the health of fish and shellfish after completion of the dredging operations. Bottom fish and shellfish are currently exposed to contaminated sediments in the Taunton River on a continuous basis. This constant exposure is part of the reason shellfish harvesting is banned in the Taunton River and quahogs are relocated for depuration prior to harvest in other less contaminated areas. Moreover, studies have demonstrated that impacts resulting from dredging-induced sediment resuspension are generally small relative to naturally occurring, storm-induced sedimentation (Bohlen et al., 1979; Bohlen et al., 1996). These studies suggest that the exposure of organisms to chemicals in the sediments resuspended due to dredging may be less than the exposure to these chemicals regularly experienced by the organisms in the river from resuspension due to natural causes.

In addition to potentially releasing deleterious compounds into the water column, suspended sediments could have direct and indirect physical effects on pelagic and benthic communities in the Taunton River and Mount Hope Bay. Direct impacts could result from the exposure to sediment particles and indirect impacts could result from habitat alteration caused by sediment deposition.

SSDOSE Modeling Conducted and Mitigation Proposed by Weaver's Cove Energy

To assess the potential for direct and indirect impacts that could result from exposure to suspended or deposited sediments, Weaver's Cove Energy investigated potential impacts on different life history stages of aquatic species inhabiting the project area and conducted computer simulation modeling using the SSDOSE model. Additional details on this model are provided in Weaver's Cove Energy's modeling report entitled *Modeling Dredge-induced Suspended Sediment and the Environmental Effects in Mt. Hope Bay and the Taunton River for the Proposed Weaver's Cove Energy, LLC, Liquefied Natural Gas Import Terminal* (ASA, 2003), which is available under the "Proposal" link on Weaver's Cove Energy's website (www.weaverscove.com).

Weaver's Cove Energy's modeling focused on the direct effects of dredging such as the excavation and transport of sediments through the water column and did not specifically address effects associated with related operations such as the placement and removal of spuds required to stabilize the dredging platform. We received a comment from the DMF that we should consider the potential effects on marine organisms of anchor strike and spud movements associated with dredging. Our review, which is based on consultations with COE staff who have been involved in the recent dredging of the Providence River (O'Donnell, 2004), indicates there would be little or no effect resulting from anchor strikes if the dredging equipment utilizes spuds for barge stabilization. Further, spud placement during dredging and the direct effects on benthic habitat would be limited to the dredging footprint. Given the availability of laser surveying equipment and the use of differential GPS positioning, as well as high-resolution fathometric sensors, it should be possible to accurately set the spuds within the navigation channel. The need to set spuds outside the navigation channel would be infrequent and should have minimal impact on benthic habitat outside of the channel.

For perspective, the average footprint of a spud used to stabilize the barges would be approximately 16 square feet (ft^2) (Beaudoin, 2004b). Additional disturbance during penetration and extraction of the spud would occur around each spud in an area that would depend on the type and consolidation of the sediment. During extraction of the spuds, some resuspension of sediment would likely occur; however, the amount of resuspension would be much less than that resulting from the dredging operation itself. The deck barge used as a dredging platform would be fitted with between two to four spuds depending on the size of the barge. Assuming that the barge would be repositioned 2 to 6

times per day and the barge would need at least three spuds (48 ft^2 total) to maximize dredge stability, between 6 and 18 spud penetrations/extractions would occur per day. This would result in potential direct impacts on the benthic habitat of between 288 ft^2 and 864 ft^2 per day, most of which would be limited to the navigation channel and turning basin. Even if it were assumed that 25 percent of the spud placements and removals were to occur outside the dredging footprint (which we believe is high), the potential impact of spuds on areas outside the dredging footprint would be small, ranging from 1 to 3 percent of the total project dredge footprint (based on a total dredged area of about 8.3 million ft^2 and a 3-year dredging schedule).

Secondary effects (i.e., increased turbidity due to resuspended sediment) from spud removal and repositioning would likely be limited to the dredging footprint. Although the potential effects of spud barge operations were not included as inputs to Weaver's Cove Energy's sediment transport modeling, we believe that impacts associated with spud placement, removal, and repositioning would not significantly increase the duration or severity of impacts on aquatic resources above the levels that would result from excavation-related dredging activities.

Organisms and species that were considered in Weaver's Cove Energy's suspended sediment analysis included winter flounder, shad, alewife and blueback herring, white perch, sturgeon, striped bass, summer flounder, windowpane flounder, scup, Atlantic silverside, bay anchovy, tautog, cunner, weakfish, menhaden, bluefish, butterfish, American eel, northern quahog, blue crab, soft shell clam, eastern oysters, amphipods, polychaete worms, and zooplankton. The sediment deposition analysis considered winter flounder, Atlantic silverside, bay anchovy, and eastern oyster. A key element in assessing potential effects of suspended sediment was to determine thresholds of concern for each species, which involved the following steps:

- development of a list of species and life stages of concern present in the project area;
- a review of the life history of each stage (i.e., eggs, larvae, juvenile, and adult) for each species;
- a determination of the seasonal presence (by month) of each species (by life stage); and
- a determination of the duration of potential exposure to dredging activities during each life stage of each species.

Published literature was reviewed to determine the minimum suspended sediment concentration and minimum deposited sediment thickness (as appropriate for the organism) that has been shown to have either a lethal or sublethal effect for any exposure duration for each life stage of each species. A screening analysis was performed on each dredging scenario and location to determine if the minimum effects threshold would be exceeded for any duration of exposure (short or long) for each species and life stage. Where suspended sediment concentrations in the water or sediment layer thickness on the bottom exceeded the minimum threshold for a species life stage over any time period, the effect of duration and degree of exposure were evaluated using the SSDOSE model.

Weaver's Cove Energy's modeling results, which are consistent with the results of field studies conducted by Bohlen et al. (1979, 1996), indicate that the sediment plume resulting from dredging would be temporary, linear in nature, and confined primarily to the dredged area. The modeling results also indicate that the concentration of suspended sediments in the water column would be below the minimum threshold concentrations that would result in sublethal or lethal effects on fish, shellfish, or other marine organisms in the project area. These results suggest that no species or lifestage would be exposed to sublethal or lethal suspended sediment concentrations during dredging regardless of time of year or tidal

conditions. The results also suggest that organisms inhabiting the water column, including anadromous fishes and the American eel migrating through the area, would not be adversely affected by suspended sediments during the proposed dredging operations.

NOAA Fisheries commented on Weaver's Cove Energy's methods for determining the minimum effect threshold for certain fish species, noting that these data are not available for many species. NOAA Fisheries suggested that it would be more appropriate to evaluate behavioral response thresholds such as avoidance and increased swimming activity than sublethal thresholds, and specifically cited studies by Wildish and Power (1985) and Chiasson (1993). Wildish and Power conducted laboratory experiments with smelt to determine if smelt are capable of avoiding suspended sediments. They found that smelt exhibited an avoidance response to suspended sediment levels above 20 mg/L. Chiasson's study investigated the potential for suspended sediments (concentrations ranging from 0 to 40 mg/L) to modify natural movements or migration patterns of rainbow smelt in a laboratory. The results of this study indicated that:

- fish did not attempt to flee at higher concentrations of suspended sediment;
- fish were not fatigued by increases in the amount of suspended sediment; and
- the effects of inert suspended sediment on smelt are probably sublethal.

However, the results of the study also indicated that rainbow smelt were more active at higher levels of suspended sediment. Chiasson (1993) interpreted this as an "alarm reaction" but noted that the fish showed no preference for direction of flight. Chiasson (1993) concluded that smelt may not use the current gradient to determine a specific direction of flight in the presence of above normal concentrations of suspended sediments. However, movement downstream or upstream from a point source of suspended sediment are two possible strategies that would enable fish to reduce or eliminate this source of stress. These studies, while conducted under laboratory conditions, suggest that fish may respond in their natural environment to suspended sediment concentrations that are well below sublethal concentrations through behavioral responses such as avoidance or increased swimming activity.

Some agencies questioned the validity of the modeling results and recommended that a timing restriction be required to avoid silt-producing activities during upstream (between March 1 and July 31) and/or downstream (between June 15 and October 31) fish migrations. Weaver's Cove Energy's revised modeling of the proposed dredging segments using an open bucket indicated that in any single hour, dredging would induce a suspended sediment plume with a concentration of 15 to 66 mg/l above background if scow overflow is allowed and a concentration of 9 to 33 mg/l above background if scow overflow is not allowed.[12] If a closed bucket is used, the resulting concentration of the dredging induced sediment plume would likely be lower than 20 mg/l. The modeling also indicates that the plume would only extend over 25 percent of the width of the river. Additionally, even though instream activities could cause migrating fish to avoid the navigation channel, other portions of the Taunton River would continue to be available for passage. Therefore, we do not believe that restricting dredging to avoid impacts on anadromous fish is necessary. Nonetheless, the COE could require an anadromous fish timing restriction as a condition of Weaver's Cove Energy's section 404 permit, if issued. We note, however, that requiring Weaver's Cove Energy to adhere to a timing restriction prohibiting instream work during fish migration periods would have considerable implications on the proposed dredging schedule (see section 3.6.2).

[12] As discussed in section 4.3.2, Weaver's Cove Energy assumed the background TSS concentration in the Taunton River is about 11 mg/L. We believe this is reasonable based on review of monthly TSS concentration data collected within the Taunton River during a study completed between 1988 and 1990.

In regards to the effects of sediment deposition, the results of the SSDOSE modeling indicated that no life history stage of any species except winter flounder eggs would be exposed to the minimum effects threshold during dredging regardless of time of year or tidal conditions.

The preliminary SSDOSE model results were based on published literature which suggested that winter flounder spawn between January and April, primarily in water depths of less than 5 meters, and the minimum effects threshold for winter flounder eggs would be an accumulation of 1 millimeter of sediment deposition over a period of 21 days or less (the average duration of the incubation period). After reviewing preliminary results of the suspended sediment model, including the input values and assumptions, NOAA Fisheries recommended Weaver's Cove Energy revise the model parameters that were used for winter flounder. Specifically, NOAA Fisheries recommended that Weaver's Cove Energy rerun the model using the following assumptions: winter flounder may use depths up to 8 meters as suitable spawning habitat in the Taunton River and Mount Hope Bay; lethal effects on winter flounder eggs may result from as little as 0.5 millimeter of sediment deposition; and winter flounder egg development could take as long as 40 days. NOAA Fisheries also requested that Weaver's Cove Energy use an assumed bucket loss rate (of sediment during dredging) of 2 percent.

Based on our review of literature and research being conducted in the project area, we conclude that NOAA Fisheries' recommendations are conservative and tend to overestimate potential impacts. For example, although Bigelow and Schroeder (1953; as cited in Pereira et al., 1999) reported that winter flounder spawn in waters as deep as 45 to 73 meters, Pereira et al. (1999) reported that the spawning at these greater depths occurs in stocks on Georges Banks, and most probably, on Nantucket Shoals. According to Pereira et al. (1999) the winter flounder on Georges Bank tend to grow larger and at a faster rate, have different fin ray counts, and different movement patterns than those residing inshore. Moreover, most of the fish tagged on Georges Bank stay on the Bank and almost no fish moved away from coastal areas to Georges Bank (Lux et al., 1970). Lux et al. (1970) indicated that the fish from Georges Bank are clearly separate from those in inshore areas but were unable to determine whether these differences could be attributed to temperature or other factors. Regardless, we believe this research suggests that the spawning depths of the winter flounder on Georges Bank differ from the spawning depths of winter flounder in inshore areas, where winter flounder spawning appears to generally occur in waters less than 6 meters deep. Thus we believe modeling results based on an 8 meter spawning depth are overly conservative.

With respect to egg development, several researchers and NOAA Fisheries have noted an inverse relationship between winter flounder egg incubation time and water temperature. NOAA Fisheries also commented that hatching can be protracted for up to 40 days in a laboratory setting. Williams (1975) indicated that the hatching of winter flounder eggs can be protracted by cold water temperatures and reported that on average winter flounder eggs hatch or die in 38.6 days when held at 0° C. However based on our review of studies by Pereira et al. (1999) and Rogers (1976) and consultations with Grace Klein-MacPhee, who has studied winter flounder egg development in the Providence River, it appears that winter flounder eggs typically develop in less than 25 days and perhaps less than 21 days even at cold temperatures. Grace Klein-MacPhee indicated that incubation of winter flounder eggs only extends to as much as 30 days when water temperatures are less than 0° Celsius (C) for an extended period of time, which generally does not occur in the project area (Klein-MacPhee, 2004). The premise that prolonged water temperatures at or below 0° C is rare in the project area is also supported by our review of water temperature data collected at Fall River and in the Providence River (NOAA, 2004c). Based on data collected at a depth of 2.05 meters below MSL from the south end of the State Pier in Fall River between October 1999 and December 2004 and at a depth of 1.5 meters below MSL in the Providence River from September 1995 to December 2004, temperatures at or below 0° C occurred only three times during the recording period. In 2000, the average daily water temperature was at or below 0° C for 9 days at Fall River and 2 days in the upper Providence River. In 2003 and 2004, the average water temperatures were

at or below 0° C for 10 days and 23 days, respectively, in Fall River and 2 days and 7 days, respectively, in the Providence River. These data indicate that the coldest temperatures that have been shown to prolong incubation periods upwards to 40 days are typically limited to relatively short periods during late January and early February. Additionally, given that water temperatures increase through late winter and early spring (March through May) and the incubation period progressively decreases, we believe NOAA Fisheries position that the modeling should assume winter flounder development takes 40 days in the project area is overly conservative.

The potential for resuspended sediment to impact fish eggs and larvae depends upon the species, the concentration of particles, and the duration of exposure. Demersal eggs such as those of the winter flounder may be partially or completely covered by fine particles that settle back to the bottom. Buried eggs may result in a slower exchange of oxygen between the water and egg and thus slow development or cause eggs to experience higher mortality rates (Wilbur and Clarke, 2001). Recent studies in the Providence River suggest that winter flounder eggs and larvae exposed to increased levels of sediment adjacent to dredging operations survived at statistically similar rates to controls (Klein-MacPhee et al., 2005). In related studies, winter flounder eggs were buried at various depths ranging from 0.5 to 6 egg diameters in fine-grained clean and contaminated sediment (Berry et al., 2005). Hatching success decreased and incubation period increased with increasing burial depth in clean sediment. The results with contaminated sediment were complicated by low control survival but eggs buried to 0.5 diameter had survival rates similar to the controls. Overall, the results indicated that winter flounder eggs may be more resistant to sediment burial than previously thought.

The bucket loss rate assumed in Weaver's Cove Energy's original modeling (0.66 percent) was based on data reported from a study conducted in Boston Harbor. The dredged sediments from the Boston Harbor Navigation Improvement Project consisted of 2 feet of maintenance silts and 1 foot of overdredge material composed of relatively stiff clays (Hayes et al., 2000). The majority of materials dredged during the study period consisted of maintenance silts (Hayes, 2004a) with physical properties similar to the sediments that would be dredged for the Weaver's Cove LNG Project. As noted in Weaver's Cove Energy's modeling report (ASA, 2003), 10 of the 12 maintenance silt sampling stations analyzed for the Boston Harbor Navigation Improvement Project contained sediments that were composed of 69 to 95 percent fines (silt plus clay). In comparison, grain-size data for the Weaver's Cove LNG Project ranged from 67 to 93 percent fines. Further, since scow overflow was not allowed during dredging for the Boston Harbor Navigation Improvement Project, the only source of additional suspended solids was the open or closed buckets that were used for the dredging.

Additionally, the suspended sediment monitoring conducted by Hayes et al. (2000) occurred within 5 to 20 meters of the bucket, so measured turbidity and TSS values had not been diluted to any significant degree. The modeling originally conducted by Weaver's Cove Energy included a scenario that used a bucket loss rate of 1.32 percent (or twice the bucket loss rate of 0.66 percent). This value was used to: 1) account for "unknown factors such as operator control and debris problems," and 2) estimate the potential affect of scow overflow on suspended solids concentrations. As described in the modeling report and confirmed by Hayes (2004a), the use of suspended solids concentrations that are double the bucket loss rate is an acceptable means of obtaining an initial estimate of the potential effects of scow overflow. Accordingly, we believe that Weaver's Cove Energy's original bucket loss rate is a reasonable estimate and the use of a 2 percent loss rate in the model runs as recommended by NOAA Fisheries is overly conservative.

Taking into account the conservative nature of NOAA Fisheries' comments, Weaver's Cove Energy reran the suspended sediment model and reassessed the model results based on NOAA Fisheries' recommendations (i.e., all areas up to 8 meters deep could be winter flounder spawning habitat, the potential for impacts on winter flounder eggs could result from the deposition of 0.5 millimeter of

sediment, and a loss rate of 2 percent[13]). Based on the results of the sediment characterization study and the revised modeling of suspended sediment, we reported the following potential impacts of dredging on aquatic organisms and habitats in the draft EIS:

- Mobile species and life stages would burrow out of any accumulation that results from the redeposition of sediments;
- The deposition of sediments would be below the threshold for sublethal effects of windowpane, black sea bass, scup, and summer flounder;
- The deposition of sediments could impact winter flounder eggs depending on the equipment used and the time of year dredging is conducted;
- If a 26 cubic yard open bucket is used for dredging during the spawning period and the scows are allowed to overflow when being filled with the dredged material, up to 144 acres of winter flounder egg habitat could be affected;
- If a 26 cubic yard open bucket is used for dredging during the spawning period and the scows are not allowed to overflow when being filled with the dredged material, approximately 29 acres of winter flounder egg habitat could be affected; and
- If a 26 cubic yard closed bucket is used for dredging during the spawning period and the scows are not allowed to overflow when being filled with the dredged material, no winter flounder egg habitat would be affected. We note, however, there is some potential for sediment release when using a closed bucket due to entrainment of large debris that can interfere with bucket closure.

After reviewing the revised modeling results, NOAA Fisheries, DMF, EPA, and other resource agencies continued to express concern about the potential impacts of the project on winter flounder spawning habitat within Mount Hope Bay and the Taunton River. According to the agencies, winter flounder impacts are of particular concern since existing winter flounder populations are stressed and substantially below historic levels, despite extensive agency efforts to improve winter flounder population size. As a result, these agencies recommended that Weaver's Cove Energy implement additional mitigative measures to avoid or minimize impacts on aquatic resources. To address these concerns, Weaver's Cove Energy revised its proposed dredging program to include the following:

- use of a 15 cubic yard open bucket to dredge the stiffer and coarser grained native material from the turning basin;
- use of a closed or "environmental" bucket to dredge depositional sediments (i.e., for dredging all areas except the native sediments in the turning basin);
- dredging would be conducted by working in a line parallel to the river flow during the upstream anadromous fish run;
- a time-of-year restriction would be implemented to prohibit dredging in the turning basin during February, March, and April; and
- no significant scow overflow would be allowed in any area or during any season.

[13] Initially, Weaver's Cove Energy did not rerun the model assuming a 40 day winter flounder egg development period, as requested by NOAA Fisheries.

Weaver's Cove Energy's modeling results indicate that the above mitigative measures would eliminate the majority of indirect winter flounder impacts associated with dredging. Only the 15 cubic yard open bucket proposed for dredging native sediments in the turning basin would result in deposition of greater than 0.5 mm of sediment over winter flounder eggs. The area of suitable habitat in water depths up to 8 meters that would be affected by this deposition over a 21-day period (assuming a sediment loss rate of 0.66 percent using an open bucket and no scow overflow and a sediment loss rate of 0.22 percent using a closed bucket and no scow overflow) would be about 6.2 acres.[14]

In addition to the potential for indirect impacts on winter flounder egg habitat, dredging would also have a direct impact on winter flounder egg habitat as the result of expanding the turning basin. The existing turning basin would be expanded from 33 acres to 54 acres and deepened to a depth of 41 feet to accommodate the maneuvering of LNG ships. Of the 21-acre expansion area, approximately 11 acres are currently less than 25 feet (8 meters) deep and could potentially provide suitable winter flounder spawning habitat. Dredging of these areas in May during the spawning period would likely injure or kill winter flounder eggs in the turning basin expansion area. Dredging of the trench for the pipeline across the Taunton River could also damage or destroy any winter flounder eggs that are present during the dredging operations.

NOAA Fisheries and other agencies have acknowledged that the recent mitigation proposed by Weaver's Cove Energy would reduce impacts on winter flounder habitat. However, these agencies continue to have concerns regarding the modeling results. In particular, some agencies maintain that the revised modeling underestimates impacts on winter flounder. Although we disagree, we also recognize that winter flounder is a valuable and highly stressed resource within the project area. We also acknowledge that while the proposed mitigation substantially reduces impacts, it does not eliminate all potential effects of dredging on winter flounder. We also note that the COE, as the lead regulatory agency over dredging and other riverbed disturbing activities, has indicated that it will likely require additional mitigative measures to avoid or minimize impacts on winter flounder within the Taunton River and Mount Hope Bay as a condition on any section 404 permit issued for the project. For these reasons and because NOAA Fisheries has submitted EFH conservation recommendations that additional mitigation is needed to reduce the impact of dredging on winter flounder, **we recommend that:**

- **Weaver's Cove Energy modify its proposed dredging program and pipeline construction plans within the Taunton River to prohibit any silt-disturbing construction activities during the winter flounder spawning period (January 15 through May 31). In addition, Weaver's Cove Energy should continue to consult with federal and state agencies and develop a mitigation plan to offset permanent loss of winter flounder spawning and juvenile development habitat resulting from expansion of the turning basin. The revised dredging plan and the winter flounder habitat mitigation plan should be submitted to the FERC prior to dredging.**

We received comments on the draft EIS indicating that the Massachusetts Waterway Act (310 CMR 9.40(2)(a)) prohibits dredging activity between March 15 and June 15 except upon determination by the DMF that a project would not have adverse effects on aquatic resources. We believe that our above recommendation in conjunction with Weaver's Cove Energy's proposed mitigative measures would adequately meet the intent of this law and would sufficiently protect the aquatic resources, including anadromous species, in the Taunton River and Mount Hope Bay.

[14] The use of a 21-day developmental window as a modeling parameter seems appropriate when discussing impacts since Weaver's Cove Energy would not dredge in the turning basin between February and April, which constitutes most of the winter flounder spawning period.

Implementation of timing restrictions to avoid the winter flounder spawning period and/or other sensitive fish periods could affect the proposed 3-year construction schedule for the project. Any restrictions that reduce the amount of dredging days or the rate of dredging could potentially prolong the construction schedule beyond 3 years. Weaver's Cove Energy has indicated that a timing restriction to avoid dredging during the winter flounder spawning period (January 15 to May 31) would make it highly unlikely that the necessary dredging would be completed within a 3-year period. Prolonging the construction schedule could have additional environmental impacts such as noise, air emissions, traffic, and visual impacts related to the construction activities. Section 3.6.2 provides additional discussion of implications of timing restrictions on Weaver's Cove Energy's proposed schedule.

LNG Terminal Construction and Operation

LNG Terminal Construction Activities

As discussed in section 4.3.2, stormwater runoff from the construction site and placement of fill into the Taunton River could increase suspended sediment and turbidity levels near the site. Disturbance near the water's edge by construction equipment and the resulting temporary increase in turbidity could lower fish usage in the immediate vicinity of the site. However, the shoreline along the proposed site has been previously disturbed and man-made shoreline is abundant along the river near the site. Thus, fish affected by construction would likely utilize similar habitats upstream and downstream of the proposed site.

The removal of the existing pier structure and replacement by a new ship unloading facility could also result in increased turbidity in the water column and temporarily reduce fish usage of the area. Additionally, piles driven into the riverbed to support the new ship unloading facility would permanently affect about 800 square feet of benthic habitat. However, piers and other structures are present upstream and downstream of the proposed site and fish disturbed by construction activities at the site would likely use the nearby structures for habitat. Also, although there would be a temporary loss of structural habitat during the period between removal of the existing structure and completion of the new unloading facility; the habitat lost from removal of the existing pier would likely be replaced and perhaps supplemented with development of the new facility. Fish using the benthic habitat in the area would likely relocate to similar nearby areas and fish requiring structural habitats may become more abundant following construction of the new unloading facility.

Direct spills of petroleum products into the Taunton River from dredging or other construction equipment could be toxic to fish. To reduce the potential for direct surface water contamination during construction and dredging, Weaver's Cove Energy would implement both onshore and offshore SPCC Plans. These plans would include provisions that prohibit the storage of fuel and other potentially toxic materials within specified distances of waterbodies and procedures for refueling equipment designed to minimize potential spills. These plans would also outline procedures for containing, cleaning up, and reporting spills.

Hydrostatic Testing

Weaver's Cove Energy has indicated that its preference is to obtain hydrostatic test water from the City of Fall River. If the City does not allow Weaver's Cove Energy to use its water, Weaver's Cove Energy may withdraw up to about 33 million gallons of water from the Taunton River to hydrostatically test the LNG storage tank and pipelines. If water is appropriated from the Taunton River to hydrostatically test the LNG storage tank, Weaver's Cove Energy would attach a temporary 12- to 14-inch-diameter pipe to the newly constructed pier. The intake pipe would be set at a depth of 5 feet below MLLW and would be fitted with a fine mesh screen to minimize potential entrainment and impingement

of aquatic organisms. Weaver's Cove Energy estimates that the appropriation rate would be between 5,000 to 7,000 gpm. The withdrawal of river water for hydrostatic testing would not likely entrain adult fish since the water intakes would be screened as required by the FERC Procedures. However, the screens would not necessarily prevent the entrainment and/or impingement of larvae and eggs, particularly if the withdrawal hose is positioned in the water column where a preponderance of larvae or eggs are present (e.g., at the bottom of the waterbody when demersal eggs are present). Hydrostatic test water withdrawals would be conducted in accordance with the FERC Procedures and applicable state permits, which would take into account timing and position of the intake. As such, impacts on aquatic resources within the Taunton River would be minimized.

The hydrostatic test water would not require pre-treatment and no chemical additives (e.g., biocides or neutralizing agents) would be mixed with the water during the test or prior to discharge. After the hydrostatic testing is completed, Weaver's Cove Energy is proposing to discharge the test water directly into the Taunton River over a period of several days. The water would be filtered prior to discharge and would be returned at a rate and location that would minimize bottom disturbance and potential impacts on aquatic resources.

LNG Ship Ballast Water

The entrainment or impingement of larvae and eggs could also occur during operation of the LNG terminal when ballast water would be withdrawn from the river by ships during offloading of LNG. Weaver's Cove Energy has estimated that up to 70 ships would offload LNG at the proposed facility annually. The ballast water would be pumped at a maximum rate of about 16,000 gpm and an average rate of about 12,000 gpm over a 12- to 16-hour period. The intake aperture on the ships would be about 25 to 30 feet below the water surface. Assuming a maximum water withdrawal of about 14 million gallons per ship, a total of about 980 million gallons of water could be withdrawn each year from the river for ship ballast. These withdrawals could entrain and/or impinge larvae and eggs, particularly if the withdrawals occur where a preponderance of larvae or eggs are present. Impacts attributable to impingement mortality and entrainment include losses of early life stages of fish and shellfish, reductions in forage species, and decreased recreational and commercial landings (EPA, 2004d).

To estimate of the numbers of eggs and larvae that could be entrained through ballast water intake associated with LNG ships offloading at the proposed LNG terminal, we reviewed ichthyoplankton data collected over several years by MRI in Mount Hope Bay and the Taunton River that studied the effects of the Brayton Point Power Plant. As shown in table 4.6.2-1, the ichthyoplankton intake rates were translated to age-1 equivalents by multiplying by survival rate to the end of the first year. Estimates of survival rates for eggs and larvae were adopted from the 316(b) Case Studies, Part F Brayton Point, Appendix F1 (EPA, 2002c). Expressing impingement mortality and entrainment losses as age-1 equivalents is an accepted method for converting losses of all life stages into individuals of an equivalent age, accounting for the fact that most eggs and larvae do not normally survive, and providing a standard metric for comparing losses among species and years (EPA, 2004d). However, it is also important to recognize that precise quantification of the nature and extent of impacts to populations and ecosystems is difficult and that ichthyoplankton densities are difficult to interpret because natural mortality rates are high and few eggs or larvae typically survive to adulthood in nature.

TABLE 4.6.2-1

Estimated Annual Ichthyoplankton Numbers Potentially Entrained by Ballast Water Intakes from LNG Ships on the Taunton River a/

Species	Eggs	Larvae	Age-1 Equivalents
Atlantic Silverside	2,620	46,200	20
Bay Anchovy	5,770,000	0	269
Butterfish	29,600	8,420	5
Scup	16,200	12,900	12
Tautog	6,440,000	448,000	65
Weakfish	7,650	7,430	< 1
Windowpane Flounder	70,600	79,800	9
Winter Flounder	13,300	1,297,250	2,855
Total:	12,349,970	1,900,000	3,325

a/ The estimates assume that 70 ships would offload at the facility annually and each ship would take on about 14 million gallons of ballast water during the unloading operations.

The above estimates indicate that annual ballast water withdrawals could result in the loss of up to 3,325 age-1 equivalent fish per year, of which about 86 percent would be winter flounder. The percentage of winter flounder age-1 equivalents estimated to be entrained in the LNG ship ballast water is similar to the percentage estimated to be entrained in cooling water at Brayton Point Power Plant in Mount Hope Bay (82 percent). However, as discussed in section 4.13, water withdrawals at the power plant result in substantially more loss of fish eggs and larvae on an annual basis than ship ballasting. While these estimates provide some indication of potential impacts associated with withdrawals for ship ballasting, it is important to note that the potential for entrainment or impingement of ichthyoplankton during withdrawals for ship ballast would depend on a variety of factors, including but not limited to the time of year and the distribution of the ichthyoplankton within the water column relative to the intakes for the ballast water.

LNG ships calling from international ports could potentially introduce aquatic invasive species into U.S. waters. Alternatively, visiting LNG ships could transport native species to other parts of the world. Although the potential for this to occur cannot be entirely eliminated, several factors, both general and specific to the project, tend to mitigate this potential impact.

Weaver's Cove Energy has indicated that the LNG ships would not discharge ballast water into the Taunton River or Mount Hope Bay. However, LNG ships calling from international ports could still potentially introduce aquatic invasive species into U.S. waters. Alternatively, visiting LNG ships could transport native species to other parts of the world. Although the potential for this to occur cannot be entirely eliminated, several factors, both general and specific to the project, tend to mitigate this potential impact. First, because no LNG ship ballast water would be discharged in the proposed project area, the potential to spread invasive aquatic species is significantly reduced. Second, the LNG ships that would visit the proposed terminal would arrive from ports located primarily throughout the Atlantic region, which is also where the project is located. Third, Fall River is not a new port and ships of all types originating from different ports have and will continue to visit Narragansett Bay and enter Mount Hope Bay and the Taunton River.

Considerable effort and resources are being applied to minimize the movement of non-indigenous species around the globe by the marine industry. In February 2004, a new international convention to prevent the potentially devastating effects of the spread of harmful aquatic organisms carried by ship ballast water was adopted by the IMO, the United Nations agency responsible for the safety and security of shipping and the prevention of marine pollution from ships. The convention requires all ships to

implement a Ballast Water and Sediments Management Plan. All new ships will have to possess a Ballast Water Record Book and will be required to carry out ballast water management procedures to a given standard. Existing ships will be required to do the same, but after a phase-in period. With the adoption of this convention, the IMO has made global provisions to control and manage ballast water and thus prevent, minimize, and eliminate the transfer of harmful aquatic organisms and pathogens.

The Coast Guard has developed responses to exotic invasive organisms associated with foreign vessels. The Coast Guard Office of Operating and Environmental Standards developed Mandatory Practices for All Vessels with Ballast Tanks on All Waters of the United States. The mandatory practices include requirements to:

- rinse anchors and anchor chains during retrieval to remove organisms and sediments at their place of origin;
- remove fouling organisms from hull, piping, and tanks on a regular basis;
- and dispose of any removed substances in accordance with local, state, and federal regulations.

The Coast Guard has also implemented a Shipboard Technology Evaluation Program to encourage ship owners and operators along with technology developers to develop prototype treatment systems. To support investment in new technology, experimental treatment systems that function as designed may be deemed to meet future ballast water standards for up to the life of the treatment system or the life of the ship.

The Northeast Aquatic Nuisance Species Panel with its Ballast Water Committee is a regional committee of the Federal Aquatic Nuisance Species Task Force. The task force is an intergovernmental organization dedicated to preventing and controlling the introduction and spread of aquatic nuisance species by implementing the Non-indigenous Aquatic Nuisance Species Prevention and Control Act of 1990, which was amended in 1996 as the National Invasive Species Act.

In February 2005, the Ballast Water Management Act of 2005 was introduced to Congress to amend the Non-indigenous Aquatic Nuisance Prevention and Control Act to establish vessel ballast water management requirements. All ships entering U.S. ports would be required to have on board an aquatic species management plan outlining actions to minimize the transfer and introduction of invasive species. The Act details ballast water exchange requirements and subject to an implementation schedule ships will be required to treat ballast water prior to discharge in U.S. waters. Treated ballast water will be required to achieve minimum concentrations of planktonic organisms and indicator microbes.

We believe the measures and efforts described above would minimize the potential for the introduction of non-indigenous attached organisms via LNG ship hulls or the potential to introduce planktonic and nektonic organisms via ballast water into the Taunton River, Mount Hope Bay, or Narragansett Bay.

LNG Ship and Tug Prop Wash

During operation of the LNG terminal, prop wash and other hydraulic effects from LNG ships and tugs could also temporarily increase suspended sediments and turbidity within the navigation channel and turning basin. As a vessel navigates through a waterway, it generates hydraulic disturbances in the form of waves and currents, mainly drawdown, return current, slope supply currents, wash waves, and jet wash (Wolter and Arlinghaus, 2003). These activities have the potential to resuspend sediments resulting

in impacts similar to those for dredging plumes and the subsequent deposition of those sediments described elsewhere in this section.

Impacts associated with prop wash would occur more frequently than dredging because as many as 70 ships may berth at the terminal annually. Prop wash could affect the substrate within and adjacent to the navigation channel and could limit the recolonization of benthic species in those areas. Potential indirect effects of vessel movement through the waterway could include disturbances preventing fish from nest guarding (Mueller, 1980; cited in Wolter and Arlinghaus, 2003) or feeding (Barrett et al., 1992; cited in Wolter and Arlinghaus, 2003) and dislodgement of eggs and redistribution of eggs and larvae in less suitable habitats (Hofbauer, 1965; Jude et al., 1998; cited in Wolter and Arlinghaus, 2003). Dislodgement and redistribution of eggs into less suitable habitats could lower the reproductive success of affected fish species. Weaver's Cove Energy has not proposed any mitigative measures to avoid or minimize impacts as the result of prop wash.

Modeling was conducted for the Boston Harbor Navigation Improvement Project to assess the effect of ship passage on the resuspension of surficial sediments in the federal ship channels (COE, 1995). The modeling was developed based on the post-dredging dimensions of the channel and information collected during interviews with pilots regarding the operation of various types of vessels. The analysis modeled the effects of a number of vessels including an LNG ship, a container ship, a 41,000-displacement-weight tanker, an ocean tug, and a harbor tug. The modeling assumed a channel depth of 45 feet and varying vessel drafts from 12 to 42 feet. The study concluded that silt, the predominant grain-size of the surficial sediments assessed in the model, can be resuspended by currents as slow as 0.65 ft/sec. The study also found that bottom velocities generated by cargo vessels passing at slow speeds through the harbor can exceed this value up to 1,312 feet astern of the vessel and that tugs can generate bottom velocities above this value up to 656 feet astern of the vessel. Turning areas were found to be particularly susceptible to resuspension of sediments as the result of ship passage. The results indicated that the surficial sediments in the federal ship channels and berth areas are subject to resuspension during virtually every ship passage.[15] However, the results also indicated that ship-induced bottom velocities dissipate rapidly following the passage of the ship and that sediments resuspended by these currents settle back to the substrate after being transported relatively short distances (COE, 1995).

Following completion of the Boston Harbor Navigation Improvement Project, the COE conducted additional studies to monitor the effect of deep-draft vessel movement on the resuspension of bottom sediments (Science Applications International Corporation (SAIC), 2000, 2001). These studies used static and mobile monitoring techniques to evaluate the impact of the passage of an LNG ship (*Matthew*) on bottom sediment resuspension from the confined aquatic disposal (CAD) cells along a portion of the Mystic River downstream of the Distrigas LNG facility as well as material resuspended from other parts of the channel. CAD cell M8-11 was not capped with coarse-grained sediment during these monitoring studies. Therefore, the data for the area surrounding this cell should provide reasonable estimates of the potential resuspension of the fine-grained sediments along the Taunton River, although prop wash and other hydrologic effects associated with the Weaver's Cove LNG Project could be somewhat greater because, due to the depth of the channel and the drafts of the various sized LNG ships, the LNG ships calling on the proposed LNG terminal could have less clearance between the hull and the river bottom than was the case in the COE study. The COE also observed near-bottom sediment plumes and conducted TSS monitoring at two other locations within the Mystic River navigation channel south of the Inner Confluence.

[15] Once suspended, fine-grained sediments may be more susceptible to resuspension as other ships pass through the channel (Schoellhamer, 1996).

Depending on the monitoring location and the speed of the LNG ship as it passed the monitoring location, the near-bottom plume widths ranged from about 33 to 164 feet. Near the CAD cell, TSS levels extending up to about 7 feet above the channel bottom ranged from 350 mg/l as measured along the channel bottom at the time of ship passage to 40 mg/l about 3 minutes after ship passage as measured along transects perpendicular to the channel within the plume area. At the Inner Confluence, suspended sediment concentrations in the plumes ranged from 18 to 24 mg/l, almost one-half the levels observed near the uncapped CAD cell. The elevated TSS concentrations returned to near-background levels within about 7 minutes after the ship passed the static monitoring equipment at the bottom of the channel, and were found to have returned to background levels 1 hour after ship passage as measured by the mobile monitoring technique (SAIC, 2000 and 2001).

Based on observed TSS levels in the vicinity of CAD cell M8-11, the authors conservatively estimated that as much as 2.6 cubic yards of sediment could have been mobilized by passage of the LNG ship. Due to the generally slow near-bottom currents (about 0.16 ft/sec) in the Mystic River study area, the authors further estimated that the suspended sediments could have been moved a distance of about 590 feet in 1 hour (SAIC, 2000). These studies demonstrate that sediment resuspension due to passage of deep-draft vessels can mobilize bottom sediments, but the volume of sediment resuspended is relatively small and the sediments are not transported far from their original locations. Ship movements within a navigation channel result in short-term water quality effects that generally dissipate within 1 hour of the vessel passing any particular point along the channel.

The potential for resuspended sediment to impact fish eggs and larvae depends upon the species, the concentration of particles, and the duration of exposure. Demersal eggs such as those of winter flounder may be partially or completely covered by fine-grained sediments as they settle back to the bottom. This may slow the exchange of oxygen between the water and egg and, therefore, slow development or cause eggs to experience higher mortality rates (Wilbur and Clarke, 2001). Exposure to high levels of TSS (between 200 and 500 mg/L) for durations of less than 24 hours has been shown to reduce feeding rates in some fish larvae (Breitburg, 1988). In general, however, exposure to increased turbidity for periods of less than 1 day appears to have little measurable effect on pelagic fish eggs and larvae (Kiorboe et al., 1981; Wilbur and Clarke, 2001).

Based on the results of the Boston Harbor studies, the increased TSS levels resulting from LNG ship passage could result in reduced feeding rates for some fish larvae along the Taunton River navigation channel. However, we expect there would be minimal impact from elevated TSS levels on most pelagic fish eggs and larvae because TSS concentrations should return to background conditions within 1 hour or less of ship passage. The measured widths of the resuspended sediment plumes in the Boston Harbor studies (33 to 164 feet wide at 7 feet above the channel bottom) suggest that the plumes would generally remain within the Taunton River navigation channel, which ranges from about 400 to 800 feet in width. Based on the initial monitoring in the Mystic River, the sediment plume did not rise above mid-water elevations (i.e., the plume was not observed at the water surface, and monitoring equipment indicated a maximum water column elevation of about 20 feet above the channel bottom). The dimensions of the monitored plumes in Boston Harbor suggest that impacts to demersal fish eggs and larvae outside the channel by remobilized sediments in the Taunton River and Mount Hope Bay would likely be limited.

Pipeline Construction and Operation

Weaver's Cove Energy proposes to cross all waterbodies along the proposed pipeline routes using the open-cut construction method. In general, pipeline construction results in temporary impacts on streams and rivers, and there are no long-term effects on water temperature, pH, dissolved oxygen, benthic invertebrate populations, or fish populations (Vinkour and Shubert, 1987; Blais and Simpson, 1997). Some potential impacts on fishery resources, such as sedimentation and turbidity, destruction of

stream bank cover, introduction of water pollutants, or entrainment of fish could result from construction activities. Overall, the impact of construction on fish and other aquatic organisms is expected to be localized and short term. To minimize these potential impacts, Weaver's Cove Energy would adhere to the protective measures outlined in the FERC Procedures. Other federal, state, or local agencies may require Weaver's Cove Energy to implement additional protective measures. Impacts on the Taunton River from activities associated with installing the Western Pipeline across the river (i.e., dredging a trench, installing the pipe, and backfilling the trench) would be similar to the effects of dredging as previously described for the LNG terminal.

Sedimentation and Turbidity

Increased sedimentation and turbidity as the result of construction activities have the greatest potential to adversely affect fishery resources. Sedimentation is known to bury demersal fish eggs, while turbidity affects juvenile and adult fish by reducing oxygen uptake by the gills. In-stream turbidity levels generally increase during construction but decrease rapidly after construction activities are completed (Vinkour and Shubert, 1987; Blais and Simpson, 1997). Turbidity also reduces photosynthesis of aquatic vegetation, which results in reduced dissolved oxygen levels in the water column.

Standard open-cut crossing techniques as proposed for this project could elevate the concentration of suspended solids, but the elevated levels would be high for relatively short periods and short distances downstream of the stream crossing. In addition, increased sedimentation may affect fish nesting sites and areas where eggs and young fry concentrate, and may reduce access to some food sources. In the immediate area of disturbance, if construction occurs during the spawning period or immediately after, fish reproductive activities would be affected due to temporary destruction of spawning areas, disturbances to fish, and reduced egg survival from increased sedimentation. Weaver's Cove Energy would be required by the FERC Procedures to complete most in-stream work within a 24-hour period at each minor waterbody. Therefore, impacts would be temporary, and suspended sediment concentrations would be expected to return to preconstruction levels soon after construction in each stream is completed.

Impacts on fisheries from construction-induced sedimentation and turbidity would be reduced to short-term, temporary disturbances if the measures contained in the FERC Procedures are followed. For the 10 waterbodies less than 50 feet wide, trench spoils would be stored on or above the stream banks. Waterbodies would be protected with silt fence, hay bales, or other erosion control devices that would minimize the potential for sediment-laden water to enter the stream. Additionally, in accordance with the FERC Procedures, all staging areas would be located at least 50 feet back from the water's edge where topographic conditions permit (unless otherwise permitted). This setback distance reduces the loss of riparian vegetation and minimizes the potential for erosion and sedimentation along the stream banks.

Loss of Cover

Stream bank vegetation, in-stream logs and rocks, and undercut banks provide important cover for fish. Some in-stream and shoreline cover would be altered or lost at open-cut stream crossings, and fish that normally reside in these areas would be displaced. However, these effects would be relatively minor because of the small area affected at each stream. In addition, the FERC Procedures limit vegetation maintenance on stream banks and require long-term revegetation of all shoreline areas with native herbaceous and woody plant species, except for a 10-foot-wide corridor over the pipelines maintained with herbaceous species.

Minimal impact on fisheries is expected from maintenance mowing or manual removal of woody vegetation in the vicinity of the pipeline rights-of-way. Vegetation control would be conducted solely by mechanical means. No herbicides, which could run off into nearby aquatic resources, would be used.

Other Potential Impacts

Other potential effects of pipeline construction include interruption of fish migration and spawning and mortality from toxic substance (e.g., fuel) spills. Construction may cause temporary emigration of fish populations from the immediate area, and fish movements and migrations upstream or downstream may be temporarily disrupted by construction activities. However, it is unlikely that relocation or disrupted migration would significantly affect diadromous fish populations because construction activities are short term and waterbodies that would be affected by the project are through developed areas and contain limited fish resources.

Direct spills of petroleum products into streams and rivers could be toxic to fish, depending on the type, quantity, and concentration of the spill. To reduce the potential for direct surface water contamination, Weaver's Cove Energy would implement the procedures in its SPCC Plan, including restrictions on refueling equipment and storing fuel and other potentially toxic materials at least 100 feet from waterbodies.

Essential Fish Habitat

The MSA (Public Law 94-265 as amended through October 11, 1996) was established, along with other goals, to promote the protection of EFH in the review of projects conducted under federal permits, licenses, or other authorities that affect or have the potential to affect such habitat. EFH is defined in the MSA as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.

Federal agencies which authorize, fund, or undertake activities that may adversely impact EFH must consult with NOAA Fisheries. Although absolute criteria have not been established for conducting EFH consultations, NOAA Fisheries recommends consolidated EFH consultations with interagency coordination procedures required by other statutes, such as the NEPA, Fish and Wildlife Coordination Act, ESA, or the Federal Power Act (50 CFR 600.920(e)) in order to reduce duplication and improve efficiency. Generally, the EFH consultation process includes the following steps:

1) **Notification** - The action agency should clearly state the process being used for EFH consultations (e.g., incorporating EFH consultation into EIS, section 10 permit, etc.).

2) **EFH Assessment** - The action agency should prepare an EFH Assessment that includes both identification of affected EFH and an assessment of impacts. Specifically, the EFH should include: 1) a description of the proposed action; 2) an analysis of the effects (including cumulative effects) of the proposed action on EFH, the managed fish species and major prey species; 3) the federal agency's views regarding the effects of the action on EFH; and 4) proposed mitigation, if applicable.

3) **EFH Conservation Recommendations** - After reviewing the EFH Assessment, NOAA Fisheries would provide recommendations to the action agency regarding measures that can be taken by that agency to conserve EFH.

4) **Agency Response** - Within 30 days of receiving the NOAA Fisheries recommendations, the action agency must respond to NOAA Fisheries. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. For any conservation recommendation that is not adopted, the action agency must explain its reason to NOAA Fisheries for not following the recommendation.

We consolidated EFH consultations for the Weaver's Cove LNG Project with the interagency coordination procedures required under NEPA. For purposes of reviewing this project under NEPA, the FERC is the lead federal agency and the COE, EPA, NOAA Fisheries, and Coast Guard are cooperating federal agencies (see section 1.4). As such, the FERC requested that NOAA Fisheries consider the draft EIS notification of initiation of EFH consultation. NOAA Fisheries provided comments and conservation recommendations to the draft EIS and the EFH Assessment. Those comments and recommendations are responded to herein.

Managed Fish Species

NOAA Fisheries Northeast Regional Office (National Marine Fisheries Service (NMFS), 2003) EFH designations tables identify potential EFH within the project area for 14 fish species. NOAA Fisheries subsequently reported that 3 of the 14 species (American plaice, Atlantic mackerel, and cobia) are not likely to occur in the project area, while two additional species (little skate and winter skate) should be added to the EFH analysis. None of these managed stocks are endangered or threatened under the ESA. Table 4.6.2-2 summarizes the EFH required by these species by life history stage. This information was primarily obtained from NOAA Fisheries' *Essential Fish Habitat Source Documents* prepared for individual species. The primary categories of EFH for these species include water column, benthic habitats, and man-made structures. Prey for managed fish species comprise a critical component of EFH. Potential effects of the proposed project on these habitats and prey species are discussed below.

TABLE 4.6.2-2

Major EFH Categories for Managed Species in the Project Area

Species/ Life Stage	EFH Characteristics a/	Seasonal Occurrence in Project Area
Windowpane Flounder		
Eggs:	Pelagic; surface waters; < 70 m	April - September
Larvae:	Pelagic; < 70 m	May - September
Juveniles:	Demersal; nearshore bays and estuaries; < 75 m; fine sandy sediment	January - October, December
Adults:	Demersal; nearshore bays and estuaries; < 75 m; fine sandy sediment	Year round
Haddock		
Eggs:	None b/	None
Larvae:	Pelagic; surface waters; 30 - 90 m; 34 - 36 ppt	March - November
Juveniles:	None	None
Adults:	None	April - June
Red Hake		
Eggs:	None	May - September
Larvae:	Pelagic; surface waters; < 200 m; > 0.5 ppt	May - October
Juvenile:	Demersal; < 100 m; 31 - 33 ppt; shell fragments	April - February
Adults:	Demersal; 10 - 130 m; 33 - 34 ppt; sand, mud	Year round
Winter Flounder		
Eggs:	Demersal; 10 - 32 ppt; < 6 m; mud to sand or gravel	January - April
Larvae:	Demersal; 3.2 - 30 ppt; 1- 4.5 m; fine sand, gravel	February - May
Young of Year:	Demersal; 23 - 33 ppt; 0.5 - 12 m; mud to sand with shell or leaf litter	Year round
Juveniles:	Demersal; 19 - 21 ppt; 18 - 27 m; mud, shell	Year round
Adults:	Demersal; 15 - 33 ppt; 1 - 30 m; mud, sand, cobble, rocks, boulders	Year round
Black Sea Bass		
Eggs:	Pelagic; 0 – 200 m	May - October
Larvae:	Demersal; structured inshore habitats	May - November
Juveniles:	Mostly offshore; < 24 m; shell patches, shallow hard bottoms with structure	April - August
Adults:	Demersal; 25 - 30 ppt; 6 - 38 m; rocks, sand, and shell substrates	May - October
Atlantic Sea Herring		
Eggs:	None	October - December
Larvae:	Pelagic; 50 - 90 m; 32 ppt	March - April
Juveniles:	Pelagic and demersal; 15 - 135 m; 26 - 32 ppt	Year round
Adults:	Pelagic and demersal; 20 - 130 m; > 28 ppt; gravel, sand, cobble	Year round
Bluefish		
Eggs:	None	None
Larvae:	None	May - August
Juveniles:	Pelagic; 23 - 33 ppt; 6 - 15 m; shorelines, sand, mud, silt, clay	April - August
Adults:	Pelagic; ocean salinities; not common in bays or larger estuaries	April - September
Scup		
Eggs:	Planktonic; < 50 m; > 15 ppt	April - June
Larvae:	Pelagic; < 50 m; > 15 ppt	May - August
Juveniles:	Demersal; > 38 m; sand, silty sand, mud; > 15 ppt	April - September
Adults:	Demersal; < 30 m; fine to silty sand, mud, mussel beds, rock, other structures; > 15 ppt	April - September
Summer Flounder		
Eggs:	None	None
Larvae:	Pelagic; tidal creeks and creek mouths; 10 - 70 m; 23 - 33 ppt	September - February
Juveniles:	Demersal; lower estuary; flats, channels, salt marsh; 22 - 35 ppt; sandy substrate; mud bottom, shell hash	May - October

TABLE 4.6.2-2 (cont'd)

Major EFH Categories for Managed Species in the Project Area

Species/ Life Stage	EFH Characteristics a/	Seasonal Occurrence in Project Area
Adults:	Demersal; sand; < 25 m; 18 - 35 ppt	May - October
Little Skate		
Eggs:	Demersal; mud, sand, or gravel; < 27 m	June - January
Juveniles:	Demersal; 1 - 65 m; 15 - 35 ppt	April - May, September – November
Adults:	Demersal; 1 - 75 m; 18 - 35 ppt	April - May, September – November
Winter Skate		
Eggs:	Demersal; mud, sand, or gravel	June - January
Juveniles:	Demersal; 1 - 75 m; 15 - 35 ppt	April - May, September - November
Adults:	Demersal; 1 - 75 m; 20 - 33	April - May, September - November
Coastal Migratory Pelagics		
King Mackerel		
Sandy shoals of capes and offshore bars; high profile rocky bottom; coastal inlets; > 30 ppt		
Spanish Mackerel		
Sandy shoals of capes and offshore bars; high profile rocky bottom; coastal inlets; > 30 ppt		

a/ Values presented describe general physical and chemical habitat requirements for the associated life stage. Preferred salinity and depth ranges are in parts per thousand (ppt) and meters (m), respectively.

b/ None - Denotes life stages or species that do not have EFH designated in the project area.

Potential Effects on EFH

The majority of potential impacts of the proposed project on EFH would be similar to those impacts previously described in this section and in section 4.3.2. However, a discussion of those impacts directly related to designated EFH is included below. A summary of the impacts on managed fish species is included in table 4.6.2-3.

TABLE 4.6.2-3

Summary of Potential Impacts on Specific Life Stages of Federally Managed Fish Species

Species/Group	Potential Impacts During Dredging and Trenching			LNG Ship Traffic During Operation
	Suspended Sediments/Turbidity in Water Column	Sediment Deposition a/	Benthic Habitat Alteration	
Windowpane flounder	Eggs, larvae		Juveniles, adults	Eggs, larvae
Haddock	Larvae			Larvae
Red hake	Larvae		Juveniles, adults	Larvae
Winter flounder		Eggs, larvae	Eggs, larvae, juveniles, adults	Eggs, larvae
Black sea bass			Adults	
Atlantic sea herring	Larvae, juveniles, adults		Juveniles, adults	Larvae
Bluefish	Juveniles, adults			
Scup	Eggs, larvae		Juveniles, adults	Eggs, larvae
Summer flounder	Larvae		Juveniles, adults	Larvae
Little skate		Eggs	Eggs, juveniles, adults	Eggs, juveniles, adults
Winter skate		Eggs	Eggs, juveniles, adults	Eggs, juveniles, adults
King mackerel			X b/	
Spanish mackerel			X	
Anadromous Fish (prey)	X		X	X
Shellfish (prey)	X	X	X	X

a/ Juveniles and adults are expected to be physically able to avoid impacts of sediment deposition.
b/ "X" denotes that impacts on species or group are likely to occur, but specific life stages are not designated.

Water Column

The water column in the vicinity of the proposed LNG terminal serves as EFH for various life stages of several species and their prey by providing habitat for spawning, breeding, feeding, growth, and shelter. The managed species that use water column habitats include windowpane flounder, haddock, red hake, Atlantic sea herring, bluefish, scup, and summer flounder. Additionally, prey species for many of these species also occur within the water column. Weaver's Cove Energy's proposal to dredge up to approximately 2.6 million cubic yards of sediments from the federal navigation channel, turning basin, and the pipeline crossing in the Taunton River and Mount Hope Bay would increase the level of suspended sediments and the turbidity of the water. These activities would also potentially release contaminants contained within the sediments into the water column, and reduce dissolved oxygen concentrations by releasing oxygen-demanding materials (decomposing organic materials contained within the sediments).

As previously discussed, the results of Weaver's Cove Energy's sediment sampling indicate that mercury levels exceed ERL, PEL, and ERM criteria in all dredging areas. The 95 percent UCL concentrations of all other compounds are lower than ERM criteria and generally lower than PEL criteria, although the 95 percent UCL concentrations of some PAHs and some metals are higher than PEL criteria between the Braga Bridge and the lower end of the turning basin. Elutriate tests performed on sediment samples collected from the project area indicate that with the exception of zinc and copper, chemicals would remain tightly adsorbed to sediments during dredging, would be below published EPA AL-CMC and AL-CCC levels, and would not be released into the water column in high concentrations.

Seasonal migrations by managed fish species and their prey occur within the Taunton River and Mount Hope Bay. Generally, migratory fish populations can be impacted by increased concentrations of suspended sediments if dredging activities occur during migratory periods. High concentrations of suspended sediment may delay or divert migratory passage and in some instances could cause total avoidance of an area by fish. These potential effects could be exacerbated if the migrating fish are in generally poor condition and under stress by other factors. Disturbance of migratory fish patterns, including disturbance of pelagic prey species migrations, could also adversely affect fish and their ability to find food resources. Decreased foraging success could have physiological effects on fish, including lowered reproductive rates, decreased competitive fitness, and increased risk of mortality.

However, we do not believe that the increased turbidity that would result from this project would significantly disrupt managed migratory fish or their prey. These fish generally ascend rivers when flows (and consequently, turbidity levels) are high. Thus these fish are quite tolerant of high turbidity conditions. Additionally, as Weaver's Cove Energy's modeling indicates, the TSS levels associated with suspended sediment plumes are expected to be far below the levels migrating fish can tolerate. Moreover, the sediment plumes are not expected to encompass the width of the entire river, thus migrating fish could and likely would avoid the plumes to reach undisturbed spawning areas upstream of the construction activities.

Benthic Habitats

Benthic habitats may consist of intertidal mudflats (inundated during high tides) and subtidal substrates (permanently covered by water). Intertidal mudflats serve as important nursery and feeding areas for many bird, fish, and invertebrate species. Subtidal substrates are important feeding habitats for fish and benthic species that feed on polychaete worms and mollusks inhabiting these areas. Managed species that use benthic habitats for spawning or foraging are windowpane flounder, red hake, winter flounder, black sea bass, scup, summer flounder, little skate, winter skate, and coastal migratory pelagics. Dredging in these habitats would result in the displacement or mortality of the marine organisms that inhabit the immediate area of disturbance. Dredging would also increase the turbidity and sedimentation in adjacent communities, release contaminants and oxygen-consuming substances, and alter hydrologic regimes and physical habitats. Similar to potential effects of increased suspended sediments on prey species within the water column, displacement or mortality of demersal organisms near the project could reduce the availability of prey species inhabiting benthic communities. The subsequent potential reduction in foraging success could also affect managed fish species similar to impacts for the water column impacts discussed above.

Based on the results of sediment sampling in the proposed dredging area, the deposition of sediments is not anticipated to significantly change the concentration of any pollutant in the area or have an adverse effect on benthic communities. The results of SSFATE modeling indicate that the deposition of suspended sediments would be localized and confined largely to the dredged area. Mobile species and life stages adjacent to the dredging footprint would likely burrow out of any accumulation of redeposited sediments. However, the results of the SSDOSE modeling indicate that the deposition of suspended

sediments resulting from the current project design could affect winter flounder eggs. Dredging of the turning basin would directly affect winter flounder spawning habitat. Potential impacts on winter flounder spawning habitat and eggs were discussed previously in this section.

Man-Made Structures

Man-made structures built in aquatic environments often provide habitat for fish and other aquatic organisms. Man-made structures currently within the project area include an existing wooden pier and mooring dolphins offshore of the LNG terminal site. Of the managed species potentially occurring within the project area, only adult scup are likely to use man-made structures regularly. The existing structure would be removed and replaced with a new ship unloading facility consisting of a concrete structure supported on steel piles and connected to shore by two trestles. Additionally, two breasting dolphins and four mooring dolphins would be constructed. Although there would be a temporary loss of habitat during the period between removal of the existing structure until completion of the new unloading facility, the habitat lost from removal of the existing pier would likely be replaced and perhaps supplemented with development of the new structure.

Cumulative Impact Analysis

Cumulative impact results when impact associated with a proposed project is superimposed on or added to impact associated with past, present, or reasonably foreseeable future projects within the area affected by the proposed project. Although the individual impacts of the separate projects might be minor, the additive effects from all the projects could be significant.

Existing environmental conditions in the project area reflect extensive changes based on past projects and activities. For example, substantial impacts have occurred and continue to occur because of water quality degradation from point and non-point source pollution along the Taunton River. Residential, commercial, and industrial developments are directly impacting EFH by dredging or by affecting the watershed. Point source discharges from industry, wastewater treatment plants, and the Brayton Point and Montaup Power Plants, combined with septic tank leachates, stormwater runoff, and oil and chemical spills contribute to lower water quality and degraded fishery habitats.

The final EIS provides a detailed environmental analysis of the effects of construction and operation of the Weaver's Cove LNG Project and our recommendations to mitigate environmental impact. Construction of the Weaver's Cove LNG Project would adversely affect surface water quality and biological resources associated with Mount Hope Bay and the Taunton River. Specific project activities such as dredging, dredge disposal, pipeline installation, hydrostatic testing, and upland clearing/grading could result in a variety of impacts related to aquatic resources that include:

- increased water turbidity and resuspension of sediments;
- surface runoff/erosion;
- loss of wetland or upland vegetation;
- disturbance to benthic substrates (e.g., quahog habitats);
- entrainment and impingement of aquatic organisms; and
- potential spills of hazardous substances.

Although mitigation would lessen these impacts, gradual and cumulative impacts that could result from the construction and operation of the proposed project and other projects in the area and within the near future would result in some unavoidable adverse effects on the existing environment. However, the cumulative impact of dredging, pipe installation, and other damage to benthic habitats, when conducted in

accordance with Weaver's Cove Energy's proposed plans and our recommendations, would be relatively minor and short term in comparison to available habitats in the Taunton River and Mount Hope Bay.

Conservation Measures

The placement of dredged material in an upland area is an important measure proposed by Weaver's Cove Energy to minimize potential impacts on federally managed fish species and EFH. As previously discussed, Weaver's Cove Energy would use the material dredged from the navigation channel and turning basin on the proposed LNG terminal for structural fill. Use of the material in an upland area would avoid the need for offshore disposal and reintroduction of the dredged material into an aquatic environment that may include EFH.

Implementation of additional conservation measures proposed by Weaver's Cove Energy in response to agency concerns or required by the FERC or resource agencies would also avoid or minimize impacts on EFH, including implementing the measures in the FERC Plan and Procedures to minimize impacts on wetlands and waterbodies. As previously mentioned, we recommended that Weaver's Cove Energy prohibit silt-disturbing construction activities in the Taunton River between January 15 and May 31 to avoid impacts on winter flounder eggs. This restriction is in addition to the other mitigative measures Weaver's Cove Energy has proposed to minimize impacts on aquatic resources as described previously in this section.

NOAA Fisheries commented on the draft EIS and expressed concern that potential impacts on aquatic resources were underestimated in the EIS. Based on its review of the draft EIS, NOAA Fisheries also provided conservation recommendations to further avoid, minimize, and mitigate adverse effects on EFH, including:

- prohibiting in-water silt-producing activities between January 15 and May 31 of any year to protect winter flounder spawning and juvenile development;
- requiring mitigation to offset permanent loss of winter flounder spawning and juvenile development habitat resulting from expansion of the turning basin; and
- requiring mitigation to offset the placement of fill within intertidal, salt marsh, and subtidal areas during site development.

We have reviewed these recommendations and agree that implementation of the measures would further reduce potential impacts on EFH and managed species occurring in the project area. Weaver's Cove Energy has prepared a Wetland Mitigation Plan that provides mitigation for impacts on salt marsh and freshwater wetlands (see section 4.4). We have recommended in section 4.4 that Weaver's Cove Energy consult with the COE and NOAA Fisheries regarding the mitigation of wetlands as well as intertidal and subtidal areas and file a COE-approved Wetland Mitigation Plan with the Commission prior to construction. Additionally, we have recommended in this final EIS that Weaver's Cove Energy avoid silt-disturbing construction activities in the Taunton River during the winter flounder spawning period (i.e., January 15 through May 31) and prepare a mitigation plan to offset permanent loss of winter flounder habitat in the turning basin.

Conclusions of the EFH Assessment

Dredging associated with the proposed project could affect water column, benthic substrate, and man-made structure EFH in the project area. Activities within the Taunton River and Mount Hope Bay also have the potential to affect anadromous fish and shellfish resources, two primary prey groups for

managed fish species. The temporary resuspension of sediments during dredging could temporarily affect use of the water column by managed species in the area. Deepening of the navigation channel and expansion of the turning basin would result in temporary destruction and permanent alteration of existing benthic habitat within the dredging footprint as well as affect existing benthic habitat outside of the footprint through deposition of suspended sediments. Most notably, without additional revisions to the current proposed dredging program, the modeling conducted by Weaver's Cove Energy has indicated that impacts on managed species as a result of benthic habitat destruction and alteration could include temporary loss of up to 6.2 acres of winter flounder spawning habitat (assuming suitable habitat occurs to a depth of 8 meters) during the flounder spawning period. In addition, a maximum of about 11 acres of winter flounder spawning habitat (also assuming suitable habitat occurs to a depth of 8 meters) would be permanently lost as the result of widening the turning basin. However, implementation of the conservation measures discussed above would likely avoid or minimize impacts on managed fish species and designated EFH.

4.7 THREATENED, ENDANGERED, AND OTHER SPECIAL STATUS SPECIES

Federal agencies are required by section 7 of the ESA Act (Title 19 USC Part 1536(c)), as amended (1978, 1979, and 1982), to ensure that any actions authorized, funded, or carried out by the agency 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 of a federally listed species. The action agency (i.e., the FERC) is required to consult with the FWS and/or NOAA Fisheries to determine whether federally listed endangered or threatened species or designated critical habitat are found in the vicinity of the proposed project, and to determine the proposed action's potential effects on those species or critical habitats. For actions involving major construction activities with the potential to affect listed species or designated critical habitat, the federal agency must prepare a BA for those species that may be affected. The action agency must submit its BA to the FWS and/or NOAA Fisheries and, if it is determined that the action may adversely affect a listed species, the federal agency must submit a request for formal consultation to comply with section 7 of the ESA. In response, the FWS or NOAA Fisheries would issue a Biological Opinion as to whether or not the federal action would likely jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. In compliance with section 7, the FERC requests that the FWS and NOAA Fisheries consider this final EIS as the BA for the Weaver's Cove LNG Project.

For purposes of this environmental analysis, special status species of plants and animals include:

- species that are listed by the federal government as endangered or threatened; and
- species listed by Massachusetts and Rhode Island as endangered, threatened, or species of concern.

With assistance from Weaver's Cove Energy, we informally consulted with the FWS, NOAA Fisheries, DFW, DMF, and the Natural Heritage and Endangered Species Programs of the DEM and DEP to assess impacts on special status species. These agency consultations resulted in the identification of five federal[16] and three state special status species (one of which is also a candidate for federal protection) that might occur in the project area. In addition to the species identified during informal agencies consultations specific to the Weaver's Cove LNG Project, NOAA Fisheries identified in its comments on the KeySpan LNG Facility Upgrade Project that federally listed whales, in particular the North Atlantic right whale, have a potential to occur in the offshore waters that would be transited by LNG ships. These nine species are listed in table 4.7-1.

The FWS stated that one federally listed species, the bald eagle, could only occur in the project area as a transient. Thus bald eagles would not be expected to regularly occur in the area. If present as transients, eagles could use but would not be dependent on the resources found in the project area. Consequently, bald eagles would not be disturbed by construction or operation activities and the proposed project would have no effect on bald eagles. Therefore, this species does not require consideration in this NEPA analysis.

4.7.1 Federally Listed Threatened and Endangered Species

Sea Turtles

Four sea turtle species were identified by NOAA Fisheries as having the potential to occur near the project area. The leatherback and Kemp's ridley sea turtles are federally listed (and state-listed) as

[16] All five of the federally listed species are also state-listed in Massachusetts as either endangered or threatened.

endangered. The green and loggerhead sea turtles are federally listed (and state-listed) as threatened. None of these species are known to nest in the project area.

Green turtles occupy three habitat types: high energy oceanic beaches (nesting), convergence zones in pelagic habitat (juvenile foraging), and benthic feeding grounds in relatively shallow, protected waters (adult foraging). The primary green turtle nesting area within the United States is limited to a six-county area in east central and southeast Florida. Common adult foraging habitats are pastures of seagrasses and/or algae, but small green turtles can also be found over coral reefs, worm reefs, and rocky bottoms (NMFS and FWS, 1991a). Coastal development threatens nesting habitat and populations while commercial fisheries and pollution pose significant threats to the marine environment.

TABLE 4.7-1

Special Status Species Potentially Occurring in the Vicinity of the Weaver's Cove LNG Project

Species	Federal Status a/	State Status a/	Comments
Birds			
American oystercatcher *Harmatopus palliates*	None	SC	Nesting and foraging would not be affected by proposed project.
Bald Eagle *Haliaeetus leucocephalus*	FT	SE	Transient individuals only; no known nesting sites or habitat; proposed project would have no effect on bald eagles.
Least Tern *Sterna antillarum*	None	ST	Nesting and foraging would not be affected by proposed project.
Fish			
Atlantic Sturgeon *Acipenser oxyrhynchus*	FC	SE	Possible migrant in Taunton River.
Reptiles			
Green Sea Turtle *Chelonia mydas*	FT	ST	Possible migrant in Mount Hope Bay.
Kemp's Ridley Sea Turtle *Lepidochelys kempi*	FE	SE	Possible migrant in Mount Hope Bay.
Leatherback Sea Turtle *Dermochelys coriacea*	FE	SE	Possible migrant in Mount Hope Bay.
Loggerhead Sea Turtle *Caretta caretta*	FT	ST	Possible migrant in Mount Hope Bay.
Mammals			
North Atlantic Right Whale *Eubalaena glacialis*	E	None	Not likely to occur in the project area, but could be affected by increased ship traffic and LNG ships entering Narragansett Bay while in transit to the proposed LNG terminal

a/ FE Federally Endangered
FT Federally Threatened
FC Candidate for Federal Protection
SC State Species of Concern
ST State Threatened
SE State Endangered

The major nesting beach where Kemp's ridley turtles emerge in any concentration to lay eggs is on the northeastern coast of Mexico, although additional nesting has been reported from Texas, Florida, and South Carolina. Juveniles frequent bays, coastal lagoons, and river mouths. Adults of the species are usually confined to the Gulf of Mexico, although individuals are sometimes found on the eastern seaboard of the northwestern Atlantic Ocean. Members of this genus are usually found in water with low salinity, high turbidity, high organic content, and where shrimp are abundant. Major threats to this species include incidental mortality in commercial shrimping, marine pollution, and dredging activities.

Leatherback turtle nesting occurs primarily in southeastern Florida, Culebra, Puerto Rico, and Sandy Point National Wildlife Refuge, St. Croix. Virtually nothing is known of the pelagic distribution of hatchling or juvenile leatherback turtles. Leatherbacks stranded on United States shores are generally of adult or near adult size, demonstrating the importance of pelagic habitat to turtles breeding in tropical

and subtropical latitudes (NMFS and FWS, 1992). Nesting trends appear stable but populations face significant threats in the marine environment from plastic wastes and commercial fisheries.

Loggerhead turtle nesting in the United States occurs primarily on the beaches of Florida but has also been reported from North Carolina, South Carolina, and Georgia (NMFS and FWS, 1991b). Post-hatchling and juvenile habitat use is associated with sargassum and/or debris in pelagic drift lines. Subadult habitat usage is associated with nearshore and estuarine waters along continental margins, which are used as developmental habitat. Adult habitat selection is not well understood but it seems clear that adults can use a variety of habitats. Coastal development threatens nesting habitat and populations, while commercial fisheries and pollution pose significant threats to the marine environment.

NOAA Fisheries (2003) reported that in the project area, sea turtles are known to inhabit shallow harbors and embayments. NOAA Fisheries (2003) also reported that the general trend for these species is to migrate to the project region in early summer (June) and return south when water temperatures decrease in the fall (October). Sea turtles can be affected by increases in vessel traffic, including interactions that could result in injury or death of individuals. The majority of injurious vessel strikes are caused by small, fast vessels that have planing hulls. No vessels with planing hulls are proposed to be used during construction or operation of the proposed LNG terminal. Large, deep draft vessels, similar to LNG ships, push a considerable bow wave because of their bulbous hull design and large displacement tonnage. This bow wave configuration displaces water upward and ahead of the hull region, thereby reducing the magnitude of both the pressure and suction fields. Therefore, small objects at the surface (e.g., sea turtles) are pushed away from such vessels. As the proposed project would utilize only large LNG ships, the potential effects on sea turtles as a result of vessel traffic would be insignificant; therefore, the project is not likely to adversely affect sea turtles.

North Atlantic Right Whale

Listed whale species have the potential to occur in offshore waters that would be crossed by LNG ships. Of specific concern is the North Atlantic right whale, a federally endangered species most likely to be encountered by marine vessels entering Narragansett Bay through the eastern end of Long Island Sound. The North Atlantic right whale population was historically depleted by commercial whaling and has not recovered despite protection from commercial harvest. The current population is thought to be about 325 to 350 individuals and thus is considered one of the most critically endangered large whales in the world (Associated Press, 2005; NOAA, 2004d). According to the New England Aquarium, the 2004-2005 calving season resulted in the second highest number of births in a given season since scientists began tracking births in the early 1990s; however, the aquarium also noted that the newborns still need to survive their migration to summer habitat and that juvenile whales have a 25 percent mortality rate (Associated Press, 2005). The mid-Atlantic region of the United States is a principal migratory corridor for right whales that travel between the calving and nursery areas in the southeastern United States to the feeding grounds in the northeastern United States and Canada.

The two most significant human-caused threats to right whales are entanglement in fishing gear and collisions with ships. Because right whales are known to occur in or adjacent to many major shipping corridors along the eastern United States and collisions are known to account for over 50 percent of human-induced mortality in right whales, NOAA Fisheries established a right whale ship strike reduction program. Despite the measures implemented as part of that program (e.g., aerial surveys to notify mariners of whale locations, supporting shipping industry liaisons, mandatory reporting programs, etc.), right whales continue to be killed by vessel strikes. In response to this continuing problem, NOAA Fisheries developed a Strategy to Reduce Ship Strikes of Right Whales (Strategy), which is intended to minimize the overlap between ships and whales and reduce the likelihood of ship strikes to the extent practicable (NOAA, 2004d).

Although NOAA's Strategy is not yet finalized, the primary regulatory measure proposed to reduce ship strikes in the mid-Atlantic region is the establishment of uniform speed restrictions within 20 to 30 miles of the approaches of specific ports and areas, including an area south and east of Block Island Sound that would be traversed by LNG carriers visiting the proposed LNG terminal (NOAA, 2004d). NOAA (2004d) indicated that proposed speed restrictions may be in the range of 10 to 14 knots. For the area near Block Island Sound, these speed restrictions would be enforced from March through April and from September through October. We note that the Coast Guard has been coordinating with NOAA Fisheries in ongoing efforts to reduce vessel strikes by issuing periodic notices to mariners regarding ship strikes. The Coast Guard is also a partner with NOAA Fisheries in the Mandatory Ship Reporting System which requires large ships to report course and speed such that potential intersections with known whale locations can be avoided. Additionally, the Coast Guard is currently conducting a Port Access Route Study to analyze potential vessel routing measures and consider adjusting existing vessel routing measures in order to reduce vessels strikes of right whales.

Assuming that up to 70 LNG ships could unload cargo at the proposed terminal each year, about 23 of those ships would be expected to unload at the terminal during the total 4 months from March to April and from September to October. These 23 vessels approaching and entering the area near Block Island Sound would be in addition to the existing ship traffic entering the bay and visiting various ports along the Long Island Sound and Narragansett Bay. The additional ship traffic likely increases the potential risk of a right whale ship strike. However, adherence of LNG ships to NOAA Fisheries' proposed speed restrictions during the applicable time periods, in addition to other currently required measures, would be expected to effectively minimize the potential for strikes, consistent with NOAA Fisheries' goals of the Strategy. We believe that these measures are important for the protection of right whales from ship strikes, but because the proposed rule has not yet become finalized or implemented, **we recommend that:**

- **Weaver's Cove Energy coordinate with NOAA Fisheries to determine appropriate speed and seasonal restrictions, or other applicable measures, to avoid or minimize impacts on right whales. Results of the coordination, including a discussion of restrictions to be implemented, should be filed with the Secretary, prior to commencing operation of the LNG terminal.**

Although LNG ships servicing the proposed terminal have the potential to strike right whales in the vicinity of Block Island Sound, adherence to restrictions developed through coordination with NOAA Fisheries would minimize the potential for strikes such that the proposed project is not likely to adversely affect North Atlantic right whales. Such protective measures may also facilitate avoidance and/or minimization of effects on other federally protected marine animals (i.e., other whale species and sea turtles) with the potential to occur in the general vicinity of the proposed project.

We are awaiting concurrence from NOAA Fisheries on our effects determination. Weaver's Cove Energy would not be authorized to begin construction until we complete all of our section 7 obligations.

4.7.2 State-listed Species

Massachusetts has an endangered species law that prohibits the taking of listed wildlife and plants. The DFW (2003a, 2003b) reported that no state-listed threatened, endangered, or special concern species are known to occur in the vicinity of the proposed LNG terminal or pipelines. The DMF (2003) identified one species, Atlantic sturgeon, as potentially occurring in the vicinity of the proposed project.

The Atlantic sturgeon is a state-endangered species in Massachusetts and is considered a candidate species for federal protection. Atlantic sturgeon are anadromous and use estuarine or coastal marine habitats for much of their adult life stage but spawn in fast-flowing, rocky areas of large freshwater rivers. The Atlantic sturgeon is typically a benthic feeder, searching bottom sediments for organisms such as mollusks, insects, and crustaceans. Atlantic sturgeon occur from Quebec to the Gulf of Mexico and move into freshwater rivers in April and May. Females return to estuarine and coastal marine habitats following spawning, but males may depart much later, coinciding with a temperature drop in the fall.

Although no known occurrences of Atlantic sturgeon have been recorded in the immediate vicinity of the proposed terminal site, the DMF (2003) stated that this species uses the Taunton River for passage, spawning, nursery, and forage habitat. Surveys conducted elsewhere in 1991 and 1992 in the Taunton River identified only subadult (not sexually mature) sturgeon. Additionally, no other sturgeons have been recorded in Mount Hope Bay and the Taunton River despite fairly extensive surveys associated with the Brayton Point Power Plant. The lack of juvenile sturgeon likely indicates that a spawning population of this species does not occur in this river; however, the river is still potentially used as a nursery area and potentially for foraging habitat by Atlantic sturgeon.

Impacts on Atlantic sturgeon using Mount Hope Bay or the Taunton River would be similar to potential impacts on other species using these waterbodies, which are discussed in section 4.6.2. Based on suspended sediment modeling completed by Weaver's Cove Energy for in-water activities, impacts from the project on fish passage are unlikely. Therefore, the proposed project is not likely to have adverse effects on Atlantic sturgeon.

The DEM Natural Heritage Program reported that Spar Island in Mount Hope Bay has been adopted as a nesting site by American oystercatcher (species of concern) and least tern (state threatened). However, Spar Island is approximately 3,000 feet north of the proposed dredging area and would not be affected by construction activities. Also, based on suspended sediment modeling, it appears that the sediment plume associated with dredging would not extend to Spar Island during dredging activities and thus is unlikely to affect foraging habits of the birds nesting on the island.

4.8 LAND USE, RECREATION, AND VISUAL RESOURCES

4.8.1 Land Use

4.8.1.1 LNG Terminal

The proposed LNG terminal is located on a privately owned brownfield site on the east side of the Taunton River in Fall River. The 73-acre site is comprised of a 55-acre southern parcel and an 18-acre northern parcel divided by an existing CSX railroad corridor. Weaver's Cove Energy currently has an option to purchase the entire site from Fall River Marine, L.L.C., who is the current landowner.

The 55-acre southern parcel has a history of use by the oil products industry. From the 1920s to the 1990s, the site was used as a petroleum products storage and distribution facility. The southern parcel is currently used as a construction staging area for the Brightman Street Bridge project. The site currently includes eight storage tanks, a wooden pier, an office building, and miscellaneous structures. About 52.3 acres of the southern parcel would be used during construction and operation of the LNG terminal (i.e., LNG storage tank, process area, spill impoundment sumps, and ancillary buildings), the dredged material reuse areas/landform, and access roads.

The 18-acre northern parcel is currently vacant but previously housed a garage structure, of which only the concrete floor pad remains. Approximately half of the northern parcel is in an open, disturbed condition and still contains remnants of past development. The northernmost portion of this parcel is predominately forested. About 17 acres of the 18-acre northern parcel would be used during construction for parking, a construction laydown area, and access roads. After construction, use of the northern parcel would be limited to about 2.0 acres for an administrative building, associated parking, and access roads, and a small area for the stormwater drainage system.

Because the site is contaminated, there are "controls" on the use of the property. These include deed restrictions that specify no residential or agricultural use and the incorporation of a cap or exposure barrier to prevent contact with soils on the site.

Table 4.8.1-1 summarizes the acres of each land use that would be affected by construction and operation of the proposed LNG terminal.

TABLE 4.8.1-1

Land Area Affected by the Construction and Operation of the Proposed LNG Terminal

Description	Industrial/Developed (acres)	Open (acres)	Forest (acres)	Vegetated Wetland (acres)	Total (acres)
Existing Site Conditions					
Northern Parcel	3.5	3.9	8.7	1.9	18.0
Southern Parcel	48.3	1.0	3.0	2.7	55.0
Total	51.8	4.9	11.7	4.6	73.0
Proposed Site Conditions - Construction					
Northern Parcel	17.0	0.0	1.0	0.0	18.0
Southern Parcel	52.3	0.0	0.0	2.7 a/	55.0
Total	69.3	0.0	1.0	2.7	73.0
Proposed Site Conditions - Operation					
Northern Parcel	2.0	15.0	1.0	0.0	18.0
Southern Parcel	52.3	0.0	0.0	2.7 a/	55.0
Total	54.3	15.0	1.0	2.7	73.0

a/ About 0.04 acre of salt marsh would be disturbed and permanently filled during construction of the facility (see section 4.4)

Existing land uses surrounding the proposed LNG terminal site include a mixture of industrial, transportation corridor, commercial, open space, and residential uses. Along the Taunton River, land uses consist of industrial, residential, open space, and commercial areas. Operation of the LNG terminal as a marine industrial facility would be consistent with the zoning and designated uses of the site (see section 4.8.2).

The completed ship unloading facilities associated with the LNG terminal (i.e., unloading platform, service platform, trestles, breasting dolphins, mooring dolphins, and connecting walkways) would occupy an area about 150 feet wide and 1,080 feet long and would replace the existing pier.

The dredging of the federal navigation channel and turning basin would disturb a total of about 191 acres of river bottom in Mount Hope Bay and the Taunton River. Weaver's Cove Energy would dredge the existing federal navigation channel to a depth of 37 feet (plus 1 foot allowance for overdredge). More than half of the channel is already at a depth of 37 feet or greater so no additional dredging would be necessary in these areas. In total, about 136 acres of the federal navigation channel would be dredged. The existing 33-acre turning basin would be dredged to a depth of 41 feet (plus a 1 foot allowance for overdredge) and expanded to the east and north to accommodate the berth area and turning of LNG ships. The expanded and deepened turning basin would affect about 54 acres of river bottom. Another 1.3 acres of disturbance would be associated with dredging of a temporary construction access channel and installation of the pipeline across the river. Additional information on the dredging activities associated with the project is presented in section 2.4.1.3.

4.8.1.2 Pipeline Facilities

The Weaver's Cove LNG Project would involve construction of two 24-inch-diameter pipelines that would connect the LNG terminal with the existing Algonquin pipeline system. The Northern Pipeline would consist of about 3.6 miles of 24-inch-diameter pipeline in Fall River (2.7 miles) and Freetown (0.9 mile), Massachusetts. The Western Pipeline would consist of about 2.5 miles of 24-inch-diameter pipeline in Fall River (0.3 mile), Somerset (1.3 miles), and Swansea (0.9 mile), Massachusetts. Table 4.8.1-2 summarizes the land uses crossed by the proposed pipeline routes.

Of the 3.6 miles of the Northern Pipeline route, about 3.5 miles (97 percent) would be constructed within an existing utility right-of-way, specifically the existing Shell Oil easement that includes two pipelines (a 6-inch-diameter former products pipeline and a 20-inch-diameter former naphtha pipeline) (2.2 miles), or adjacent to a transportation (i.e., road or railroad) right-of-way (1.3 miles). The remaining 0.1 mile (3 percent) would be constructed on newly created right-of-way located at the northern end of the pipeline route. The Northern Pipeline, as well as the existing utility right-of-way, are adjacent to a single-track CSX railroad for about 2.8 miles. The predominant land use that would be crossed is open land, comprising about 3.2 miles (89 percent) of the pipeline route. Industrial/commercial land and forest land comprise about 0.3 mile (8 percent) and 0.1 mile (3 percent) of the pipeline route, respectively. The construction right-of-way associated with the Northern Pipeline route would also be located within 50 feet of several residences (see section 4.8.3.2).

Of the 2.5 miles of the Western Pipeline route, about 1.8 miles (72 percent) would be constructed adjacent to or within existing utility rights-of-way. The remaining 0.7 mile (28 percent) would be constructed on newly created right-of-way. The 0.7 mile of newly created right-of-way consists of 0.4 mile across the Taunton River and 0.3 mile at the western end of the pipeline route. The predominant land use that would be crossed is open land, comprising about 1.6 miles (64 percent) of the pipeline route. Open water associated with the Taunton River crossing is the second most prevalent land use, comprising 0.4 mile (16 percent) of the proposed pipeline route. Forest and industrial/commercial land comprise about 0.3 mile (12 percent) and 0.2 mile (8 percent) of the proposed pipeline route, respectively. The

construction right-of-way associated with the Western Pipeline route would also be located within 50 feet of several residences (see section 4.8.3.2).

TABLE 4.8.1-2

Land Uses Crossed by the Proposed Pipeline Facilities

Facility/Community	Open Land a/ (miles)	Open Water b/ (miles)	Forest Land c/ (miles)	Industrial/Commercial Land d/ (miles)	Total (miles)
Northern Pipeline					
Fall River	2.4	0.0	0.0	0.3	2.7
Freetown	0.8	0.0	0.1	0.0	0.9
Subtotal	3.2 (89%)	0.0 (0%)	0.1 (3%)	0.3 (8%)	3.6 (100%)
Western Pipeline					
Fall River	0.0	0.2	0.0	0.1	0.3
Somerset	1.0	0.2	0.0	0.1	1.3
Swansea	0.6	0.0	0.3	0.0	0.9
Subtotal	1.6 (64%)	0.4 (16%)	0.3 (12%)	0.2 (8%)	2.5 (100%)
Project Total	4.8 (78%)	0.4 (7%)	0.4 (7%)	0.5 (8%)	6.1 (100%)

a/ Open land consists of non-forested lands, shrublands, scrub-shrub wetlands, emergent wetlands, and open riparian wetlands.
b/ Open water includes water crossings greater than 100 feet (i.e., the Taunton River crossing).
c/ Forest land includes tracts of wooded upland or forested wetlands.
d/ Industrial/commercial land includes electric power or natural gas utility facilities, manufacturing or industrial plants, roads, and commercial or retail facilities.
Note: The totals shown in this table may not equal the sum of addends due to rounding.

Land use impacts associated with the pipelines would include the disturbance of existing land uses within the construction rights-of-way during construction and retention of new permanent rights-of-way for operation of the pipelines. Weaver's Cove Energy proposes to use a maximum 75-foot-wide construction right-of-way for the majority (89 percent) of the Northern Pipeline route. About 10 percent of the Northern Pipeline route would be constructed using a 50-foot-wide construction right-of-way to avoid buildings or structures or to stay within the existing Shell Oil easement. The remaining 1 percent of the route would be located across roads where the right-of-way would be as permitted by the local agencies.

The majority of the Western Pipeline route (71 percent) would be constructed using a maximum of a 100-foot-wide construction right-of-way. About 24 percent of the Western Pipeline route would be constructed using a reduced construction right-of-way that would vary from 50 to 80 feet wide to avoid powerlines and other structures. The remaining 5 percent of the route would be located across roads where the right-of-way would be as permitted by the local agencies. For both the Northern and Western Pipeline routes, a 50-foot-wide permanent right-of-way would be maintained for operation and maintenance of the pipelines in all areas except at road crossings where the permanent right-of-way width would be as permitted by the local agencies. The typical right-of-way cross sections that Weaver's Cove Energy would use for the Northern and Western Pipeline routes are provided in Appendix D.

In addition to the construction right-of-way, Weaver's Cove Energy has identified two temporary extra workspaces that would be required along the Western Pipeline route. The first temporary extra workspace would be located at about MP 0.5 and is needed to facilitate the crossing of the Taunton River. This temporary extra workspace would require 0.2 acre of open land. The second temporary extra

workspace would be located at about MP 2.2 and is needed to install an underground AC mitigation structure. This temporary extra workspace would require 0.2 acre of forested land. Weaver's Cove Energy has not yet identified temporary extra workspace requirements along the Northern Pipeline route.

To support construction of the Northern and Western Pipelines, Weaver's Cove Energy proposes to use one pipe storage yard located near the end of the Northern Pipeline route within the Riverfront Business Park. The yard would require about 4.0 acres of open land that was previously used as a pipe/contractor yard.

Weaver's Cove Energy proposes to construct two meter and regulation stations, one at the end of the Northern Pipeline (MP 3.6) and one at the end of the Western Pipeline (MP 2.5) where each interconnects with the Algonquin pipeline system. A portion of each meter and regulation station site would be fenced and would include metering and regulation facilities; pig launcher and receiver facilities; a data acquisition building that would house communication and other electronic equipment; an area reserved for future regulators, heaters, and filters; a light pole; and a paved driveway and parking area. The meter and regulation station at the end of the Northern Pipeline route would require 0.9 acre of forested land within the Riverfront Business Park for construction and operation. The meter and regulation station at the end of the Western Pipeline route would require 1.4 acres of forested land for construction and operation. About 1.0 acre of this area would be fenced and would be located adjacent to the existing Algonquin pipeline right-of-way. The remaining 0.4 acre would consist of a cleared area around the perimeter of the fence.

Construction of the pipeline facilities would disturb a total of about 65.5 acres of land, including the pipeline construction rights-of-way, temporary extra workspace, a pipe storage yard, aboveground facilities, and access roads. Of this total, 58.7 acres would be disturbed by the pipeline construction rights-of-way, 0.4 acre would be disturbed by temporary extra workspace, 4.0 acres would be disturbed by a pipe storage yard, 2.3 acres would be disturbed by aboveground facilities, and less than 0.1 acre would be disturbed by access roads. Table 4.8.1-3 summarizes the acres of each land use that would be affected by construction and operation of the proposed pipeline facilities.

Open land would be the primary land use affected by construction of the pipeline facilities totaling about 51.5 acres (79 percent). The remaining land uses that would be disturbed consist of 5.5 acres (8 percent) of forest land, 5.1 acres (8 percent) of open water, and 3.4 acres (5 percent) of industrial/commercial land.

Of the 65.5 acres of land affected by construction of the pipeline facilities, about 36.0 acres would be retained as permanent right-of-way for the pipelines and 2.3 acres would be retained for aboveground facilities. Most of the land required for the permanent pipeline right-of-way is currently within an existing utility easement. The land retained for the meter and regulation stations would be fenced and off limits to any future development. The land that is retained as permanent right-of-way for the pipelines would be allowed to revert to former use with certain restrictions. Activities such as the construction of aboveground structures, including houses, house additions, garages, patios, pools, or any other object not easily removable, or the planting and cultivating of trees or orchards, would be prohibited within the permanent right-of-way. The remaining 27.2 acres that are used for construction would be allowed to revert to prior uses following construction with no restrictions.

All of the pipeline facilities would be located on privately owned lands with the exception of those portions of the pipelines within public road rights-of-way. To minimize impacts on residential areas, Weaver's Cove Energy would align a majority of its proposed pipeline within or adjacent to existing utility or transportation rights-of-way (97 percent for the Northern Pipeline route and 72 percent for the Western Pipeline route). The 2.2 miles of existing Shell Oil right-of-way along the Northern

Pipeline route is comprised of easements. About half of the 1.8 miles of existing right-of-way along the Western Pipeline route is comprised of parcels owned in fee by the powerline company. The remaining 0.9 mile is comprised of easements (0.7 mile), public road rights-of-way (0.1 mile), and land within the proposed LNG terminal site (0.1 mile). Weaver's Cove Energy would need to acquire new easements or property to construct and operate the proposed facilities. The easement would convey both temporary (for construction) and permanent rights-of-way to Weaver's Cove Energy and would give Weaver's Cove Energy the right to construct, operate, and maintain the pipeline facilities. Weaver's Cove Energy would negotiate a one-time payment for each easement. An easement agreement between a company and a landowner typically specifies compensation for losses resulting from construction, including losses of non-renewable and other resources, damages to property during construction, and restrictions on existing uses that would not be permitted on the permanent right-of-way after construction.

TABLE 4.8.1-3

Acres of Land Affected by Construction and Operation of the Pipeline Facilities for the Weaver's Cove LNG Project

Facility	Open Land		Open Water		Forest Land		Industrial/ Commercial Land		Total	
	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.
Northern Pipeline										
Pipeline Right-of-Way a/	28.7	19.3	0.0	0.0	1.2	0.8	2.3	1.6	32.2	21.7
Temporary Extra Workspace b/	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pipe Storage Yard	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0
Aboveground Facilities	0.9	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.9
Access Roads	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Northern Pipeline Subtotal	33.6	20.2	0.0	0.0	1.2	0.8	2.3	1.6	37.1	22.6
Western Pipeline										
Pipeline Right-of-Way c/	17.7	9.2	5.1	2.7	2.6	1.7	1.1	0.7	26.5	14.3
Temporary Extra Workspace	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.4	0.0
Pipe Storage Yard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aboveground Facilities	0.0	0.0	0.0	0.0	1.4	1.4	0.0	0.0	1.4	1.4
Access Roads	0.0	0.0	0.0	0.0	<0.1	0.0	0.0	0.0	<0.1	0.0
Western Pipeline Subtotal	17.9	9.2	5.1	2.7	4.3	3.1	1.1	0.7	28.4	15.7
Pipeline Facilities Subtotal										
Pipeline Right-of-Way	46.4	28.5	5.1	2.7	3.8	2.5	3.4	2.3	58.7	36.0
Temporary Extra Workspace	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.4	0.0
Pipe Storage Yard	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0
Aboveground Facilities	0.9	0.9	0.0	0.0	1.4	1.4	0.0	0.0	2.3	2.3
Access Roads	0.0	0.0	0.0	0.0	<0.1	0.0	0.0	0.0	<0.1	0.0
Pipeline Facilities Total	51.5	29.4	5.1	2.7	5.5	3.9	3.4	2.3	65.5	38.3

a/ Based on a maximum of a 75-foot-wide construction right-of-way. Some areas would have a reduced construction right-of-way to avoid buildings or structures or to stay within an existing right-of-way. Operation acreage is based on a 50-foot-wide permanent right-of-way in all areas except at road crossings where the right-of-way width would likely be less based on local agency permits (assumed to be about 15 feet).

b/ Weaver's Cove Energy has not yet identified temporary extra workspace requirements for the Northern Pipeline route.

c/ Based on a maximum of a 100-foot-wide construction right-of-way. Some areas would have a reduced construction right-of-way to avoid powerlines and other structures. Operation acreage is based on a 50-foot-wide permanent right-of-way in all areas except at road crossings where the right-of-way width would likely be less based on the local agencies permits (assumed to be about 15 feet).

Const. Construction
Oper. Operation
Note: The totals shown in this table may not equal the sum of addends due to rounding.

If an easement cannot be negotiated with a landowner and the project has been certificated by the FERC, the company may use the right of eminent domain granted to it under section 7(h) of the NGA and the procedures set forth under the Federal Rules of Civic Procedure (Rule 71A) to obtain the right-of-way and extra workspace areas. The company would still be required to compensate the landowner for the right-of-way and damages incurred during construction. However, the level of compensation would be determined by a court according to state or federal law. In either case, Weaver's Cove Energy would compensate landowners for use of the land.

4.8.2 Consistency with Existing Land Use Plans, Policies, Designations, and Guidelines

There are several existing plans, polices, designations, and guidelines that have been established for land use development in the project area by state, regional, and local entities. Overall, our analysis indicates that the proposed project appears to be consistent with the existing plans and guidelines that have been established for land use development in the project area by various entities. However, we received several comments on the draft EIS suggesting that the Weaver's Cove LNG Project is inconsistent with local land use plans and policies and that the City of Fall River has identified the site of the proposed LNG terminal as a prime location for a hotel and conference center or anchor office park. Our determination was based on what is stated in existing planning documents. We cannot interpret the intent of planned uses for the proposed LNG terminal site beyond those described in these existing documents. Consistency of the Weaver's Cove LNG Project with these plans, policies, designations, and guidelines is discussed below. Consistency with coastal zone management policies is discussed in section 4.8.4.

State

Fall River - Mount Hope Bay Designated Port Area - The southern parcel of the LNG terminal site, where most of the proposed facilities would be located, is within the Fall River - Mount Hope Bay DPA. DPAs are designated by the state for the purposes of promoting and protecting marine industrial activities and supporting uses. Projects proposed within DPAs must be maritime industrial uses or supporting uses. Among other things, water-dependent industrial uses include marine terminals and related facilities for transfer and storage of goods transported by marine vessels and manufacturing facilities relying on goods shipped by waterborne transportation (The Cecil Group, Inc., 2002).

The proposed LNG terminal is consistent with the uses of a DPA because it qualifies as a marine-dependent industrial facility. Currently, the only feasible method of importing large volumes of LNG from overseas is by ship. Additional discussion of DPAs and consistency with Massachusetts coastal zone management policies is presented in section 4.8.4.

Massachusetts Contingency Program - The LNG terminal site is now in Phase V of the MCP process. As discussed in section 4.2.2, the placement of the sediments on the site would not have a significant environmental impact. The placement and reuse of dredged sediment at the proposed LNG terminal site could potentially improve the current site conditions by effectively isolating soil hot spots for lead and LNAPL from potential receptors. In addition, the upland placement of the dredged sediment on the LNG terminal site would not impede current LNAPL recovery efforts. The MCP, however, in 310 CMR 40.0032 (3)b prohibits the disposal or reuse of soils containing oil or hazardous materials "at locations where existing concentrations of oil and/or hazardous material at the receiving site are significantly lower than levels of those oil and/or hazardous materials present in the soil being disposed or reused." This is in keeping with the statutory preference contained in Chapter 21E to maintain or achieve background levels of oil or hazardous materials at sites proposed for placement or reuse of soils or sediments from offsite sources. Based on sampling and analysis of soils at the proposed LNG terminal site conducted by Weaver's Cove Energy in September 2004, it appears that upland reuse of the stabilized

dredged sediment may be in compliance with the MCP. We note, however, that the DEP has not made a final decision about this issue.

Redevelopment Within Previously Developed Riverfront Areas (310 CMR 10.58(5)) - We received a comment from the DEP stating that the project appears to fall within the provisions of 310 CMR 10.58(5). A discussion of the project relative to these provisions is provided in section 4.4.

Regional

Vision 2020: A Partnership for Southeastern Massachusetts - The Southeastern Regional Planning and Economic Development District (SRPEDD), Old Colony Planning Council (OCPC), and the Metropolitan Area Planning Council (MAPC) initiated a regional growth management project called Vision 2020: A Partnership for Southeastern Massachusetts. Southeastern Massachusetts includes 52 cities and towns in Bristol, Plymouth, and Norfolk Counties and is geographically defined by Massachusetts Bay, Buzzards Bay, and the Taunton River Watershed and its location relative to Boston, Rhode Island, and Cape Cod.

The mission of the Vision 2020 project is to "make recommendations to improve the management of land use, protect the natural environment, and foster sustainable economic growth and development in southeastern Massachusetts so that such management results in growth consistent with the region's unique character, natural and historic resources, and quality of life for the benefit of future generations" (Partnership for Southeastern Massachusetts, 2003). The project aims to refocus a larger share of regional growth on central cities, urbanized areas, inner suburbs, and areas that are already served by infrastructure. This type of development is considered "smart growth" and is in contrast to most current development practices that result in sprawl and the construction of new or expanded infrastructure. The following Smart Growth Principles were defined in Vision 2020:

- encourage growth in areas with existing and underutilized infrastructure;
- mix compatible land uses;
- build compactly;
- provide a range of housing opportunities;
- present a strong sense of place;
- coordinate public investment, and find a fair and broad-based way to fund infrastructure and municipal services;
- preserve open space, critical environmental areas, farmland, and places of natural beauty; and
- make development decisions predictable, fair, and cost effective.

In addition to Smart Growth Principles, Vision 2020 recommended in its Agenda for the Future (1999) that action strategies be prepared for open space, natural resources, economic development, urban reinvestment, land use, housing, and infrastructure. It was recommended that coordinated actions be taken to protect open space and to concentrate development within established town centers and urban areas. One of the action strategies for land use management was the creation of priority development

areas (see discussion below). Action strategies for economic development include supporting redevelopment of urban sites and promoting marine-related business.

The proposed Weaver's Cove LNG Project is consistent with both the Smart Growth Principles and the visions outlined in the Agenda for the Future in the following ways:

- the project would redevelop an existing brownfield site without impacting open spaces, critical environmental areas, or farmland;
- the LNG terminal would be located in an area that is well served by existing infrastructure;
- the project would redevelop an urban site; and
- the project would promote marine-related business.

The Agenda for the Future also stated that "in Fall River, the industrial use of the waterfront has declined; this part of the city has new potential to provide regional public amenities through the development of parks, visitor attractions and retail space" (Partnership for Southeastern Massachusetts, 1999). The areas intended for development of these facilities does not extend to the LNG terminal site. Consistency of the project with local land use plans and policies is provided below.

Priority Development and Protection Areas - To manage growth in southeastern Massachusetts, the SRPEDD prepared *Regional Land Use: Priority Development Areas and Priority Protection Areas in Southeastern Massachusetts*. The SRPEDD developed a list of preservation and development priority sites throughout southeastern Massachusetts' cities and towns to stimulate local and regional discussion, assist with the protection of the preservation priority sites, and assist with the development/redevelopment of priority development sites.

The priority development areas and redevelopment areas were nominated where infrastructure, zoning, and access made the areas most suitable for development. There are seven development priority areas in Fall River. The waterfront area of Fall River was nominated as a development priority site but does not extend northward to include the proposed LNG terminal site. The proposed dredging of the federal navigation channel in the Taunton River by Weaver's Cove Energy could promote the development of the Fall River priority development area by allowing access by deep-draft vessels to the area.

Priority protection areas were proposed where growth should be discouraged and protection and preservation encouraged in areas that are not already protected through some other means. These areas included farms, woodlands, vistas, ponds, shorelines, and other areas where excessive development would be incompatible with preservation goals. There are no priority preservation sites within a 1-mile radius of the LNG terminal site or crossed by the pipeline routes.

Comprehensive Economic Development Strategy - In 2003, the SRPEDD released its *Comprehensive Economic Development Strategy (CEDS): Toward a More Competitive Southeastern Massachusetts*. The report identifies the SRPEDD's economic strategy for the region in terms of goals, objectives, and development strategies. One of the goals is to promote the cleanup and redevelopment of existing brownfield sites for economic development (Goal G). The redevelopment of the proposed LNG terminal site would be consistent with this goal and would assist in attaining the identified objective of reducing the number of brownfield sites in the region by up to 20 percent over the next 5 years. In a letter dated August 7, 2003, the SRPEDD confirmed that the proposed LNG terminal at the former Shell Oil site would be consistent with regional land use goals and economic development strategies because it

would redevelop a brownfield site in an urban area (SRPEDD, 2003a). The SRPEDD also indicated that the continued use of the site as an industrial sea port is what was anticipated when the Coast Guard required a 200-foot-wide horizontal clearance of the bridge opening for the new Brightman Street Bridge currently under construction over the Taunton River.

The CEDS also contains a list of regional economic development and public works projects that are currently or would support the goals and objectives identified in the report. One of the projects listed is the dredging of the Taunton River/Fall River Harbor. It states that the funding source would be state bonds or other bonds and that the status of the action is unknown. The dredging proposed as part of the Weaver's Cove LNG Project would complete the majority of this project and would do so with private funds.

Narragansett Bay Estuary Program - The Rhode Island DEM runs the Narragansett Bay Estuary Program. The mission of the program is to "protect and preserve Narragansett Bay through partnerships that conserve and restore natural resources, enhance water quality and promote community involvement" (Narragansett Bay Estuary Program, 2003). One of the priorities for the program is to coordinate and oversee implementation of the Narragansett Bay Comprehensive Conservation and Management Plan (CCMP). The CCMP was completed in 1993 in compliance with section 320 of the CWA. The CCMP is based on the following overall goals (Narragansett Bay Estuary Program, 2003):

- to prevent further degradation and incrementally improve water quality in developing coastal areas with deteriorating water quality;
- to protect diminishing high quality resource areas throughout the bay watershed;
- to more effectively manage commercially, recreationally, and ecologically important estuarine-dependent living resources;
- to rehabilitate degraded waters in the bay watershed and restore water quality-dependent uses of Narragansett Bay; and
- to establish necessary interstate and interagency agreements and mechanisms to coordinate and oversee implementation of the Narragansett Bay CCMP.

Dredging activities in Mount Hope Bay and the Taunton River could potentially impact water quality and aquatic resources within Narragansett Bay. Impacts on water quality and aquatic resources and proposed mitigation measures to minimize impacts are discussed in sections 4.3.2 and 4.6.2, respectively.

Local

Fall River Zoning District Designations - Both the northern and southern parcels of the proposed LNG terminal site are zoned IND - industrial district. In an industrial district, "buildings and structures may be constructed, altered, enlarged or reconstructed and used and land may be used for manufacturing, assembling, packaging, industrial research and development, biotechnology, processing, fabrication, warehousing, wholesaling, trucking, including terminal facilities and uses customarily accessory to such uses" (City of Fall River, 1999). Requirements for industrial districts are as follows:

- Dust, smoke, fumes, gas, glare, noxious odors, noise, and vibrations shall be limited so as not to be injurious to the public health or to the use of neighboring property as provided by the laws of the commonwealth;

- All buildings and outdoor storage or work areas shall be set back at least 20 feet from any street line and property line;
- Adequate provision shall be made for the off-street accommodation of all vehicles, including those of employers, employees, customers, and visitors;
- Flashing, moving, or intermittent illumination of buildings or signs shall not be permitted;
- Off-site signs are permitted, subject to the provisions set forth by the City of Fall River; and
- Minimum lot frontage is 100 feet and minimum lot area is 10,000 square feet.

The proposed LNG terminal would conform to the uses of an industrial district and would adhere to the requirements for the area. Details on how Weaver's Cove Energy would control dust and other emissions and noise are presented in sections 4.11.1 and 4.11.2, respectively. Impacts on nearby residential and commercial areas and measures to reduce these impacts are discussed in section 4.8.3. Section 4.8.7 describes impacts on visual resources, including lighting and glare associated with the proposed facility.

Comprehensive Master Plan for Fall River - The Comprehensive Master Plan for Fall River (Master Plan) outlines goals for the City of Fall River in the areas of land utilization, existing and future development, residential development, transportation, and primary services. The Master Plan provides a description of waterfront activities and outlines a strategy to encourage revitalization of the waterfront as a major New England public attraction. There are three separate areas identified for waterfront revitalization, all of which are south of the current Brightman Street Bridge. The three areas include: 1) Christina's Marina, Steamship Cove, Point Gloria, and Coca-cola; 2) Heritage State Park and the Central Waterfront Revitalization area; and 3) Kennedy Park-Olmstead Revitalization, Kennedy Park Beach, and Borden Light Marina. The proposed LNG terminal site is not located in and would not conflict with the proposed plans for these areas.

Fall River Harbor and Downtown Economic Development Plan - The Fall River Harbor and Downtown Economic Development Plan (Harbor Plan) is a plan for the revitalization of the Fall River harbor, waterfront, and downtown areas. The purpose of the Harbor Plan "is to increase the economic diversity of the community through the expanded use and revitalization of the harbor, the harbor front, and nearby areas within the downtown. The Harbor Plan seeks to establish a clear vision for these areas and to create a pragmatic strategy for accomplishing that vision" (The Cecil Group, Inc., 2002). Two planning areas were identified in the plan, the harbor planning area and the study area. The harbor planning area encompasses about 290 acres of land and includes four sub-areas: 1) the Central DPA; 2) downtown Fall River; 3) the Central Waterfront; and 4) the South Waterfront (see figure 4.8.2-1). The study area includes the harbor planning area and additional portions of the waterfront and downtown, including the proposed LNG terminal site (referred to as the Shell Oil Terminal tank farm). Economic development recommendations, land use recommendations, and plan actions and phases related to the proposed LNG terminal site are described below. A discussion of the planned developments included in the Harbor Plan and the potential impact on these developments associated with the Weaver's Cove LNG Project is provided in section 4.8.3.1.

Insert figure

4.8.2-1 Planning Areas as Shown in the 2002 Municipal Harbor Plan

The Harbor Plan provides a summary of key economic development recommendations to implement a vision of a diversified economic base for the City of Fall River. One of the 10 recommendations for economic development is to redevelop the former Shell Oil site for new industrial development. The Harbor Plan recognizes that given the probability that some portion of the site is contaminated, it is unlikely that it can be used for residential purposes, but that the site could be used for marine industrial, light industrial, distribution, and even some office space. It also suggests that the city acquire and redevelop the site. The Harbor Plan also recommends dredging of the federal navigation channel to facilitate the proposed revitalization of the area. The cost for the proposed dredging is estimated to be $4.7 million, which would be publicly funded.

The Weaver's Cove LNG Project appears to be consistent with the economic recommendation to redevelop the former Shell Oil site for a marine industrial use. In addition, the cleanup and redevelopment of the site would be privately funded and would not require city funds. Weaver's Cove Energy would also conduct the dredging of the federal navigation channel recommended in the Harbor Plan. The initial and maintenance dredging would be financed by Weaver's Cove Energy and would not require any public funds. Information on the anticipated amount of tax revenue the City of Fall River could expect to receive as part of the Weaver's Cove LNG Project is provided in section 4.9.6.

The Harbor Plan provides additional recommendations for land use. Most of the recommendations aim to create tourism along the waterfront through conversion of underutilized industrial and vacant uses. New uses include public amenities and access throughout the waterfront, a new mixed use facility at State Pier, a performing arts center, a hotel, a marina at City Pier, and commuter rail stations. One of the recommendations, however, deals with the promotion of industrial use. The recommendation is to "support redevelopment of the Shell Oil site as an industrial area" (The Cecil Group, Inc., 2002). The Harbor Plan identifies the former petroleum products distribution site as one of only two industrial development areas proposed along the Fall River waterfront. The recommendation calls for development of industrial space and a general cargo handling facility. The Harbor Plan underscores that investigations of existing building conditions and possible site contamination need to be undertaken and that dredging would be necessary before development.

The Weaver's Cove LNG Project would involve redeveloping the Shell Oil site to a marine-industrial use. Weaver's Cove Energy is coordinating with the previous owner of the site and the DEP to ensure that development of the site is consistent with ongoing remediation efforts (see section 4.3.1). In addition, Weaver's Cove Energy would conduct the dredging needed to achieve adequate water depths for larger ships (e.g., cruise ships) traveling to the Fall River area. This work would be privately funded and would not require any financial support from the City of Fall River. As a result, the proposed project appears to be consistent with the Harbor Plan's land use recommendation for industrial use of the site and the dredging conducted by Weaver's Cove Energy would help implement a portion of the Harbor Plan without financial cost to the city.

As previously discussed, we received several comments on the draft EIS suggesting that the City of Fall River has identified the site of the proposed LNG terminal as a prime location for a hotel and conference center or anchor office park. We did not find a reference in the Harbor Plan regarding the use of the Shell Oil site for non-industrial purposes. The site is located within a DPA and currently zoned as an industrial district. Projects within DPAs must be maritime industrial uses or supporting uses. The Harbor Plan is, in part, a master plan for the DPA and "must preserve and enhance the capacity of the entire DPA to accommodate water-dependent industrial use, and must prevent substantial exclusion of such use by any other use eligible for licensing in a DPA pursuant to 310 CMR 9.32" (The Cecil Group, Inc., 2002). In addition, according to the Harbor Plan, industrial districts do not allow for hotels, marinas, boat building, and similar waterfront activities. As a result, it does not appear that use of the site for non-

industrial purposes (e.g., hotel, conference center) would be consistent with the current zoning of the site or the use of the area as a DPA and thus would require changes in these classifications.

Fall River Open Space and Recreation Plan - The Fall River Open Space and Recreation Plan (1997) aims to protect the city's natural resources, restore degraded natural areas, maintain existing public open space, and improve public access and connections to natural areas. The plan identifies the Taunton River as a driving force in the economic development of the city but recognizes that its role as a potential recreational resource has been overshadowed until recently. The plan outlines six goals:

- increase protection of North Watuppa and Copicut water supply and East Fall River watershed lands;
- expand outdoor recreational opportunities for Fall River residents;
- protect natural resources and create new greenways in urban Fall River;
- enhance the quality and appeal of Fall River's streetscapes;
- restore Fall River's park system; and
- develop implementation and funding mechanisms to support open space and recreation needs.

The Weaver's Cove LNG Project would not conflict with the Fall River Open Space and Recreation Plan because facilities associated with the project would not be located on land proposed for recreational use. In addition, the LNG terminal would be located on an industrially-zoned site that is currently contaminated and unusable for recreational purposes. The proposed project would, however, affect some recreational uses of the Taunton River as described in section 4.8.6.

Healthy City Fall River Action Plan 2004-2009 – We received comments on the draft EIS indicating that the City of Fall River, Department of Health and Human Services is involved in an initiative to define Fall River as a *Healthy City*. The Healthy City Fall River project is an effort to involve the community in a process that promotes deliberate actions designed to improve health and overall well being of those who live or work in Fall River. The five priority areas identified as part of the plan include: safety and substance abuse (increased community policing and personal safety, a drug-free community, and reduction of gangs); environment and recreation (cleaner streets and parks, increased and improved recreational opportunities for youth and adults, and measures to ensure cleaner air and water); health education; adult education, job training, and employment; and community planning and housing. As previously discussed, the proposed LNG terminal is consistent with the current zoning and DPA designation of the former Shell Oil site. The site is currently contaminated and unusable for recreational purposes. We do not anticipate that the Weaver's Cove LNG Project would interfere with the initiative to define Fall River as *Healthy City*. Impacts associated with the facility on water resources, air, and safety are discussed in sections 4.3, 4.11.1, and 4.12, respectively.

4.8.3 Existing Residences and Planned Developments

4.8.3.1 LNG Terminal

Existing Residences

Based on information contained in the LandView® Census 2000 Population Estimator produced by the EPA, NOAA Fisheries, Coast Guard, and U.S. Census Bureau, approximately 12,000 people living in 5,100 housing units are located within 1 mile of the proposed LNG storage tank. Of these 5,100

housing units, approximately 1,200 units are located within 0.5 mile of the proposed LNG storage tank. Weaver's Cove Energy inventoried and conducted an analysis of the properties that are located closest to the LNG terminal site and would be most affected by project-related activities. The analysis was conducted on two discrete blocks, Block A and Block B.

Block A includes the properties between the railroad tracks abutting the eastern edge of the proposed LNG terminal site and North Main Street. The block is made up of 25 lots that are all zoned for industrial use. Included on this block are a diesel engine/truck repair business, a commercial laundry, a storefront property, a vacant parcel comprised of four lots, 10 single-family homes, 2 two-family homes, and 1 three-family home. The closest single-family residence to the LNG storage tank (1,170 feet) is located within this block, on the west side of North Main Street and south of Alton Street. Weaver's Cove Energy has offered property owners in Block A a real estate buy-out/easement package to compensate for potential temporary inconveniences during the construction of the facility. Additional details on the real estate buy-out/easement package are provided in section 4.9.5.

Block B includes the area between North Main Street and Route 79 up to but not including 2585 North Main Street. Block B is made up of 22 lots zoned "general residence", including 2 vacant parcels consisting of five lots, a lot with a two-car oversized garage, 11 single-family homes, and a two-family home. The 13 property owners holding 15 parcels in this block have also been offered a real estate buy-out/easement package (see section 4.9.5).

Medium density single-family and multi-family residential neighborhoods lie beyond Route 79 toward the east. The Pleasant View Apartments, which consist of over 30 state-funded affordable low income family housing buildings, are located between approximately 1,850 feet and 2,950 feet east of the LNG storage tank. Industrial and commercial uses dominate the area south of the site beyond Route 79. A complex of mills south of Route 79 historically supported the textile industry has now been converted to a mixed use. One of the mills, Border City Mills, has been renovated for residential use and now supports 107 apartment units. The apartment complex is located about 1,100 feet south of the proposed LNG storage tank. The closest U.S. Department of Housing and Urban Development (HUD) housing consists of 100 units of elderly apartments located about 3,200 feet southwest of the LNG storage tank.

In addition to residences, there are several churches, schools, and health care-related facilities located within 1 mile of the LNG terminal site. Table 4.8.3-1 summarizes the location of these facilities relative to the proposed LNG storage tank. There are no hospitals located within 1 mile of the LNG terminal site.

TABLE 4.8.3-1

Churches, Schools, and Health Care-Related Facilities Located within 1 Mile of the Proposed LNG Terminal

Facility	Location	Distance and Direction from Proposed LNG Storage Tank
Artificial Kidney Center of Fall River	North side of Weaver Street	1,340 feet south
William J. Wiley Elementary School a/	Corner of North Main Street and Canedy Street	1,830 feet northeast
The Highlander Rehabilitation and Nursing Center	Highland Avenue	2,000 feet east
Seventh Day Adventist Church	Corner of North Main Street and Haskell Street	2,230 feet northeast
St. Michaels School and Church	Essex Street	3,300 feet southwest
Sunbridge Care and Rehabilitation - Rosewood	Highland Avenue	3,740 feet northeast
Somerset High School	Corner of Grandview Avenue and County Street	4,030 feet northwest
St. Joseph's School and Church	North Main Street	4,950 feet southwest
Tansey School	Ray Street	5,200 feet southeast

a/ This school has been closed.

During construction of the LNG terminal, short-term impacts on neighboring residential and commercial areas could include increased construction-related traffic on local roads, dust generated during dredged material placement and site construction, and noise from construction equipment. In general, as the distance to the construction site increases, the impacts on these areas decrease. Additional information on measures Weaver's Cove Energy would implement to reduce impacts associated with increased traffic, dust, and noise is presented in sections 4.9.4, 4.11.1, and 4.11.2, respectively.

Potential impacts on nearby residential and commercial areas during operation of the LNG terminal include increased visibility of aboveground structures associated with the facility, increased traffic, changes in air quality, and safety hazards. These impacts and applicable mitigation measures are discussed in sections 4.8.7.1, 4.9.4, 4.11.1, and 4.12 respectively.

Planned Developments

There are no planned residential developments near the proposed LNG terminal site; however, there are several commercial and industrial developments and transportation projects proposed in the general area as described below. There is also a development proposed as an alternative to the LNG terminal at the former Shell Oil site. In addition, the City of Fall River has indicated that the site of the proposed LNG terminal is a prime location for a hotel and conference center or anchor office park. Additional information on the City of Fall River's plans for the site as well as consistency with other local and regional plans is discussed in section 4.8.2.

Green Futures Development – Green Futures, a local environmental group based in Fall River, has proposed an alternative development to Weaver's Cove Energy's LNG terminal at the former Shell Oil site. The development proposed by Green Futures includes a marina and boathouse, hotel/conference center or marina condominiums, four soccer fields, four baseball fields, two football fields, four basketball courts, a concession and equipment building, a waterfront public garden, a waterfront promenade, outdoor cafes, a bandstand for summer concerts, an arboretum, a walking and jogging path around the site, a picnic area overlooking the Taunton River, a commuter rail station, and a site for a beach. Green Futures estimates the cost for the proposed development would be around $32 million and would include both public and private funds.

The Weaver's Cove LNG Project would conflict with and preclude the Green Futures development because they are both proposed for the same site. However, the Green Futures development does not appear to be consistent with the use of the site as a DPA, local zoning ordinances, or the specific recommendations for the site contained in the Harbor Plan. As discussed in section 4.8.2, projects proposed within DPAs must be maritime industrial uses or supporting uses. Unlike the proposed LNG terminal, the Green Futures development would not be a maritime industrial use and would not be a consistent use within a DPA. The Green Futures development would also be inconsistent with the current industrial zoning designation of the site and the Harbor Plan's recommendation to redevelop the former Shell Oil site for new industrial development. In addition, the Harbor Plan indicates that because of possible contamination at the site, it is unlikely it can be used for residential purposes. Another difference between the two proposed projects is that the development associated with the Weaver's Cove LNG Project would be privately funded whereas the Green Futures development would require some public funds. Additional details regarding the consistency of the Weaver's Cove LNG Project with local and regional plans is provided in section 4.8.2.

Harbor Plan Developments - As discussed in section 4.8.2, the Harbor Plan is a plan for the revitalization of Fall River's harbor, waterfront, and downtown areas. It includes several potential developments to assist in the revitalization of the area. These developments are described below.

- *City Pier* - The Harbor Plan recommends the construction of a 150- to 200-room waterfront hotel at the site of the former City Pier area. Design and construction of the hotel is slated for implementation during years 4 and 5 of the final Harbor Plan (published in 2002). The purpose of the hotel would be to anchor the waterfront and provide a connection between tourist attractions and business-related functions. The City Pier is located about 1.2 miles southwest of the proposed LNG terminal site.

- *State Pier and Battleship Cove* - The Harbor Plan describes the State Pier and Battleship Cove areas as suited for expanded cultural uses and new attractions, including a performing arts center and provisions for recreational boating, ferries, excursion boats, and cruise ships. The City of Fall River is currently securing funding to implement this vision for State Pier. In April 2002, the Seaport Advisory Council approved Fall River's request for $50,000 to conduct a cost-benefit analysis for the State Pier facilities and $10,000 for a parking analysis. State Pier and Battleship Cove are located about 2 miles southwest of the proposed LNG terminal site.

- *Waterfront Walkway/Bikeway* - The Harbor Plan calls for a 3,900-foot waterfront walkway and bikeway connecting Bicentennial Park to Heritage State Park. The proposed bikeway is intended to eventually link recreation areas in Fall River. The funding for the project is from a state grant under the 1996 Seaport Bond Bill, which encourages port cities to restore their waterfronts. Construction of the walkway and bikeway is currently underway. Bicentennial Park, the closer of the two parks to the proposed LNG terminal, is located about 1.3 miles southwest of the site.

- *Heritage State Park* - The Harbor Plan recommends new attractions that would improve attendance at the park. Potential improvements could include replacement of the existing historic display, a children's museum, or a panoramic screen theater. Heritage State Park is located about 1.8 miles southwest of the proposed LNG terminal site.

- *Redevelopment of the Crab Pond Site* - The Harbor Plan describes plans for this site as a place to "jump start" activity in the underutilized area along Water Street. A Massachusetts Bay Transportation Authority (MBTA) rail platform is currently being developed at the site. The platform is expected to allow improved access to the waterfront and the nearby downtown area. The site is located about 2.2 miles from the proposed LNG terminal site.

- *Other Development Plans* - The Harbor Plan also provides recommendations and steps for development of retail/restaurant space, expansion of the marine museum, and office development. The majority of this development is planned for areas south of Interstate 195, which is about 2.2 miles south of the proposed LNG terminal site.

The Harbor Plan is in various stages of implementation so the exact construction date for some of these projects is unknown. However, because of the distance between these planned developments and the proposed LNG terminal site, the project is not expected to conflict with these development plans and would not constrain other waterfront developments south of the site. In addition, the LNG terminal site appears to be consistent with the proposed marine-industrial use of the site (see section 4.8.2). The dredging of the federal navigation channel associated with the Weaver's Cove LNG Project may assist in the development of the area because it would allow larger ships (e.g., cruise ships) to navigate the channel and access the Fall River area. Potential impacts on recreational boating associated with the proposed project are described in section 4.8.6.2.

We received comments expressing concern that the proposed LNG terminal and associated LNG shipping would threaten these future waterfront development plans. We do not believe that this would be the case. As part of its development plans for the KeySpan LNG Facility Upgrade Project, KeySpan LNG commissioned a market analysis of Charlestown, Massachusetts, which borders the transit route of LNG ships supplying the Distrigas LNG terminal in Everett (KTR Newmark, 2005). Under the Boston Redevelopment Authority (BRA), Charlestown has been undergoing urban redevelopment. One major waterfront redevelopment project associated with the overall redevelopment of Charlestown is known as the Navy Yard. The 135-acre Navy Yard site was formerly one of six naval yards established to build warships for the United States in the 1800s. When the Charlestown Navy Yard closed in 1974, 3 years after the Distrigas LNG terminal began its operations, 98 acres of the Navy Yard site were conveyed to the BRA for redevelopment of a mixed-use project consisting of both new and old construction and the rehabilitation of existing buildings. The market analysis concluded that the Charlestown Navy Yard redevelopment has attracted millions of dollars for revitalization projects in the area and has added approximately 1,100 housing units to the neighborhood. In addition, another approximately 500 housing units are in various stages of redevelopment. Overall, the housing units developed in the Navy Yard range in selling price from the low $200,000 range to above $2 million. Recreational space, marinas, and commercial, retail, and light industrial uses have also been incorporated into the redevelopment plan. Perhaps most importantly, the redevelopment was planned, constructed, and executed directly on a waterway that has been used by ships transporting LNG since the 1970s. Based on this study, the presence of an LNG terminal and LNG shipping activity does not appear to have had an adverse impact on redevelopment efforts in Charlestown. We believe that the proposed LNG terminal and associated LNG shipping would not threaten the future waterfront development plans.

Realignment of Route 79 - There is a proposal for a new waterfront boulevard in Fall River. The new boulevard would be built by combining Route 79 and Davol Street between Heritage State Park and the Brightman Street Bridge. The project would make additional land available for development. Proposed improvements consist of changing Route 79 from a limited access highway to an urban arterial and lowering the highway for approximately 3,000 feet between the existing southern Davol Street turn around ramps and a point about 650 feet north of President Avenue. A portion of Route 79, Davol Street North, and Davol Street South would be combined into a four-lane urban boulevard with a large landscaped median separating the northbound lanes from the southbound lanes (The Cecil Group, Inc., 2002). The new waterfront boulevard would be located about 1 mile southwest of the proposed LNG terminal site and would not be affected by construction or operation of the project. Traffic impacts associated with construction and operation of the Weaver's Cove LNG Project are discussed in section 4.9.4.

Fall River Industrial Park - The Fall River Industrial Park provides over 700 acres of manufacturing, laboratory, research and development, and office space. The park is located adjacent to Route 24 on the north end of Fall River about 1 mile from the proposed LNG terminal site. In June 2003, Hatch Technology, L.L.C., a robotic equipment maker, announced plans to expand into a new 12,000 square foot terminal at the industrial park. The proposed Weaver's Cove LNG Project would not inhibit the continued use or future development of the industrial park because of the distance from the development and the ample and unconstrained transportation infrastructure that serves the area (see section 4.9.4).

Fall River Executive Park - In exchange for a 4,300-acre conservation easement for the SMB, the City of Fall River received monetary compensation and 300 acres of forested land near Route 24 for development purposes. The city plans to use this land for the Fall River Executive Park, which is expected to spur economic development along Route 24 and generate up to 2,200 new jobs. The land transfer is expected to be completed in 2004. The proposed LNG terminal is located about 1.5 miles south of the planned Fall River Executive Park and would not affect its development or operation.

Stop & Shop Regional Distribution Terminal - A 1.3 million square foot distribution center is currently under construction in the adjoining municipality of Freetown, immediately north of the Fall River-Freetown municipal boundary. The terminal's location was selected to take advantage of the ample and unconstrained transportation infrastructure associated with Route 79. The proposed LNG terminal would not inhibit the development or operation of the distribution terminal because of the distance between the facilities and the ample and unconstrained transportation infrastructure that serves the area (see section 4.9.4).

MBTA Commuter Rail Project - The MBTA has proposed an extension of its Stoughton Line commuter rail service from South Station and Back Bay Station to New Bedford and Fall River. The proposed extension includes new construction of track, bridges, grade crossings, intersection improvements, and eight new commuter rail stations as well as two train layover facilities. The project would provide 16 daily roundtrips (8 round trips to New Bedford and 8 round trips to Fall River) and serve about 4,300 new daily inbound riders. Two stations are proposed for Fall River. The Fall River Station would be located at the intersection of Pearce Street and North Davol Street, about 1.2 miles southwest of the proposed LNG terminal site. The Battleship Cove Station would be located off Water Street near Anawan Street about 2.2 miles southwest of the proposed LNG terminal site.

The extension of the commuter rail line would use existing CSX railroad tracks through the east side of Taunton to Myricks Junction in Berkley. From Myricks Junction, the line continues southwest through Freetown to Fall River. The Fall River line would remain single-tracked with the addition of passing sidings to facilitate train movement. Work required on the Fall River segment includes reconstruction of the existing active freight tracks, signals, crossings, and bridges. The extension of the commuter line through Fall River would use the existing CSX railroad tracks that bisect the northern and southern parcels of the proposed LNG terminal site.

A final Environmental Impact Report was filed for the project in April 2002; however, actual implementation of the proposed extension of the MBTA commuter rail service is uncertain at this time. According to the MBTA, the project is on hold indefinitely due to lack of funding (DeRoma, 2004). As a result, construction of the commuter rail line extension is not expected to occur at the same time as construction of the proposed Weaver's Cove LNG Project. Therefore, no construction-related impacts are anticipated. Weaver's Cove Energy contends that if the MBTA Commuter Rail Project were to be constructed, it would not be affected by operation of the Weaver's Cove LNG Project. However, if the rail project were to go forward, Weaver's Cove Energy would consult with the MBTA and adhere to all safety stipulations agreed to by the parties.

4.8.3.2 Pipeline Facilities

Existing Residences

Weaver's Cove Energy's proposed construction work area for the pipeline facilities (i.e., construction right-of-way and temporary extra workspaces) would be located within 50 feet of 35 residential dwellings (i.e., homes or condominium units). Of the 35 residences, 14 are located along the Northern Pipeline route and 21 are located along the Western Pipeline route. Table 4.8.3-2 lists these residences by milepost and indicates the distance and orientation of each from the proposed construction work area. No residences are located within 50 feet of the associated aboveground facilities.

TABLE 4.8.3-2

Residences Located Within 50 Feet of the Construction Work Area for the Pipeline Facilities Associated With the Weaver's Cove LNG Project

Facility/Community	Milepost	Description	Distance from Construction Work Area (feet)	Distance from Pipeline Centerline (feet)	Orientation from the Construction Work Area
Northern Pipeline					
Fall River	0.55	House	40	60	East
	0.77 a/	House	Not Applicable (NA)	NA	East
	0.77 b/	House	8	21	West
	0.79 a/	House	NA	NA	East
	0.83 b/	House	5	10	West
	0.86 a/	House	NA	NA	East
	0.95	House	50	100	East
	0.97	House	30	85	East
	1.00	House	35	100	East
	1.03	House	10	80	East
	1.03	House	20	95	East
	1.05	House	40	120	East
	1.17	Condos	40	100	East
	1.19	Condos	25	55	East
	1.20	Condos	15	40	East
	1.37	Condos	20	40	East
	1.41	House	50	90	East
	2.04 c/	Condos	NA	NA	East
	2.10 c/	Condos	NA	NA	East
	2.17 c/	Condos	NA	NA	Southeast
	2.34 c/	Condos	NA	NA	East
Western Pipeline					
Somerset	0.51	House	50	90	North
	0.52	House	50	90	North
	0.53	House	40	75	North
	0.54	House	35	75	North
	0.55	House	0	60	East
	0.64	House	30	65	West
	1.10	House	35	35	North
	1.11	House	0	15	North
	1.51	House	20	30	North
	1.55	House	40	75	North
Swansea	1.59	House	35	70	North
	1.61	House	35	75	North
	1.64	House	45	75	North
	1.66	House	40	80	North
	1.68	House	40	75	North
	1.70	House	30	65	North
	1.72	House	40	75	North
	1.74	House	50	80	North
	1.76	House	25	60	North
	1.78	House	40	70	North
	1.81	House	20	60	North

a/ The distance to these residences would be increased to over 50 feet from the construction work area with the incorporation of the River Street Variation into the proposed route (see section 3.5.3).

b/ The River Street Variation, which Weaver's Cove Energy agreed to incorporate into the proposed route, would be located within 50 feet of this residence.

c/ The distance to these residences would be increased to over 50 feet from the construction work area with the incorporation of the Golf Course Variation (see section 3.5.3).

In residential areas, the two most significant impacts associated with construction and operation of a pipeline are disturbance during construction and encumbrance of property for future uses (e.g., the limitation on future permanent structures within the permanent right-of-way). Residences within 50 feet of the construction work area would be most likely to experience the effects of construction and operation of the project. In general, as the distance to the construction work area increases, the impacts on residences decrease.

Temporary construction impacts on residential areas could include inconvenience caused by noise and dust generated by construction equipment, personnel, and trenching of roads or driveways; ground disturbance of lawns; removal of trees, landscaped shrubs, or other vegetative screening between residences and/or adjacent rights-of-way; potential damage to existing septic systems or wells; and removal of aboveground structures, such as sheds or trailers, from within the right-of-way.

Weaver's Cove Energy would implement the following general measures to minimize construction-related impacts on residences and other structures located within 50 feet of the construction right-of-way:

- notify landowners of the construction schedule and duration before commencement of construction;
- access construction areas from existing roads;
- catalogue and verify with the landowner before construction all landscaping and ornamental shrubbery within the construction work area;
- provide to each landowner for approval as part of the easement negotiations a plan for the replacement of all such landscaping or ornamental shrubbery or compensation for these items;
- eliminate hazards associated with open ditches (e.g., use of the stove pipe construction method and installation of safety fencing);
- restrict the hours of construction and install appropriate muffling devices on the construction equipment to minimize noise; and
- implement measures to control dust (e.g., use of water trucks to apply water to dusty areas).

In addition, Weaver's Cove Energy would prepare site-specific residential construction mitigation plans to minimize disruption and maintain access to the residences located within 50 feet of the construction work area. The plans would be developed in consultation with the affected landowners and would show the pipeline centerline; the limits of the construction work area; each residence and other structures; existing pipelines and powerlines; waterbodies, roads, driveways, fences, trees or other landscaping, and private wells; and the location of safety fencing that would be installed during construction. Potential site-specific mitigation measures that Weaver's Cove Energy would implement for residences within 50 feet of the construction right-of-way include:

- preservation of mature trees or landscaping along the edge of the proposed construction work area;
- restoration of lawns immediately after backfilling the trench; and

- installing and maintaining safety fencing along the edge of the construction work area for a distance of 100 feet on either side of the residence.

Ten residences would be located within 25 feet of the construction work area, six along the Northern Pipeline route and four along the Western Pipeline route. In addition to the measures listed above, Weaver's Cove Energy would not construct near these homes until the pipe is ready for installation. This would reduce the amount of time the residence would experience the impacts associated with construction of the pipeline. Residential properties encumbered by pipeline easements would sustain long-term impacts associated with the permanent right-of-way; however, as previously discussed, the majority of both pipeline routes would be located within existing utility rights-of-way that are already held in fee or in easements. Like the existing easements, the new easements would prohibit certain types of use, such as the construction of aboveground structures, including house additions, garages, patios, pools, or any other object not easily removable, or the planting and cultivating of trees or orchards.

We received comments from the Massachusetts EFSB regarding the close proximity of the pipeline construction rights-of-way to four residential areas and the potential loss of trees that provide aesthetic value, shade, and/or visual screening for these residences. Two of these areas are along the Northern Pipeline route (MPs 0.54 to 0.91 and around MP 2.0). The other two areas are located along the Western Pipeline route (MPs 0.49 to 0.54 and MPs 1.51 to 1.82). Several of the residences in these four areas would be located within 50 feet of the construction right-of-way and would be included in the preparation of site-specific residential construction mitigation plans as described above. Additional discussion of these areas and the potential impacts on visual resources is presented in section 4.8.7.2.

Also, in sections 3.5.3 and 3.5.4 we evaluated several route variations in the vicinity of these residences to avoid potential impacts and recommended the Golf Course Variation near MP 2.0. The Golf Course Variation would minimize impacts on residences by avoiding construction disturbance and vegetation clearing adjacent to several condominium buildings (see section 3.5.3). In the draft EIS, we also requested that Weaver's Cove Energy investigate the feasibility of the River Street Variation between MPs 0.68 and 0.91 to avoid impacts on additional residences (see section 3.5.3). In its comments on the draft EIS, Weaver's Cove Energy agreed to incorporate both the Golf Course Variation and River Street Variation into the proposed route. The River Street Variation reduces impacts on three residences that were previously identified as being within 50 feet of the construction work area; however, this variation would be within 50 feet of two newly affected residences where the route is aligned within the existing River Street corridor. The Gulf Course Variation avoids impacts on four condominiums that were previously identified as being within 50 feet of the construction work area. Table 4.8.3-2 reflects the reduced residential impacts associated with the incorporation of both the River Street and Gulf Course Variations.

Planned Developments

There are two planned developments along both the Northern and Western Pipeline routes. Consistency with local and regional plans is discussed in section 4.8.2.

Planning for the Riverfront Business Park located at the end of the Northern Pipeline route is underway. At this time the Riverfront Business Park is not expected to include any residential development. The proposed meter and regulation station at the end of the Northern Pipeline route would be located within the Riverfront Business Park in an area that currently consists of an Algonquin pipeline easement and meter and regulation station. The area was formerly used as a synthetic natural gas facility. The Northern Pipeline would also be located adjacent to the existing CSX railroad tracks that the MBTA has proposed for its Stoughton Line commuter rail service (see section 4.8.3.1).

New residential development is planned along the Western Pipeline in two locations. The first is between MPs 1.23 and 1.50 and consists of approximately 10 single family lots. These subdivided lots are vacant with no current plans for development (Hamblin, 2004). The pipeline would be located within an existing powerline easement through this area, which would minimize potential impacts on any future development of this area. A second proposed residential subdivision is located between MPs 2.18 and 2.45 of the Western Pipeline. According to town officials, the subdivision has not been approved and there are no current plans for development (Ramos, 2004). However, we received a letter from a landowner working on the development expressing concern over the placement of the pipeline in this area. The majority of the pipeline on this landowner's parcel would be located within an existing powerline easement and would not further preclude development in this area. At MP 2.18, the pipeline would leave the powerline corridor and would create new right-of-way through a forested area. With the exception of about 200 feet, the pipeline would be located along property boundaries and would not bisect the parcels, which would minimize potential conflicts with future development. We also analyzed a route variation in this area to minimize impacts on forest land that would also avoid this proposed residential development; however, it was not found to be environmentally preferable to the proposed route (see section 3.5.4).

4.8.4 Coastal Zone Management

In 1972, Congress passed the CZMA to "preserve, protect, develop, and where possible, to restore or enhance, the resources of the nation's coastal zone for this and succeeding generations" and to "encourage and assist the states to exercise effectively their responsibilities in the coastal zone through the development and implementation of management programs to achieve wise use of the land and water resources of the coastal zone" (16 USC 1452, section 303 (1) and (2)).

Section 307 (c)(3)(A) of the CZMA states that "any applicant for a required federal license or permit to conduct an activity, in or outside the coastal zone, affecting any land or water use or natural resource of the coastal zone of that state shall provide a certification that the proposed activity complies with the enforceable policies of the state's approved program and that such activity will be conducted in a manner consistent with the program." In order to participate in the coastal zone management program, a state is required to prepare a program management plan for approval by the National Oceanic and Atmospheric Administration, Office of Coast and Ocean Resource Management (OCRM). Once the OCRM has approved a plan and its enforceable program policies, a state program gains "federal consistency" jurisdiction. This means that any federal action (e.g., a project requiring federally issued licenses or permits) that takes place within a state's coastal zone must be found to be consistent with state coastal policies before federal action can take place (OCZM, 2002).

The Weaver's Cove LNG Project is subject to a Federal Coastal Zone Consistency Review because it would 1) involve activities within the coastal zones of Massachusetts and Rhode Island as described in sections 4.8.4.1 and 4.8.4.2, respectively; and 2) require several federal permits and approvals (see table 1.4-1). Both Massachusetts and Rhode Island have approved coastal zone management programs administered by the Massachusetts OCZM and the Rhode Island CRMC, respectively. A description of each state's program, the applicable project activities, and information provided by Weaver's Cove Energy in its FERC section 7(c) application regarding consistency of the project with state policies is provided below.

4.8.4.1 Massachusetts

The Massachusetts CZMP Plan was approved by the OCZM in 1978. The mission of the Massachusetts program is "to balance the impact of human activities with the protection of coastal and marine resources" (OCZM, 2002). According to the CZMP Plan, the coastal zone of Massachusetts

includes the lands and waters within an area defined by the seaward limit of the state's territorial sea (generally 3 miles from shore), extending from the Massachusetts/New Hampshire border south to the Massachusetts/Rhode Island border, and landward to 100 feet inland of specified major roads, rail lines, or other visible rights-of-way. Other areas within the coastal zone include islands; transitional and intertidal areas; coastal wetlands and beaches; tidal rivers and adjacent uplands, at a minimum, to the extent of vegetation affected by saline water; anadromous fish runs to the fresh water breeding area, if the area is within a coastal town; and areas 100 feet inland of the 100-year floodplain along tidal rivers and fish runs.

The activities associated with the Weaver's Cove LNG Project within the coastal zone of Massachusetts and subject to the policies of the CZMP Plan include the:

- maintenance and improvement dredging of the federal navigation channel and other sections of the Taunton River within the jurisdictional boundaries of the Commonwealth of Massachusetts;
- LNG terminal; and
- pipeline facilities, specifically:
    - the entire Northern Pipeline route (MPs 0.0 to 3.6) and the associated aboveground facility; and
    - the first 0.8 mile of the Western Pipeline route (MPs 0.0 to 0.8).

A summary of the regulatory policies under the Massachusetts program and information provided by Weaver's Cove Energy in its FERC section 7(c) application regarding the project's consistency with these policies is presented in table 4.8.4-1. However, this is not a consistency certification. Weaver's Cove Energy filed a draft federal consistency certification with the OCZM in July 2004, which indicates that the project would be in full compliance with the Massachusetts CZMP Plan; however, Weaver's Cove Energy has not received concurrence from the OCZM regarding the project's consistency with the Massachusetts CZMP Plan. Pursuant to 310 CMR 23.00, OCZM cannot begin its federal consistency review until the final MEPA Certificate is issued and cannot issue concurrence until all other state environmental permits and licenses have been obtained for the project. If the Weaver's Cove LNG Project is approved by the Commission, concurrence from the OCZM that the project is consistent with the Massachusetts CZMP Plan must be received prior to any issuance of a Notice to Proceed with construction from the Secretary of the FERC. Therefore, **we recommend that:**

- **Weaver's Cove Energy file documentation of concurrence from the OCZM that the project is consistent with the Massachusetts CZMP Plan with the Secretary <u>prior to construction</u>.**

TABLE 4.8.4-1

Draft Outline of Coastal Consistency Issues Related to Massachusetts Office of Coastal Zone Management Policies

Subject Matter/ Policy or Principle	Policy Guidelines	Applicable Project Activity or Facility			Comments
		Dredging	LNG Terminal	Pipeline Facilities	
Energy					
Policy #1	For coastally dependent energy facilities, assess siting in alternative coastal locations. For non-coastally dependent energy facilities, assess siting in areas outside of the coastal zone. Weigh the environmental and safety impacts of locating proposed energy facilities at alternative sites.		X	X	The proposed LNG terminal is a coastally dependent energy facility because it would rely on cryogenic pipelines to transfer gas from ships to shore-side storage. The Western and Northern Pipelines are coastally dependent energy facilities because they would involve the transportation of energy from the coastal zone (i.e., the LNG terminal) to inland and/or coastal delivery points. Several alternative coastal locations and other alternatives have been evaluated (see section 3.0).
Management Principle #1	Encourage energy conservation and the use of alternative sources such as solar and wind power in order to assist in meeting the energy needs of the Commonwealth.				This management principle does not apply because energy conservation programs and alternative energy sources by themselves will not meet the increasing energy demand in New England and new supplies of natural gas will be needed. .
Water Quality					
Policy #1	Ensure that point-source discharges in or affecting the coastal zone are consistent with federally- approved state effluent limitations and water quality standards.	X	X	X	Weaver's Cove Energy would comply with all federal and state effluent limitations and water quality standards, including those specified in its section 401 Water Quality Certification and National Pollutant Discharge Elimination System permit. Additional information on water quality issues is provided in section 4.3.2.
Policy #2	Ensure that nonpoint pollution controls promote the attainment of state surface water quality standards in the coastal zone.	X	X	X	Weaver's Cove Energy would implement pollution controls that would promote the attainment of state surface water quality standards. Additional information on water quality issues is provided in section 4.3.2.
Policy #3	Ensure that activities in or affecting the coastal zone conform to applicable state and federal requirements governing subsurface waste discharges.				This policy does not apply because the project would not involve subsurface waste discharges.

TABLE 4.8.4-1(cont'd)

Draft Outline of Coastal Consistency Issues Related to Massachusetts Office of Coastal Zone Management Policies

Subject Matter/ Policy or Principle	Policy Guidelines	Applicable Project Activity or Facility			Comments
		Dredging	LNG Terminal	Pipeline Facilities	
Habitat					
Policy #1	Protect coastal resource areas including salt marshes, shellfish beds, dunes, beaches, barrier beaches, salt ponds, eelgrass beds, and fresh water wetlands for their important role as natural habitats.	X	X	X	The waterside improvements associated with the LNG terminal would permanently or temporarily affect salt marsh, land under the ocean, coastal beach, and land containing shellfish. These resources could also be affected by dredging activities associated with the deepening and/or enlargement of the turning basin and federal navigation channel and the installation the Western Pipeline. Weaver's Cove Energy proposes to implement the mitigation measures discussed in sections 4.4 and 4.6 and to implement the Wetland Mitigation Plan attached in Appendix M to compensate for the impacts on these areas. In addition, we have recommended that Weaver's Cove Energy modify its proposed dredging program and pipeline construction plans within the Taunton River to prohibit any silt-disturbing construction activities during the winter flounder spawning period (see section 4.6.2).
Policy #2	Restore degraded or former wetland resources in coastal areas and ensure that activities in coastal areas do not further wetland degradation but instead take advantage of opportunities to engage in wetland restoration.		X		Weaver's Cove Energy would implement the Wetland Mitigation Plan attached in Appendix M to compensate for the permanent loss of salt marsh (see section 4.4).
Protected Areas					
Policy #1	Preserve, restore, and enhance complexes of coastal resources of regional or statewide significance through the Areas of Critical Environmental Concern (ACEC) Program.				This policy does not apply because the project facilities would not be located in an ACEC.
Policy #2	Protect state and locally designated scenic rivers and state-classified scenic rivers in the coastal zone.				This policy does not apply because the project facilities would not cross state or locally designated scenic rivers or state-classified scenic rivers. However, the portion of the Taunton River affected by the proposed project is currently included in a study area for inclusion in the federally-administered Wild and Scenic River Program (see section 4.8.6.1).

TABLE 4.8.4-1(cont'd)

Draft Outline of Coastal Consistency Issues Related to Massachusetts Office of Coastal Zone Management Policies

Subject Matter/ Policy or Principle	Policy Guidelines	Applicable Project Activity or Facility			Comments
		Dredging	LNG Terminal	Pipeline Facilities	
Policy #3	Ensure that proposed developments in or near designated or registered historic districts or sites respect the preservation intent of the designation and that potential adverse effects are minimized.	X	X	X	Weaver's Cove Energy has conducted archaeological reconnaissance surveys and consulted with the Massachusetts SHPO and Massachusetts Board of Underwater Archeology to identify and assess potential impacts on historic districts and sites within the Area of Potential Effect of the project (see section 4.10). Weaver's Cove Energy would develop avoidance plans or treatment plans acceptable to appropriate agencies as necessary so as to minimize adverse effects on any designated status of these resources.
Coastal Hazards					
Policy #1	Preserve, protect, restore, and enhance the beneficial functions of storm damage prevention and flood control provided by natural coastal landforms, such as dunes, beaches, barrier beaches, coastal banks, land subject to coastal storm flowage, salt marshes, and land under the ocean.		X		The proposed LNG terminal site is located on a former industrial site that is largely void of natural coastal landforms due to historical operations. Weaver's Cove Energy would develop a wetland mitigation plan to compensate for permanent wetland loss and would develop the site to provide protection from coastal storms, flooding, erosion, and sea level rise.
Policy #2	Ensure construction in waterbodies and contiguous land areas will minimize interference with water circulation and sediment transport. Approve permits for flood or erosion control projects only when it has been determined that there will be no significant adverse effects on the project site or adjacent or down coast areas.	X	X	X	The dredging of the turning basin and federal navigation channel and other proposed waterside improvement activities would suspend and transport sediments and change circulatory patterns within the Taunton River. The proposed onshore activities would also disturb soils and increase the potential for soil erosion and runoff. The majority of these effects would be temporary and limited to the period of construction. Weaver's Cove Energy would minimize these impacts by implementing the erosion and sediment control measures discussed in sections 4.2, 4.4, and 4.6. The primary impacts during operation of the LNG terminal would include the resuspension of sediments along the ship channel during the transit of LNG ships to the terminal and a local reduction in the flow velocity of the river within the turning basin.

TABLE 4.8.4-1(cont'd)

Draft Outline of Coastal Consistency Issues Related to Massachusetts Office of Coastal Zone Management Policies

Subject Matter/ Policy or Principle	Policy Guidelines	Applicable Project Activity or Facility			Comments
		Dredging	LNG Terminal	Pipeline Facilities	
Policy #3	Ensure that state and federally funded public works projects proposed for location within the coastal zone will: not exacerbate existing hazards or damage natural buffers or other natural resources; be reasonably safe from flood and erosion related damage; not promote growth and development in hazard-prone or buffer areas; especially in Velocity Zones and ACECs; and not be used on Coastal Barrier Resource Units for new or substantial reconstruction of structures in a manner inconsistent with the Coastal Barrier Resource/Improvements Acts.				This policy does not apply because the Weaver's Cove LNG Project is not a state or federally funded public works project and activities would not be conducted in a Velocity Zone, ACEC, or Coastal Barrier Resource Unit.
Policy #4	Prioritize hazard mitigation funds for acquisition of hazardous coastal areas for conservation or recreation use, and relocation of structures out of coastal high hazard areas, giving due consideration to the effects of coastal hazards at the location to the use and manageability of the area.				This policy does not apply because the project facilities are not located in a coastal high hazard area.
Port and Harbor Infrastructure					
Policy #1	Ensure that dredging and disposal of dredged material minimize adverse effects on water quality, physical processes, marine productivity, and public health.	X	X	X	Weaver's Cove Energy would implement several mitigation measures to ensure that dredging and disposal of dredged material avoid or minimize adverse effects on water quality, physical processes, marine productivity, and public health (see sections 4.2.2, 4.3.2, 4.6.2, and 4.11.1).
Policy #2	Obtain the widest possible public benefit from channel dredging, ensuring that designated ports and developed harbors are given highest priority in the allocation of federal and state dredging funds. Ensure that dredging is consistent with marine environmental policies.	X			The dredging activities associated with the Weaver's Cove LNG Project would be privately funded and would not require the allocation of federal or state funds. The dredging would occur within a federal navigation channel to a designated port area (DPA) in Fall River. The dredging of the federal navigation channel by Weaver's Cove Energy could enhance the use of other DPAs along the Taunton River.

TABLE 4.8.4-1(cont'd)

Draft Outline of Coastal Consistency Issues Related to Massachusetts Office of Coastal Zone Management Policies

Subject Matter/ Policy or Principle	Policy Guidelines	Applicable Project Activity or Facility			Comments
		Dredging	LNG Terminal	Pipeline Facilities	
Policy #3	Preserve and enhance the capacity of DPAs to accommodate water-dependent industrial uses, and prevent the exclusion of such uses from tidelands and any other DPA lands over which a state agency exerts control by virtue of ownership, regulatory authority, or other legal jurisdiction.	X	X		The LNG terminal is a water-dependent, industrial facility that would be located within a DPA. The dredging of the federal navigation channel by Weaver's Cove Energy could enhance the use of other DPAs along the Taunton River.
Management Principle #1	Encourage, through technical and financial assistance, expansion of water dependent uses in designated ports and developed harbors, redevelopment of urban waterfronts, and expansion of visual access.	X	X		The LNG terminal is a water-dependent, industrial facility that would be located within a DPA.
Public Access					
Policy #1	Ensure that the adverse impacts of developments proposed near existing public recreation sites are minimized.	X		X	There are no public recreation sites immediately surrounding the LNG terminal site. Dredging, construction of the Western Pipeline across the Taunton River, and the transit of LNG ships to and from the terminal site could temporarily affect recreational use of the waterway. Weaver's Cove Energy would prepare and implement a Navigation Work Plan to minimize impacts on recreational use of the Taunton River (see section 4.8.6.2).
Management Principle #1	Improve public access to coastal recreation facilities and alleviate auto traffic and parking problems through improvements in public transportation. Link existing coastal recreation sites to each other or to nearby coastal inland facilities via trails for bicyclists, hikers, and equestrians, and via rivers for boaters.				This management principle does not apply because the project would not involve a coastal recreational facility.
Management Principle #2	Increase capacity of existing recreation areas by facilitating multiple use and by improving management, maintenance and public support facilities. Resolve conflicting uses whenever possible through improved management rather than through exclusion of uses.				This management principle does not apply because the project would not involve an existing recreation area.

TABLE 4.8.4-1(cont'd)

Draft Outline of Coastal Consistency Issues Related to Massachusetts Office of Coastal Zone Management Policies

Subject Matter/ Policy or Principle	Policy Guidelines	Applicable Project Activity or Facility			Comments
		Dredging	LNG Terminal	Pipeline Facilities	
Management Principle #3	Provide technical assistance to developers of private recreational facilities and sites that increase public access to the shoreline.				This management principle does not apply because the project would not involve development of a private recreational facility.
Management Principle #4	Expand existing recreation facilities and acquire and develop new public areas for coastal recreational activities. Give highest priority to expansions or new acquisitions in regions of high need or limited site availability. Assure that both transportation access and the recreational facilities are compatible with social and environmental characteristics of surrounding communities.				This management principle does not apply because the project would not involve an existing recreation facility or the development of new public areas for coastal recreational activities.
Ocean Resources					
Policy #1	Support the development of environmentally sustainable aquaculture, both for commercial and enhancement (public shellfish stocking) purposes. Ensure that the review process regulating aquaculture facility sites (and access routes to those areas) protects ecologically significant resources (salt marshes, dunes, beaches, barrier beaches, and salt ponds) and minimizes adverse impacts upon the coastal and marine environment.				This policy does not apply because the project would not involve aquaculture.
Policy #2	Extraction of marine minerals (other than sand and gravel) will be considered in areas of state jurisdiction, except where prohibited by the Massachusetts Ocean Sanctuaries Act, where and when the protection of fisheries, air and marine water quality, marine resources, navigation and recreation can be assured.				This policy does not apply because the project would not involve the extraction of marine minerals.

TABLE 4.8.4-1(cont'd)

Draft Outline of Coastal Consistency Issues Related to Massachusetts Office of Coastal Zone Management Policies

Subject Matter/ Policy or Principle	Policy Guidelines	Applicable Project Activity or Facility			Comments
		Dredging	LNG Terminal	Pipeline Facilities	
Policy #3	Accommodate offshore sand and gravel mining needs in areas and in ways that will not adversely affect shoreline areas due to alteration of wave direction and dynamics, marine resources and navigation. Mining of sand and gravel, when and where permitted, will be primarily for the purpose of beach nourishment.				This policy does not apply because the project would not involve the mining of sand or gravel.
Growth Management					
Principle #1	Encourage, through technical assistance and review of publicly funded development, compatibility of proposed development with local community character.				This management principle does not apply because the project is not publicly funded.
Principle #2	Ensure that state and federally funded infrastructure projects primarily serve existing developed areas, assigning highest priority to projects that meet the needs of urban and community development centers.				This management principle does not apply because the project is not state or federally funded.
Principle #3	Encourage the revitalization and enhancement of existing development centers in the coastal zone through technical assistance and federal and state financial support for residential, commercial and industrial development.	X	X	X	The dredging associated with the project would be conducted within an existing federal navigation channel. The LNG terminal would redevelop an existing contaminated site in a developed area slated for industrial use. The pipelines would be located primarily within existing rights-of-way in previously developed areas.

4.8.4.2 Rhode Island

The agency responsible for implementing Rhode Island's coastal zone management program is the CRMC. The CRMC adopted the Rhode Island Coastal Resources Management Program (RICRMP) in 1976 and received its federal program approval pursuant to the CZMA in 1978 (CRMC, 2003). The RICRMP is structured as a strategic plan for the state's coastal areas and is regulatory in nature. It is based on six CRMC water types. There are specific polices and prohibitions that apply to each water type. The six water types are:

- Type 1 - Conservation Areas;
- Type 2 - Low Intensity Use;
- Type 3 - High Intensity Boating;
- Type 4 - Multipurpose Waters;
- Type 5 - Commercial and Recreational Harbors; and
- Type 6 - Industrial Waterfronts and Commercial Navigation Channels.

The seaward extent of Rhode Island's coastal zone boundary is the 3 mile outer limit (CRMC, 2003). The CRMC's jurisdiction includes all tidal waters within the state boundaries. The activities associated with the Weaver's Cove LNG Project within the coastal zone of Rhode Island and subject to the polices and performance standards of the RICRMP include the maintenance and improvement dredging of the federal navigation channel within Mount Hope Bay (that portion within the jurisdictional boundaries of the State of Rhode Island). These activities would occur in Type 6 waters. The section of the RICRMP applicable to the Weaver's Cove LNG Project is 300.9, Dredging and Dredged Materials Disposal. A summary of the policies and performance standards for section 300.9 and information provided by Weaver's Cove Energy in its FERC section 7(c) application regarding the project's consistency with these standards is presented in table 4.8.4-2. However, this is not a consistency certification. Weaver's Cove Energy filed a draft federal consistency certification with the CRMC in July 2004, which indicates that the project is expected to be in full compliance with the RICRMP; however, Weaver's Cove Energy has not received concurrence from the CRMC regarding the project's consistency with the RICRMP. If the Weaver's Cove LNG Project is approved by the Commission, concurrence from the CRMC that the project is consistent with the RICRMP must be received prior to any issuance of a Notice to Proceed with construction from the Secretary of the FERC. Therefore, **we recommend that:**

- **Weaver's Cove Energy file documentation of concurrence from the CRMC that the project is consistent with the RICRMP with the Secretary <u>prior to construction</u>.**

TABLE 4.8.4-2

Draft Outline of Coastal Consistency Issues Related to Rhode Island Coastal Resources Management Policies

Section & Subject Matter/Policy or Principle	Performance Standard	Comments
Section 300.9, Dredging and Dredged Materials Disposal		
Policy #1	The CRMC shall support necessary maintenance dredging activities in Type 2, 3, 4, 5, and 6 waters, provided environmentally sound disposal locations and procedures are identified.	The maintenance and improvement dredging in Rhode Island associated with the Weaver's Cove LNG Project would occur in Type 6 waters. Weaver's Cove Energy proposes to use the dredged material at the LNG terminal site in Fall River, Massachusetts. Weaver's Cove Energy would obtain all the necessary permits and approvals for the use of the dredged material at the LNG terminal site and would implement measures to ensure that the activities are conducted in an environmentally sound manner (see sections 4.2.2, 4.3.2, and 4.6.2).
Policy #2	The CRMC favors offshore open-water disposal for large volumes of dredged materials, providing that environmental impacts are minimized.	Weaver's Cove Energy proposes to beneficially use dredged material in an upland area at the LNG terminal site in Fall River, Massachusetts. The proposed upland reuse of the material would minimize impacts on waters. Open water disposal is not considered an environmentally preferable alternative (see section 3.6). In addition, the Rhode Island Department of Environmental Management (DEM) has indicated that the proposed upland reuse of the dredged materials is preferable to other disposal options.
Policy #3	The CRMC encourages the use of innovative nearshore methods of dredged materials disposal, particularly when small volumes of material must be disposed. These options include creation of wetlands, shellfish habitat, and beach nourishment in suitable areas.	The amount of dredged material associated with the Weaver's Cove LNG Project needing to be disposed is up to 2.6 million cubic yards, making it infeasible to use for these types of activities. In addition, the DEM has indicated that the proposed upland reuse of the dredged materials is preferable to other disposal options.
Policy #4	For disposal of dredged material resulting from maintenance dredging operations, a Category A Review may be permitted provided the Executive Director determines 1) that the disposal is conducted consistent with the DEM's classification of the dredged material sediments; 2) the disposal volume is not greater than 2,000 cubic yards; 3) the area of disposal is not greater than one (1) acre in size; 4) the proposal complies with all applicable local zoning ordinances; 5) applicable soil erosion and sediment controls are employed; and 6) the proposal meets the standards of section 110.1 (Applications for Category A and Category B Council Assents).	This policy does not apply because the amount of dredged materials would be over 2,000 cubic yards.
Policy #5	For beach replenishment, a Category A review may be permitted for the placement of clean sands provided the Executive Director determines that the placement of the materials shall be beach replenishment only, and the proposal meets the standards of section 110.1 and 300.9 as applicable.	This policy does not apply because the project does not involve beach replenishment.

TABLE 4.8.4-2 (cont'd)

Draft Outline of Coastal Consistency Issues Related to Rhode Island Coastal Resources Management Policies

Section & Subject Matter/Policy or Principle	Performance Standard	Comments
Prerequisites		
Prerequisite #1	Permits for maintenance and improvement dredging and disposal projects for navigational purposes must be obtained from the COE as well as the CRMC. CRMC and COE requirements are designed to complement one another; applicants should consider the requirements of both agencies when preparing to begin the permit process and may apply for CRMC and COE permits concurrently.	Weaver's Cove Energy is in the process of obtaining all applicable permits for the dredging and disposal activities, including authorizations from the COE. Section 1.4 provides details on the permits, approvals, and consultations needed for the Weaver's Cove LNG Project.
Prerequisite #2	Except for federal consistency reviews, applicants for dredging or open water disposal of dredged materials shall be required to obtain a section 401 (Clean Water Act) Water Quality Certification from the DEM before the CRMC can consider granting approval for the project.	The Weaver's Cove LNG Project is subject to a federal consistency review. Weaver's Cove Energy will also be obtaining a section 401 Water Quality Certification from the DEM (see table 1.4-1).
Prerequisite #3	All materials to be dredged for either open water disposal or upland disposal must be classified by the DEM based upon an approved analysis process prior to the CRMC acting on an application of either dredging or dredged materials disposal.	Weaver's Cove Energy is not pursuing open water disposal or upland disposal in the State of Rhode Island. Disposal in Massachusetts would be in compliance with all applicable state and federal regulations.
Prerequisite #4	Any application for open water disposal of dredged materials shall have all requisite COE and U.S. EPA approvals.	Weaver's Cove Energy does not propose open water disposal of dredged materials; however, Weaver's Cove Energy would obtain all the necessary permits for the disposal of dredged material (see table 1.4-1).
Prerequisite #5	All applicable requirements of the Freshwater Wetlands Act have or will have been met.	Requirements of the Freshwater Wetlands Act do not apply to the Weaver's Cove LNG Project because no freshwater wetlands would be affected in Rhode Island.
Prerequisite #6	Upland disposal of dredged materials must comply with all applicable local zoning ordinances.	Weaver's Cove Energy is not proposing to dispose any dredged material in Rhode Island; however, Weaver's Cove Energy would comply with all applicable local zoning ordinances in Massachusetts.
Prohibitions		
Prohibition #1	The disposal of dredged materials on or adjacent to coastal wetlands in Type 1 and 2 waters is prohibited unless associated with a CRMC-approved program of wetland building or rehabilitation. The disposal of dredged materials is also prohibited on coastal wetlands designated for preservation in Type 3, 4, 5, and 6 waters.	Weaver's Cove Energy is not proposing to dispose any dredged materials on or adjacent to coastal wetlands In Rhode Island.
Prohibition #2	No dredging for navigational purposes is permitted in Type 1 waters, and only maintenance dredging may be permitted in Type 2 waters.	The dredging associated with the Weaver's Cove Energy project would be conducted within Type 6 waters.

TABLE 4.8.4-2 (cont'd)

Draft Outline of Coastal Consistency Issues Related to Rhode Island Coastal Resources Management Policies

Section & Subject Matter/Policy or Principle	Performance Standard	Comments
Additional Category B Requirements		
Requirement #1	Applicants for all dredging projects shall provide accurate soundings in the area of the proposed dredging operation.	Weaver's Cove Energy obtained recent bathymetric data from the COE and NOAA to determine the amount of dredging required and would provide accurate soundings to the CRMC for the area proposed to be dredged (see section 4.3.2).
Requirement #2	Applicants shall describe any temporary or permanent disturbance to a coastal feature which is required or anticipated in order to gain access for heavy equipment to the dredging or disposal site.	Access to dredging areas would be via existing boat ramps or the proposed LNG terminal site. The disposal site would be accessed via existing roads to the LNG terminal site. Therefore, no coastal features would be disturbed.
Requirement #3	When fine-grained sediments are to be removed, the applicant shall install siltation curtains to control the transport of materials placed in suspension by dredging unless the applicant demonstrates to the CRMC on the basis of competent professional analysis that such transport will not be significant or will be controlled by other measures.	Weaver's Cove Energy has not committed to install siltation curtains or other mitigative measures to control the transport of materials placed in suspension by the dredging activities. Weaver's Cove Energy conducted sediment fate and transport modeling to demonstrate that the resuspended sediments would have minimal impacts on aquatic resources. This modeling is discussed in sections 4.2.2 and 4.3.2.
Requirement #4	The applicant shall limit dredging and disposal to specific times of the year in order to minimize odors and/or impacts on fish and shellfish unless the applicant demonstrates to the Council on the basis of competent professional analysis that such odors or impacts will not be significant or will be controlled by other measures.	Weaver's Cove Energy would develop a modified dredging plan in consultation with the CRMC and the OCZM and other applicable agencies to minimize impacts on fisheries. We have recommended that Weaver's Cove Energy not conduct silt-disturbing activities in the Taunton River during the winter flounder spawning season (see section 4.6.2).
Requirement #5	Applicants for improvement dredging projects shall describe, on the basis of competent professional analysis, anticipated siltation rates, sediment sources, and anticipated maintenance dredging needs.	Weaver's Cove Energy performed field studies to characterize the sediments and conducted modeling to determine the fate and transport of sediments in the water column and on the bed of the bay and river. These studies are discussed in sections 4.2.2 and 4.3.2.
Requirement #6	When dredged materials are removed from a marine to an upland environment for disposal, the applicant shall demonstrate that the release of pollutants present in the materials shall not cause significant threats to groundwater or cause other environmental degradation.	Weaver's Cove Energy does not propose to dispose of any dredged material in Rhode Island; however, reuse of dredged material at the LNG terminal site in Fall River, Massachusetts would be in accordance with Massachusetts regulations and would not cause significant threats to groundwater or cause other environmental degradation (see sections 4.2.2 and 4.3.1.)
Requirement #7	Applicants proposing dredging operations associated with residential boating facilities must demonstrate that the purpose is to restore channels and basins to dimensions that support and maintain existing levels of use, and must submit clear and convincing evidence documenting a diminished use of a facility or navigational fairway by natural shoaling or accretion, not merely a need for additional water depth.	The Weaver's Cove LNG Project would not involve dredging associated with residential boating facilities.

TABLE 4.8.4-2 (cont'd)

Draft Outline of Coastal Consistency Issues Related to Rhode Island Coastal Resources Management Policies

Section & Subject Matter/Policy or Principle	Performance Standard	Comments
Standards		
Standard #1	For dredging: a) bottoms of dredged areas shall slope downward into the waterway so as to maximize tidal flushing; b) bottom slopes at the edges of dredged areas shall have a maximum slope of 50 percent; c) dredging shall be planned so as to avoid undermining adjacent shoreline protection facilities and/or coastal features; and d) shellfish dredged from waters classified SB or lower shall not be made available for human consumption or bait.	Details on the dredging operation associated with the Weaver's Cove LNG Project are presented in section 2.4.1.3. The Weaver's Cove LNG Project would not involve harvesting shellfish for human consumption or bait.
Standard #2	For dredged materials disposed in open water: a) dredged materials may not be placed in areas determined by the CRMC to be prime fishing grounds; b) measures must be employed and described to ensure that all dredged materials will be dumped solely within the confines of an approved site; c) hydrographic conditions at the approved disposal site must be such that the disposed dredged materials will remain within the disposal area and that resuspension of bottom sediments will be minimal; d) following disposal operations involving polluted materials, clean coarse-grained materials must be deposited to cap the spoil mound and minimize the release of any potential contaminants to the water column. The cap shall have minimum thickness of 6 inches; and e) the applicant shall provide for an environmental monitoring program designed to detail physical conditions and biological activity at and near the site for a period of at least 1 year. The results of such programs shall be made public. However, if the monitoring of the disposal of dredged materials at a site is to be performed by, and/or in conjunction with, a state or federally-sponsored monitoring program, then the applicant shall adhere to the requirements of such state- or federally-sponsored program.	Weaver's Cove Energy currently does not propose to dispose of dredged material in open water areas.
Standard #3	For dredged materials disposal in the creation of wetlands, aquatic habitat, or island: a) disposal sites must be sheltered environments which are approved by the Council for such purposes and are not prone to extensive wave or current energies yet subject to sufficient tidal action to provide adequate flushing; b) dredged materials must be pumped or placed into a containment area that will permit sediment consolidation and prevent erosion; c) the applicant must provide for an environmental monitoring program designed to detail physical conditions and biological activity at and near the site for a period of at least 1 year. The results of such a program shall be made public; and d) all applicable requirements of section 300.2 (Filling, Removing, or Grading of Shoreline Features) shall be met.	Weaver's Cove Energy does not propose to use dredged material for creation of wetlands or aquatic habitat.

TABLE 4.8.4-2 (cont'd)

Draft Outline of Coastal Consistency Issues Related to Rhode Island Coastal Resources Management Policies

Section & Subject Matter/Policy or Principle	Performance Standard	Comments
Standard #4	For upland disposal: a) dewatering of dredged materials shall occur behind a berm or bulkhead of sufficient height to contain the material; b) after dewatering, dredged materials placed on uplands adjacent to tidal waters shall be vegetated or otherwise permanently stabilized. Surface slopes of the disposal area shall be graded so as to prevent surface ponding; c) where dredged materials are placed behind a wall or bulkhead the structure shall be suitably engineered to resist the pressures of the dredged material, the material, including fines, shall be prevented from seeping through the wall or bulkhead by the placement of an adequate filtering device, and all applicable standards listed for shoreline protection facilities shall be met; and d) all applicable requirements of section 300.2 shall be met.	Weaver's Cove Energy does not propose to dispose of dredged material in Rhode Island; however, the disposal of dredged material at the LNG terminal site in Fall River, Massachusetts would be in compliance with all applicable permits and regulations.
Standard #5	For disposal for beach nourishment: a) the placement of dredged materials on a beach is a preferred disposal alternative, providing that the materials in question are predominantly clean sands possessing grain size and such other characteristics to make them compatible with the naturally occurring beach material; b) in areas where the processes of littoral drift would result in significant reentry of dredged sediments into a navigable waterway, dredged materials must be placed on the downdrift side of the inlet; and c) all applicable requirements of section 300.2 shall be met.	Weaver's Cove Energy does not propose to use dredged materials to create wetlands, aquatic habitat, or islands.

4.8.5 Hazardous Waste Sites

The southern parcel of the LNG terminal site was used as a petroleum product storage and distribution terminal between the 1920s and 1990s. Historical operations at the site resulted in contamination of soil and groundwater by petroleum products. Releases were documented from ASTs, USTs, loading racks, pipelines, and ship loading areas. Additional information on contamination within the LNG terminal site is provided in section 4.3.1.

The proposed pipeline facilities would cross two hazardous waste or contaminated sites and would be located within 0.25 mile of several others (see table 4.3.1-1). Most of the sites are registered USTs that contain either gasoline or diesel, but there are two sites that the DEP considers hazardous waste sites. Construction of the pipelines in the vicinity of these sites could disturb contaminated soils. To address potential impacts associated with encountering contaminated soils during construction, we have recommended that Weaver's Cove Energy develop a Discovery and Management of Contaminated Soils and Groundwater Plan. This plan would provide for management of contaminants at known sites and include procedures for the identification and management of unknown contaminants in other locations (see section 4.2.1).

4.8.6 Recreation, Public Interest, and Special Use Areas

The Weaver's Cove LNG Project would not affect any state forest land, national or state parks, or Indian reservations. The project would be located on private property that does not provide public access to the Taunton River and would not involve conversion of land held for natural resources purposes in accordance with Article 97 of the Amendments to the Constitution of the Commonwealth of Massachusetts; however, the Northern Pipeline would be located within 0.25 mile of the SMB as discussed below. There are several other designated recreation and public interest areas located near the proposed facilities. Areas for general recreational activities, including motor boating, sailing, fishing, and further down Narragansett Bay yachting regattas, are also located in the project area and/or along the proposed ship route.

4.8.6.1 Designated Recreation and Public Interest Areas

Fall River

Fall River Country Club - The Northern Pipeline route would cross an access road and golf course associated with the Fall River Country Club between MPs 1.7 and 1.9. Additionally, we have recommended and Weaver's Cove Energy has agreed to incorporate a minor route variation through the golf course property between MPs 1.6 and 2.4 (see section 3.5.3). The golf course is a private, 18-hole course that is open for play during the spring, summer, and fall. The Northern Pipeline route, with the incorporation of the Golf Course Variation, would not have a direct impact on the golf course fairways; however, disruption and noise during construction could temporarily affect the activities of golfers. The degree of these impacts would depend on the timing of construction. Construction of the pipeline during the summer months when golfing activities are at their peak would cause more of a disruption than construction during the off-peak, winter months. Some of the construction-related impacts would be unavoidable including the crossing of the club access road; however, the duration of the impacts would be short-term, lasting several days to several weeks until the right-of-way and affected golf course areas are restored in accordance with the requirements specified in the easement agreement between the country club and Weaver's Cove Energy. Operation of the pipeline would not affect long-term golfing activities because the construction and permanent right-of-way would be allowed to revert to former use; however, certain activities such as the construction of aboveground structures or the planting of trees would be prohibited within the permanent right-of-way.

Southeastern Massachusetts Bioreserve - The SMB would be located within 0.25 mile of the end of the Northern Pipeline route and over 1 mile from the LNG terminal site. The SMB was dedicated by the Massachusetts EOEA in October 2002. The SMB's 13,600 acres of land extends across the eastern half of Fall River, much of southern Freetown, and parts of North Dartmouth. The SMB comprises 5,500 acres of Freetown-Fall River State Forest; 3,800 acres of private land purchased by the Massachusetts DFW, the Massachusetts DEP, and The Trustees of Reservations; and 4,300 acres of forest land from the City of Fall River.

The mission of the SMB is to "protect, restore, and enhance the biological diversity and ecological integrity of a large-scale ecosystem with diverse natural communities representative of the region; to permanently protect public water supplies and cultural resources; to offer interpretive and educational programs communicating the value and significance of the bioreserve; and to provide opportunities for appropriate public use and enjoyment of this natural environment" (The Trustees of Reservations, 2001).

Because of its distance and location within an existing pipeline right-of-way, the Northern Pipeline route would not affect the SMB. In addition, the LNG terminal would not affect this area because it is located in an industrially-zoned area over 1 mile from the SMB.

Fall River Heritage State Park - The Fall River Heritage State Park consists of 8.5 acres on the Taunton River overlooking Battleship Cove and is located about 1.5 miles southwest of the proposed LNG terminal site. The park features a visitor's center with local historical exhibits, a carousel, and a community boathouse offering sailing instructions. Battleship Cove is an exhibit of historic naval ships and related memorabilia, offering educational tours; overnight camping for youth groups; and facilities for reunions, memorial services, and banquets. The site is presently home to the USS Massachusetts, the World War II Balao-class submarine USS Lionfish, the destroyer Joseph P. Kennedy, Jr., and two PT boats. All of these were designated by the U.S. Department of the Interior and the NPS as National Historic Landmarks for their national significance in commemorating the history of the country.

The LNG terminal site is located northwest of the Fall River Heritage State Park in an area designated for industrial use and would not affect the park. The dredging associated with the project may have some temporary impacts on the park and its recreational uses. These include increased turbidity and noise (see sections 4.3.2 and 4.11.2, respectively) and conflicts with recreational boating. The arrival and departure of ships associated with operation of the LNG terminal may also affect recreational boating near the park, including the sailing programs. Potential impacts on recreational boating associated with the proposed project are described in section 4.8.6.2.

Fall River Harbor Plan Walkway/Bikeway - The Harbor Plan calls for a 3,900-foot waterfront walkway and bikeway connecting Bicentennial Park to Heritage State Park. The proposed bikeway is intended to eventually link recreation areas in Fall River. Construction of the walkway and bikeway is currently underway. The project is not expected to affect the walkway/bikeway because Bicentennial Park, the closer of the two parks to the proposed LNG terminal, is located about 1.3 miles southwest of the site.

Other Fall River Parks and Playgrounds - Fall River's parks and recreation areas are under the jurisdiction of the Department of Recreational Facilities, Cemeteries, and Trees. According to the Fall River Open Space and Recreation Plan, the city maintains 12 main parks, 14 playgrounds, 11 green spaces, and various landscaped areas covering a total of 213 acres in the city. The closest of these parks, North Park, is located over 1 mile from the LNG terminal site. North Park provides ball fields, a playground, basketball and tennis courts, and an ice skating rink. Bicentennial Park is located about 1.3 miles southwest of the LNG terminal site and includes a public boat ramp.

Construction and operation of the project would not affect recreational activities at the city parks. The dredging associated with the project may have some temporary impacts on Bicentennial Park and its boat ramp. These include increased turbidity and noise (see sections 4.3.2 and 4.11.2, respectively) and conflicts with recreational boating. The arrival and departure of ships associated with operation of the LNG terminal may also affect recreational boating near the park. Potential impacts on recreational boating associated with the proposed project are described in section 4.8.6.2.

Somerset

Chace Preserve - Chace Preserve is a municipally-owned protected or recreational open space located in Somerset adjacent to the northern edge of the construction work area of the Western Pipeline route between MPs 0.8 and 1.1. The pipeline would be located within an existing powerline easement through this area. The preserve consists of 5 acres of woodland trails open during daylight hours and is overseen by the Somerset Conservation Commission. Because the Western Pipeline would be located within an existing powerline easement and would not cross the preserve, the designated use or purpose of the areas would not be affected by pipeline construction or operation.

Other Somerset Parks and Playgrounds - The Somerset High School playing fields are located within 1 mile of the LNG terminal and adjacent to the Western Pipeline at about MP 0.8. The town's Junior High School and Elementary School playing fields are also located near the Western Pipeline route near MP 1.5. Because of the distance and location across the Taunton River, the LNG terminal would not affect the recreational use of the Somerset High School playing fields. Construction-induced effects associated with the pipeline, such as traffic, noise, and dust may affect the quality of some users' recreational experiences, but any effects would be temporary, relatively minor, and limited to the period of construction.

Taunton River

Taunton Heritage River Program - The SRPEDD administers the Taunton Heritage River Program, which aims to support the use of unique resources associated with the Taunton River and encourage tourism by local residents. The Taunton River was named the first Massachusetts Heritage River for its prominent role in the history, culture, recreation, and economy of the communities along the river.

Under this program, Green Futures, an environmental organization based in Fall River, received a grant to conduct an educational program to raise the awareness of the Taunton River for residents in communities from Fall River north to Taunton. The education program will include a narrated riverboat tour and walking tours that provide information on the cultural and natural resources of the Taunton River. Boat tours would likely start at Heritage State Park and proceed north up the Taunton River to Weir Park in Taunton and then circle back to the start of the route.

Construction of the LNG terminal would reactivate a site historically used for industrial activities and would be a consistent use for the site. The dredging associated with the project may have some temporary impacts on the boat tours associated with the program. The arrival and departure of ships associated with operation of the LNG terminal may also affect recreational boating tours. Potential impacts on recreational boating associated with the proposed project are described in section 4.8.6.2.

Wild and Scenic River Program - The NPS administers a program to identify and designate certain rivers in the United States as "Wild and Scenic River Corridors." Since the passage of the Wild and Scenic Rivers Act (WSR Act) in 1968, 163 river segments in the United States have been formally designated as having either exceptional scenic or recreational values. There are two river segments in

Massachusetts that have been formally designated as Wild and Scenic. These include a 43.3-mile segment of the Westfield River (noted as providing some of the northeast's finest whitewater canoeing and kayaking, and for traversing one of the largest tracts of roadless wilderness in Massachusetts) and 29 miles of the Sudbury-Assabet-Concord river system, portions of which traverse the Great Meadows National Wildlife Refuge.

There are no areas within or in the vicinity of the proposed project that are currently included in the NPS's Wild and Scenic River Program. However, the upper Taunton River has been designated a "study area" for inclusion in the program. The 22.5-mile-long study area stretches from Bridgewater at the confluence of the Town and Matfield Rivers to near the Taunton and Raynham town line where the Forge River meets the Taunton River. After Fall River, Somerset, and other towns along the lower Taunton River petitioned the NPS to be included in the study area, the NPS expanded the study area to include the lower Taunton River, with the southern terminus at Mount Hope Bay.

To be designated a Wild and Scenic River, a river must be free-flowing and have one outstandingly remarkable value such as history, fish and wildlife, culture, scenery, geology, archaeology, or recreation. If designated a Wild and Scenic River, development of any new federal dams or water resource projects that would adversely affect the free-flow of the river or otherwise impair the values for which it was designated (e.g., fisheries, exceptional recreational, or scenic resources) would be impeded. According to the NPS, the WSR Act does not generally impose restrictions on a river like a wilderness designation. The intent of the WSR Act is not to stop development and use of a river but to preserve the character of a river. Development that does not damage the outstanding resources of a designated river, or curtail its free flow, is usually allowed (NPS, 2004).

In a comment letter on the draft EIS, the U.S. Department of the Interior stated that based on preliminary findings of the study, the Taunton River appears to support natural and cultural resource values that would qualify it for national designation. The 40-mile-long main stem of the Taunton River is one of the few significant rivers in the region that is free of dams and does not have a history of damming, obstruction, channelization, or other significant alteration. This natural, free-flowing condition supports significant fish, wildlife, cultural, and recreational values ranging from shipbuilding/maritime history to one of the most significant anadromous fish resources of the state and region. Specifically, the fisheries resources of the Taunton River are considered to be one of the most significant contributors to the river's potential eligibility as a National Wild and Scenic River.

A final decision on including the Taunton River in the Wild and Scenic River program has not yet been made. However, protections of the Wild and Scenic River Program are in effect on an interim basis during the study period and for up to 3 years afterward. The NPS expects to complete its study of the Taunton River in 2005. If the NPS recommends the inclusion of the Taunton River in the Wild and Scenic River Program, Congress would then have to approve the designation.

The Weaver's Cove LNG Project would not adversely affect the free-flow of the river. The proposed LNG terminal would be consistent with the historical industrial use of the site and would not impair the values of the river to any greater extent than the other facilities currently located along the lower Taunton River. These include the remnants of the former Shell Oil facility at the proposed site, the Montaup Power Plant, the old and new Brightman Street Bridges, and the existing overhead transmission lines and towers located on either side of the river.

The dredging and construction activities associated with the marine terminal and the arrival and departure of ships during operation of the LNG terminal could affect recreational boating and fishing (see section 4.7.8.2). The Western Pipeline would be installed in the river bed and could also affect recreational use of the river during construction. These impacts would be temporary, lasting only during

the period of active construction. Operation of the pipeline would not impede recreational use of the river. Additional information about impacts associated with the Weaver's Cove LNG Project on visual and historic resources is provided in sections 4.8.7 and 4.10, respectively.

As previously discussed, the fisheries resources of the Taunton River are considered to be one of the most significant contributors to the river's potential eligibility as a National Wild and Scenic River. The dredging and construction activities associated with the LNG terminal and Western Pipeline and the arrival and departure of LNG ships increases the potential for turbidity and sedimentation in the river, which could potentially affect water quality and aquatic resources (see sections 4.3.2 and 4.6.2). To minimize impacts on fisheries resources, we have recommended that Weaver's Cove Energy modify its proposed dredging program and pipeline construction plans within the Taunton River to prohibit any silt-disturbing construction activities during the winter flounder spawning period (January 15 through May 31) (see section 4.6.2). The disturbance associated with the arrival and departure of LNG ships would be unavoidable; however, the ships would use an existing federal navigation channel to access an existing DPA and an area that currently and historically has accommodated commercial shipping.

For the reasons stated above, we do not believe that construction or operation of the proposed project would have a substantial adverse affect on the Taunton River's potential designation as a Wild and Scenic River. However, final determination on whether the Weaver's Cove LNG Project would have a substantial adverse affect on the Taunton River's potential designation as a Wild and Scenic River would be made by the U.S. Department of the Interior. In addition, the COE would provide a draft of its permits pursuant to section 10 of the Rivers and Harbors Act and section 404 of the CWA to the NPS for review. If the NPS objects to the permit under the provision of the WSR Act, the COE would not issue the permits. Therefore, **we recommend that:**

- **<u>Prior to construction</u>, Weaver's Cove Energy file with the Secretary documentation of concurrence from the U.S. Department of the Interior that the project would not have a substantial adverse affect on the Taunton River's potential designation as a Wild and Scenic River and that the project would be consistent with the WSR Act if the Taunton River were designated a Wild and Scenic River.**

4.8.6.2 General Recreation and Special Uses

Recreational Boating and Fishing

Narragansett Bay, Mount Hope Bay, and the Taunton River provide ample opportunities for recreational boating and fishing. These activities generally occur during the six warmest months of the year, but are particularly concentrated during the summer months between late June and September when an estimated 60,000 recreational boats use the bays and river.

The DEM (2000) reported that in 1999 there were 35,891 registered boats in Rhode Island. According to data cited in Colt et al. (2000) here were about 7,700 slips and 5,000 moorings in Narragansett Bay in 1988. These data also indicated that another 4,500 boats may also be kept at private docks and moorings within the bay. The Rhode Island Attorney General indicated in his comments on the draft EIS that there are proposals that would significantly increase the existing number of boat slips along the East Passage of Narragansett Bay. By evaluating permit applications submitted to the COE between May 2003 and March 2005, as well as the East Bay Newspapers online edition, we were able to determine that there are proposals for an additional approximately 2,056 boat slips within the entire Narragansett Bay area (COE, 2005; East Bay Newspapers, 2005). Most of these slips are associated with a single project, the Weaver Cove Marina in Portsmouth, which was approved in the mid 1990s. Based on a newspaper report, this proposed marina would be the largest marina on the East Coast; however, no

actual docks are yet in place for the project and the marina's eventual size may be smaller than originally proposed (East Bay Newspapers, 2005). Regardless, the data indicate that the number of boat slips on the bay is likely to continue to increase at least in the short term.

During the summer months yachting regattas are held within Narragansett Bay. Smaller yachts tend to race closer to Newport while larger yachts race further from shore. Several races are scheduled throughout the summer months and about 20 to 30 marine event permits are issued annually. The largest events are focused at Quonset (air show), Newport (Americas Cup), Breton Reef, north of Conamicut and Barrington Points, Greenwich Bay, and the Wickford and Bristol Bay racing series. Weekend volumes tend to be twice that of weekday volumes.

Fall River's recreational boating opportunities are provided primarily by private marinas. The only public boating facility in Fall River is a boat ramp located in Bicentennial Park, about 1 mile southwest of the LNG terminal site. The Harbor Plan identifies four marinas with a total of 215 slips and 49 designated moorings within its study area. These include the King Philip Boat Club, Borden Light Marina, Battleship Yacht Club, Heritage State Park, and Regatta Marina. Additional marinas beyond the Harbor Plan study area include Point Gloria Marina and Captain John O'Connell Marina. Point Gloria Marina is located just south of Bicentennial Park and provides 10 slips. The Captain John O'Connell Marina includes approximately 25 slips and is located north of the LNG terminal site along River Street.

The City of Fall River does not provide specific areas for recreational fishing in any of its parks or recreational areas; however, Heritage State Park located about 1.5 miles south of the LNG terminal site allows fishing south of its boathouse. Some fishing also occurs along bridges in the area, particularly from the Brightman Street Bridge. In 2002, 82 percent of the Brightman Street Bridge openings were for pleasure and fishing boats with 89 percent of the openings occurring between May and October.

There are also several opportunities for recreational boating and fishing in Somerset. Many private residences along the Taunton River in Somerset have their own dock or boat ramp. There are also several private marinas. Public recreational boating facilities include a boat ramp located at Brayton Point and the Somerset Village Waterfront Park, which includes a boat ramp and other docking and launching facilities.

Weaver's Cove Energy conducted a recreational boating traffic study focused on recreational traffic passing through the Brightman Street Bridge and under the Mount Hope Bridge during a peak summer weekend and the following Monday (see section 4.12.5 for further discussion of this study). The traffic estimates suggested that the heaviest use of the waterways for recreational purposes occur between the hours of 8 AM and sunset on Saturday and Sunday. Traffic levels fell off dramatically on the following Monday.

Several construction-related activities could impact recreational boating and fishing within the Taunton River. These include the dredging of the federal navigation channel and turning basin near the LNG terminal site, construction activities associated with the marine terminal, and construction of the Western Pipeline across the river.

Weaver's Cove Energy would schedule the dredging activities in coordination with the COE, NOAA Fisheries, the Massachusetts DMF, and other regulatory agencies to minimize disruption and conflicts with other uses of the river. Weaver's Cove Energy would also develop a Navigation Work Plan in consultation with the COE, Coast Guard, local harbor masters, and the Northeast Marine Pilots Association. The Navigation Work Plan would include measures to ensure the safe passage of waterborne transportation and recreational use of the waterway during construction activities. The dredging that would be conducted by Weaver's Cove Energy could also have a beneficial impact on the

economy because it would facilitate the achievement of adequate water depths for larger ships (i.e., cruise ships) to travel to the Fall River area. Impacts on fisheries, including shellfish, associated with these activities are discussed in section 4.6.2.

Operation of the project facilities would impact recreational boating and fishing during the arrival, and departure of the LNG ships. Weaver's Cove Energy estimates that about 50 to 70 ships per year would pass through Narragansett Bay and enter Mount Hope Bay and the Taunton River to deliver its cargo to the LNG terminal. Weaver's Cove Energy also estimates that the total travel time of a 145,000 m^3 LNG ship would be about 4 hours from the time the ship enters Narragansett Bay to being moored at the ship unloading facility.

Weaver's Cove Energy would be in regular contact with the Coast Guard and other waterway users to ensure that the arrivals of the LNG ships are coordinated with other ship traffic to minimize disruption on waterway users. As discussed in section 4.12.5.2, the Coast Guard would routinely provide Notice to Mariners prior to the arrival and departure of LNG ships as the Coast Guard currently does for Liquefied Petroleum Gas (LPG) vessels and for other activities such as the Tall Ship parades. The notification system includes broadcasts on radio frequencies used by mariners. Picket boats would also precede the LNG ship to inform vessels of the approaching security zones.

The LNG ships would use an existing federal navigation channel used by other commercial traffic, which would minimize the overall impacts on recreational traffic. In addition, Weaver's Cove Energy has indicated that it would be willing to consider limiting LNG ship transits during peak weekend hours and using early morning periods, subject to tidal conditions. With the agreement of the Coast Guard and pilots, Weaver's Cove Energy would also explore the possibility of eventually using nighttime transits for the LNG ships to minimize impacts on recreational boating.

Docks in Fall River currently accommodate both industrial and commercial ships and industrial ships have historically used the facilities at the proposed LNG terminal site. As a result, marine traffic associated with the project would not introduce any significant new type of impacts on recreational boating or fishing. However, the moving safety and security zone enforced around each LNG vessel (generally 2 miles ahead, 1 mile astern, and 1,500 feet on either side of the LNG vessel) and around the ship unloading facility while a ship is docked would widen the area restricted to boaters. This could cause additional impacts on recreational boating and fishing but the impacts would be temporary while the boat is in transit or moored at the ship unloading facility.

Because the safety and security zone would be a moving zone around the ship, the impacts would be of short duration at any given point along the shipping route. Many recreational boats should be able to go around the LNG ships at points in the river that are sufficiently wide for them to be outside of the security zone. In locations were the waterway is narrow, a recreational craft attempting to travel in the opposite direction of an LNG ship traveling at 10 knots may need to wait up to 18 minutes for the LNG ship to pass before proceeding on its way. The delay would increase to up to 36 minutes when the LNG ship is traveling at 5 knots and up to 60 minutes when the LNG ship is traveling at 3 knots. For boaters near or upstream of the facility, an additional 60 minute delay may be experienced while the LNG ship is berthed or turned. The Coast Guard has not defined the size of the safety and security zone around a docked LNG ship but has stated that it would make every effort to minimize disruption to other water way users. Moreover, the Coast Guard security zones would not be treated as absolute exclusion zones that would preclude all other vessel movements. Rather, other vessels may be allowed to transit through the security zone with the permission of the Captain of the Port. Additional information on marine traffic and the safety and security exclusion zone is presented in sections 4.9.4 and 4.12.5.

The extent of the impact on recreational boaters would depend on the number of boats in the project area during the days of the year that LNG ships would call on the LNG terminal. These impacts would be greatest during the peak recreational boating season between about May and September. As discussed above, the Coast Guard would most likely use a program of announcements to give advance notice of each safety and security zone schedule.

Operation of the LNG terminal would not affect public access to the city's waterfront, which is a requirement under Chapter 91 regulations, because the existing industrial site is privately owned and does not currently provide public access to the waterfront. Public access is also not a consistent use of any site designated as a DPA. Chapter 91 regulations support offsite mitigation to provide riverfront access in the vicinity of a proposed project. Weaver's Cove Energy would address this issue with the DEP as part of the Chapter 91 permit review process and has indicated that appropriate mitigation such as improved public access or enjoyment of a riverfront area in the vicinity of the proposed LNG terminal site would be discussed with the DEP.

Commercial Fisheries

Shellfish resources in the vicinity of the proposed LNG terminal site include northern quahog. As described in section 4.6.2, since 1997, the Massachusetts DMF has contracted with shell fishermen to harvest quahogs from biologically contaminated areas in Mount Hope Bay and the Taunton River. Harvested quahogs are then offered to other coastal towns for relocation, or "relay," to clean sites where they remain for a suitable depuration period before harvested for consumption. Weaver's Cove Energy reported that over the 6-year period of the program, an average of 7,940 bushels of quahogs has been collected in the lower Taunton River. Shell fishermen harvesting quahogs for relay in the lower Taunton River would be required to temporarily avoid or vacate the areas affected by the moving security zone during the transit of an LNG ship.

The Rhode Island shellfish industry is also dominated by the northern quahog. Shellfish resources are managed by the DEM through designated management areas and a rotational transplant/harvest system. Stock assessments based on fishery landings, fishery effort, and independent survey data indicate that quahog stock biomass is at a relatively low level and below that needed for maximum sustainable yield. However, the steady decline that occurred between the mid 1980s and mid 1990s has leveled off as the result of water quality improvements in Greenwich Bay and the DEM's rotational harvest/transplant program in the Pottowomut and High Banks Spawner sanctuaries.

Most of Upper Narragansett Bay and Mount Hope Bay in Rhode Island are permanently closed to shellfishing due to poor water and sediment quality. Other closed areas along the proposed LNG ship route include: the vicinity of Melville east of a line from Coggshall Point; Carr Point to buoy "GrC" located at Fiske Rock; the area east of Jamestown; the East Passage and Newport Harbor east; and Castle Hill Cove. In areas where shellfishing occurs, the passage of LNG vessels may inconvenience the commercial harvesting of shellfish as a result of the moving safety and security zone around transiting LNG ships. However, assuming a maximum operating depth range of 26 feet for quahog harvesting by bull rake (Desbonnet and Lee, 1991), there are few areas encompassed by the moving safety and security zone that would be within effective depth ranges harvested by shell fishermen. The few areas that could be affected include the area northeast of Prudence Island and a small area south of Dyer Island. Shell fishermen in these areas would be required to temporarily avoid or vacate the areas affected by the moving security zone during the transit of an LNG ship. Aside from these areas, a majority of the East Passage that would fall within the security zone is not prime shellfishing areas due to either permanent closure or depths below 26 feet (i.e., the maximum permitted depth for harvesting shellfish by hydraulic dredge and the maximum depth for effectively harvesting by bull rake).

Salinity levels and a lack of suitable rocky habitat generally limit American lobsters to Narragansett Bay. The Rhode Island inshore fishery for lobster has declined sharply in recent years and both fishery landings and abundance have dropped to low levels. In spite of this decline, fishing for lobster continues to occur year round in Narragansett Bay. The deep and rocky areas of the bay contain the most abundant populations and provide the best lobster fishing. The most heavily fished areas are the southern coast and the East Passage of the bay. The northern limit of the fishery is around Ohio Ledge, located between Rocky Point in Warwick and North Point in Bristol, and the mouth of Mount Hope Bay. Due to the favorable habitat conditions that exist within the navigation channel, many lobstermen set their pots within the channel (Olszewski and Lynch, 2005).

The passage of LNG vessels could inconvenience the commercial harvesting of lobster as a result of the moving security zones established by the Coast Guard. Lobstermen in these areas would be required to avoid or vacate the areas affected by the moving security zone. However, this effect would be temporary (up to about 18 minutes, as discussed in more detail in section 4.12.5) and limited to periods when the LNG ships are in transit to the facility. Commercial fishermen are trained in the rules, safety procedures, and regulations within the waters of Narragansett Bay. Additionally, they are currently subject to similar restrictions along the channel while other types of commercial vessels are in transit to Mount Hope Bay. For these reasons, it is not expected that the transiting LNG ship would cause a significant disruption in the commercial shellfishing industry (Olszewski and Lynch, 2005). Passage of the LNG vessels could also damage lobster gear that is placed within the navigation channel. However, because the LNG ships would use an existing dredged federal navigation channel that is maintained specifically to allow passage by large vessels, the placement of lobster gear in this channel by lobstermen assumes these inherent risks. Lobstermen who actively fish these areas typically factor in the potential for broken gear in the economics of their operations (Olszewski and Lynch, 2005).

Finfish fisheries in the project area include demersal (bottom-dwelling) and pelagic (water column) fish. Historically, commercial fishing occurred for several of these species in the Narragansett Bay watershed. However, due to the current status of fish populations, commercial fishing has been essentially eliminated from Mount Hope Bay and the Taunton River. The finfish community in Narragansett Bay has changed from an assemblage dominated by demersal species to one currently dominated by pelagic fish species and longfin squid. Important finfish found in the bay include winter flounder, scup, bluefish, striped bass, tautog (blackfish), and menhaden (EPA, 1992). Trawling for finfish occurs in Narragansett Bay from April through November. Trawling activities are concentrated within the East Passage, within the waters on the northeast side of Jamestown north to Hope Island, and south of Hog Island in the waters west of Prudence Island. The passage of LNG vessels could inconvenience the commercial harvesting of finfish as a result of the moving security zones. However, with the exception of a small area south of Hog Island, most of the trawling activities take place outside of areas that would be affected by the security zones for LNG ships transiting to the proposed LNG terminal. Trawling boats in this area would be required to temporarily avoid or vacate the area during the transit of an LNG ship.

4.8.7 Visual Resources

4.8.7.1 LNG Terminal

The degree of visual impact that may result from a proposed project is typically determined by considering the general character of the existing landscape and the visually prominent features of the proposed facility. The proposed LNG terminal would be constructed at an existing industrial terminal site in a location that is surrounded by industrial, commercial, and residential uses. The site is bordered on the north by the Taunton River and a wooded area; the east by a mix of industrial, commercial, and residential uses; the south by Route 79 and beyond that a mix of commercial, residential, and industrial

uses; and the west by the Taunton River. The terrain in the area of the site is flat along the river and slopes upward east and west of the river.

The most prominent visual feature of the proposed LNG terminal would be the LNG storage tank. Due to its location adjacent to the Taunton River and the density of the area, the tank would be highly visible from a number of locations in Fall River and Somerset. The concrete shell of the tank would be left unpainted and would be whitish-gray in color. The tank would be about 280 feet in diameter and about 195 feet high and would be constructed at a base elevation of about 25 feet above MSL. As a result, the anticipated elevation of the top of the tank would be about 220 feet above MSL. In comparison, the tanks currently located at the site are about 50 feet high, the electrical transmission towers adjacent to the site are about 300 feet high, and the stacks at the Montaup Power Plant across the Taunton River range in height from about 280 feet to 310 feet.

A visual analysis was conducted by Sasaki Associates, Inc. from areas with possible views of the LNG terminal site during leaf on and leaf off periods based on topography, surrounding buildings, and forested areas. The results of this study are shown on photographs provided in Appendix G. The most prominent views of the facilities would be from the back of the Border City Mill Complex Apartments and the Somerset side of the river. Although there are some existing visual distractions in the area (e.g., transmission lines, transmission towers, and buildings), the LNG tank associated with the terminal site would dominate the viewshed for these areas and would result in both temporary and permanent changes to the surrounding visual landscape.

Because of the limited potential for screening, the visual impacts associated with the LNG terminal would be unavoidable; however, Weaver's Cove Energy would use the dredged material to construct a landform north and east of the tank to provide some visual screening of the facility from locations to the east and northeast. The landform would have a height ranging between about 148 feet and 188 feet MSL; however, the LNG storage tank would still rise over the top of this landform. Disturbed areas within the site, including the earthen landform, would be covered with a layer of topsoil, if needed, to support vegetation, and planted with vegetation in accordance with a landscaping plan and/or a portion may be covered with material other than vegetation (e.g., crushed rock). Because Weaver's Cove Energy would be cleaning up and removing the existing facilities on the site, some beneficial impacts on the viewshed could occur. To ensure that visual impacts of the LNG terminal are minimized**, we recommend that:**

- **Weaver's Cove Energy prepare a Landscaping Plan showing how the northern and southern parcels of the LNG terminal site would be restored and revegetated. The Plan should include the locations and descriptions of specific measures and plantings to screen views of the LNG facilities from nearby residences. The Landscaping Plan should be filed with the Secretary for review and written approval by the Director of OEP <u>prior to construction</u>.**

Exterior lighting at the LNG terminal site would be installed as necessary for general plant operations, worker and visitor safety, and security. Floodlighting would be installed for critical process areas and the unloading facility. Lower intensity lighting would be installed along internal roads, at general plant areas, and at the perimeter fencing. The tank would be equipped with security and worker lighting on work platforms on the top of the tank, as well as the stairs leading to the dome. Lighting at the LNG terminal site would be in accordance with OSHA requirements, other applicable codes, and proper security practices. Weaver's Cove Energy would downcast the lighting at the internal roads and perimeter fence to minimize offsite light scatter.

In its *Notice of Proposed Construction or Alteration* submitted to the Federal Aviation Administration (FAA), Weaver's Cove Energy requested that the proposed LNG storage tank not be required to display marking or lighting designed to meet FAA standards. The FAA's Advisory Circular 70-7460-1K, Chapter 1, Subsection 5(b)(2) indicates that no marking and/or lighting is considered necessary or required in instances where "the object may be so located with respect to other objects or terrain; removed from the general flow of air traffic; or may be so conspicuous by its shape, size, or color that marking or lighting would serve no useful purpose." As previously discussed, the proposed 195-foot-tall LNG storage tank would be located in an area with existing electrical transmission towers that are about 300 feet tall and stacks at the Montaup Power Plant that are between 280 and 310 feet tall. There is also a steep bluff to the east of the site with several buildings in excess of four stories in height located at the top of the bluff. The closest operating airport to the LNG storage tank is the New Bedford regional airport, which is located more than 10 miles northwest of the site. In addition, because of its size, the tank would be clearly visible during daylight hours and the security and worker lighting on the top of the tank would be lit between sunrise and sunset. Although this lighting would not be designed to meet FAA standards (e.g., it would not flash or strobe), it would make the tank visible at night. As a result, marking or lighting the tank in accordance with FAA standards would not enhance its visibility and would not serve a useful purpose as indicated by Advisory Circular 70-7460-1K.

In addition to the site itself, the LNG ships would temporarily affect the visual landscape while in transit and docked at the LNG terminal. The LNG ships expected to deliver LNG to the site would typically have a total length of about 950 feet, a beam (width) of about 145 feet, and a loaded draft of about 37.5 feet. As discussed in section 2.2.2, LNG ships have a distinctive appearance compared with other transport ships due to a high freeboard (i.e., that portion of the ship above water). Weaver's Cove Energy estimates that the total travel time of a 145,000 m^3 LNG ship would be just over 4 hours from the time the ship enters Narragansett Bay to being secured at the berth (see section 4.9.4). Docking, LNG cargo unloading, and undocking would take less than 24 hours. Although the visual impacts associated with the LNG ships would be unavoidable, they would be temporary and short term.

4.8.7.2 Pipeline Facilities

The pipelines facilities would be located on private lands that are not subject to federal or state visual management standards. Visual resources along the pipeline route are a function of geology, climate, and historical processes and include topographic relief, vegetation, water, wildlife, land use, and human uses and development. The vegetation along the pipeline route consists largely of grasses, shrubs, and small- to medium-diameter trees on mostly flat to rolling terrain.

Weaver's Cove Energy proposes to use a maximum of a 75-foot-wide construction right-of-way for the Northern Pipeline route and a 100-foot-wide construction right-of-way for the Western Pipeline route. Some areas along both routes would be widened for temporary extra workspaces. Visual impacts associated with the construction right-of-way and temporary extra workspaces would include the removal of existing vegetation and the exposure of bare soils, as well as earthwork and grading scars associated with heavy equipment tracks, trenching, and machinery and tool storage. Other visual effects could result from the removal of large individual trees that have intrinsic aesthetic value; the removal or alteration of vegetation that may currently provide a visual barrier from undesirable views; or landform changes that introduce contrasts in visual scale, spatial characteristics, form, line, color, or texture.

Visual impacts would be greatest where the pipeline route parallels or crosses roads and the pipeline right-of-way may be seen by passing motorists, on residents where vegetation used for visual screening of existing utility rights-of-way would be removed, and in forested areas. The duration of visual impacts would depend on the type of vegetation that is cleared or altered. The impact of vegetation clearing would be shortest in open lands consisting of scrub-shrub vegetation, where the reestablishment

of vegetation following construction would be relatively fast (generally less than 5 years). The impact would be greater in forest land, which would take many years to regenerate mature trees. The greatest potential visual impact would result from the removal of large specimen trees, which would take longer than other vegetation types to regenerate and would be prevented from reestablishing on the permanent right-of-way.

The majority of the Northern Pipeline would be located within the existing Shell Oil right-of-way and portions would be adjacent to an existing railroad. Construction within or adjacent to existing rights-of-way typically reduces impacts on visual resources because it minimizes vegetation clearing. The existing Shell Oil easement, however, has not been maintained and vegetation, including trees, has been allowed to reestablish on the right-of-way. This vegetation would be cleared during construction of the Northern Pipeline and would result in both short-term and long-term impacts on visual resources depending on the type of vegetation that is removed. In contrast to the existing conditions of the Shell Oil easement, Weaver's Cove Energy would maintain its permanent right-of-way along the Northern Pipeline route in a herbaceous state.

The Northern Pipeline would cross five roadways: Collins Road, Wilson Road, Clark Street, Terry Lane, and Country Club Road. Some screening vegetation including trees would be cleared at the first four of these roads, which may increase the visibility to the west towards the river at these crossings. The crossing at Country Club Road is located adjacent to a large open area and would have only a short term impact on visual resources. In addition to these road crossings, the Northern Pipeline route would be constructed from or within River Street with the incorporation of the River Street Variation into the proposed route. By constructing the pipeline from or within the road, impacts on mature vegetation would be minimized (see section 3.5.3)

The 0.1 mile of newly created right-of-way at the end of the Northern Pipeline route would be constructed through a forested area. The establishment of a new pipeline right-of-way through this forested area would create a permanent visual impact. Although the temporary portion of the construction right-of-way would be allowed to revert to preconstruction conditions, the new permanent right-of-way would be maintained in an herbaceous state. The significance of these visual impacts is reduced because this right-of-way segment is not visible from any residences or public roads.

The Western Pipeline would be located adjacent to or within existing rights-of-way for the majority of the route (about 1.8 miles or 72 percent). The existing rights-of-way consist of public roads and powerline facilities. The pipeline right-of-way would be visible to passing motorists on the roads at several locations. The removal of vegetation within the construction right-of-way, which currently screens the powerline facilities, would result in both short-term and long-term impacts on visual resources depending on the type of vegetation that is removed.

The Western Pipeline would cross five roads (Riverside Avenue, County Street, Prospect Street, Brayton Avenue, and Swansom Road) and be adjacent to Riverside Avenue and Clifford M. Holland Road. Little visual screening exists along Riverside Avenue and County Street and construction of the pipeline in these areas would have only a temporary visual impact. Tree screening in the form of trees and shrubs exist to varying degrees along the other four roads. Construction would remove some of this visual screening at or along these roads, which would increase the visibility of the right-of-way and the adjacent existing transmission lines. In its comments on the draft EIS, Weaver's Cove Energy indicated that it is considering installing the pipeline within Clifford M. Holland Road to preserve the existing vegetation along this road (see section 3.5.4).

The 0.7 mile of newly created right-of-way associated with the Western Pipeline is comprised of 0.4 mile across the Taunton River and 0.3 mile through a forested area at the end of the pipeline route.

The newly created right-of-way across the Taunton River would not be visible and would not affect visual resources in the area. The establishment of a new pipeline right-of-way through the 0.3 mile of forested area would create a permanent visual impact. Although the temporary portion of the construction right-of-way would be allowed to revert to preconstruction conditions, the new permanent right-of-way would be maintained in an herbaceous state. The significance of these visual impacts is reduced because this right-of-way segment is not visible from any residences or public roads.

We received comments from the Massachusetts EFSB regarding the loss of trees that provide aesthetic value, shade, and/or visual screening for four residential areas in close proximity to the pipeline construction rights-of-way. Two of these areas are along the Northern Pipeline route (MPs 0.54 to 0.91 and around MP 2.0) and two of these areas are located along the Western Pipeline route (MPs 0.49 to 0.54 and MPs 1.51 to 1.82). Weaver's Cove Energy has incorporated route variations that would avoid or minimize visual impacts on the two areas along the Northern Pipeline route (River Street Variation and Golf Course Variation). In addition, Weaver's Cove Energy has developed site-specific measures to minimize visual impacts on the area between MPs 1.51 and 1.82 of the Western Pipeline route (Jaffrey Street Variations) (see sections 3.5.3 and 3.5.4). The fourth area between MPs 0.49 and 0.54 of the Western Pipeline route is discussed below.

After crossing the Taunton River, the Western Pipeline route would make landfall at about MP 0.48 just south of Annette Avenue on property owned by Somerset Power, L.L.C. There are five residences located north of Annette Avenue between MPs 0.49 and 0.54. These residences are located immediately adjacent to the street and there is little or no vegetation between the houses and the edge of the street. There are, however, several deciduous and evergreen trees on the Somerset Power, L.L.C. property that provide varying levels of visual screening of the Montaup Power Plant from these residences. It appears based on a field review of the area that most of these trees would be removed during construction of the pipeline. We evaluated alternative Taunton River crossing locations and minor route variations around the Montaup Power Plant that would avoid the Annette Avenue area. However, none of these alternatives or route variations was determined to be environmentally preferable to the proposed pipeline route (see section 3.5.4). Four of the five residences between MPs 0.49 and 0.54 would be located within 50 feet of the construction work area and Weaver's Cove Energy would prepare site-specific residential construction mitigation plans to minimize impacts on these residences. However, as previously noted, the trees that would be removed during construction in this area are on property owned by Somerset Power, L.L.C. Therefore, to ensure that potential impacts associated with the loss of visual screening in this area are minimized, in addition to or in conjunction with the residential construction mitigation plans for this area, **we recommend that:**

- **Weaver's Cove Energy file with the Secretary for the review and written approval of the Director of OEP <u>prior to construction</u>, a Visual Screening Plan developed in consultation with and approved by Somerset Power, L.L.C. that includes measures to replace screening vegetation removed from the temporary construction right-of-way between MPs 0.49 and 0.54 of the Western Pipeline route.**

Construction and operation of the new aboveground facilities associated with the Northern and Western Pipelines would have a permanent impact on visual resources. Both facilities would be located in forested areas. The meter and regulation station at the end of the Northern Pipeline route would affect about 0.9 acre of shrub land within the Riverfront Business Park. The meter and regulation station at the end of the Western Pipeline route would affect about 1.4 acres of forest land. However, neither station site is located in an area that is visible from residences or major roads.

4.9 SOCIOECONOMICS

The Weaver's Cove LNG Project would involve construction of an LNG terminal in the City of Fall River in Bristol County, Massachusetts. In addition, two natural gas pipelines totaling about 6.1 miles long would be constructed from the LNG terminal through Fall River and the Towns of Somerset, Swansea, and Freetown to existing pipeline systems. Some of the potential socioeconomic effects from construction, operation, and maintenance of the project are related to the number of construction workers that would work on the project and their impact on population, public services, nearby homes and businesses, and temporary housing during construction. Other potential impacts are related to construction and operation of the LNG terminal, such as increased traffic or disruption of normal traffic patterns in the vicinity of the terminal site. Other effects associated with the project include increased property tax revenue, increased job opportunities and income associated with local construction employment, and local expenditures by the company and non-local construction workers.

The potential impact of the project on land use and residences in the project area is discussed in section 4.8. A discussion of the project's effects on population and employment, public services, housing, traffic, tax revenue, transportation, and environmental justice is provided below.

4.9.1 Population, Economy, and Employment

Table 4.9.1-1 provides a summary of selected demographic and socioeconomic statistics for the state, county, and cities where project facilities are proposed. The population of Bristol County was 534,678 in 2000 and had increased 5.3 percent in the previous 10 years.

TABLE 4.9.1-1

Existing Socioeconomic Conditions for the Weaver's Cove LNG Project

State/County/City	Population		Population Density a/		Per Capita Income (1999)	Civilian Labor Force (2001)	Unemployment Rate (percent)		Top Two Major Industries
	1990	2000	1990	2000			2000	2001	
MASSACHUSETTS	6,018,101	6,349,097	768	810	$25,952	3,317,479	2.6	3.7	1. Education, Health, and Social Services 2. Manufacturing
Bristol County	506,324	534,678	911	962	$20,978	274,768	3.8	4.8	1. Education, Health, and Social Services 2. Manufacturing
Fall River	92,703	91,938	2,988	2,964	$16,118	42,019	4.9	5.8	1. Manufacturing 2. Education, Health, and Social Services
Somerset	17,655	18,234	2,177	2,248	$22,420	9,418	2.9	3.6	1. Education, Health, and Social Services 2. Manufacturing
Swansea	15,411	15,901	668	689	$21,776	8,620	3.4	3.9	1. Education, Health, and Social Services 2. Manufacturing
Freetown	8,522	8,472	233	232	$24,237	4,515	3.6	4.3	1. Education, Health, and Social Services 2. Manufacturing

a/ Persons per square mile, based on population and land area size: Massachusetts (7,840 sq. mi.), Bristol County (556 sq. mi.), Fall River (31.02 sq. mi.), Somerset (8.11 sq. mi.), Swansea (23.07 sq. mi.), and Freetown (36.58 sq. mi.).

Sources: U.S. Census Bureau, DP-3 Profile of Selected Economic Characteristics: 2000; Commonwealth of Massachusetts Division of Employment and Training, Employment and Wages ES-202 Series; and U.S. Department of Labor, Bureau of Labor Statistics, Local Area Unemployment Statistics.

The City of Fall River, where the LNG terminal would be located, has the highest population and population density of the cities and towns that would be affected by the project.

The main industries in the county and cities that would be affected are education, health, social services, and manufacturing. The unemployment rate for the City of Fall River was 5.8 percent in 2001, which was higher than the rates for the state and Bristol County (3.7 and 4.8 percent, respectively), and higher than the remaining cities that would be affected by the project.

Weaver's Cove Energy estimates that an average of 185 workers would be employed during the 36-month-long construction period of the LNG terminal, with a peak workforce of 275 personnel. Of the peak workforce, Weaver's Cove Energy estimates that 15 management/staff jobs and 195 supervisor/crew jobs would be given to local workers (i.e., within 50 miles of the site). The remaining 65 employees would be hired from outside the Fall River area, including personnel highly qualified in mechanical, electrical, and instrumentation work and control tradesmen.

Approximately 36 months would be required to complete dredging and dredged material reuse activities. Weaver's Cove Energy estimates it would employ up to 75 workers for these activities, approximately half of which would be local hires.

Population impacts within the project area are expected to be temporary and proportionally small. A majority of the impacts would come from the temporary influx of construction personnel. The total population change would equal the total number of non-local construction workers, plus any family members accompanying them. Assuming all 103 non-local construction workers relocate to the project area with family members, this would equate to 267 people using a typical household size of 2.59 persons (U.S. Department of Commerce, 2003). This temporary increase in population corresponds to less than 1 percent of the existing population and would not have a permanent impact on population. A brief decrease in the unemployment rate could occur as a result of construction due to the hiring of local workers for construction and the increased demands on the local economy. However, given the relatively short construction period, the impacts on the economy and employment as a whole would be temporary and minimal.

Thirty permanent employees would be required for operation of the LNG terminal. Weaver's Cove Energy has indicated it would hire and train local workers to the extent possible. Given the small number of permanent workers, the project would not have a significant impact on the permanent population, economy, or employment.

We received a scoping comment and comments on the draft EIS regarding the limited number of permanent jobs that would be created by the proposed LNG terminal compared to the higher number of permanent jobs that have been created by the development of similar sized parcels elsewhere. We recognize that different types of development could create more jobs than the proposed project. However, no such developments have been proposed for the LNG terminal site that would be consistent with local plans (see section 4.8.2).

Construction of the pipeline facilities, including the Taunton River crossing, is anticipated to occur over 10 months, beginning in early 2007 and to be completed concurrent with the completion of the LNG terminal. The pipeline facilities would be constructed with one spread each for the Western Pipeline, the Northern Pipeline, and the Taunton River crossing. A peak construction workforce of 60 to 140 personnel is anticipated, all of which Weaver's Cove Energy anticipates would likely be hired from the local area. Following construction, Weaver's Cove Energy plans to contract with Algonquin to operate the pipelines. Due to the short length of the pipelines, its unlikely Algonquin would hire additional permanent staff.

4.9.2 Housing

Housing is relatively abundant in the vicinity of the Weaver's Cove LNG Project. Rental vacancy rates are higher in the City of Fall River than the remaining cities and the whole of Bristol County (see table 4.9.2-1). Table 4.9.2-2 provides the number of vacant housing units and hotel/motel/inn rooms for the county and cities in the vicinity of the proposed project.

TABLE 4.9.2-1

2000 Housing Characteristics for the Project Area

County/City	Total Housing Units	Total Vacant Housing Units	Vacancy Rate (percent)
Bristol County	216,918	11,507	5.3
Fall River	41,857	3,098	7.4
Somerset	7,143	156	2.2
Swansea	6,070	182	3.0
Freetown	3,029	97	3.2

Source: U.S. Census Bureau, American FactFinder.

TABLE 4.9.2-2

Temporary Accommodations Available in the Project Area

County/City	2000 Vacant Housing Units Available for Rent	2000 Vacant Housing Units Available for Seasonal, Recreational, or Occasional Use	2003 Hotels/Motels/Inns Rooms	2003 Campground/Recreational Vehicle (RV) Park Sites
Bristol County	4,562	2,038	a/	a/
Fall River	1,819	100	82	0
Somerset	43	19	152	0
Swansea	19	38	0	0
Freetown	7	38	0	0
Westport	a/	a/	133	25
Assonet	a/	a/	a/	65

a/ The number of individual housing units, rooms, and campground/RV sites is not available.

Sources: Bristol County Convention and Visitors Bureau (www.bristol-county.org).
U.S. Census Bureau, DP-1. Profile of General Demographic Characteristics: 2000

Temporary housing is available in the form of daily, weekly, and monthly rentals in motels, hotels, campgrounds, recreational vehicle parks, apartments, and houses. Construction could affect the availability of housing. Assuming that local construction workers do not require housing and given the high vacancy rates and the number of available units, the existing temporary housing should be sufficient to meet the demand for short-term housing required by the non-local construction workforce. The additional 30 employees anticipated for operation of the LNG terminal are expected to be local hires. These individuals should not affect the local housing availability.

4.9.3 Public Services

Two hospitals are located in Fall River, with a combined total of 497 beds. There are no hospitals in Somerset, Swansea, or Freetown. There are 15 long-term care facilities and two rest homes in Fall River. One long-term care facility is located in Somerset. Two long-term care facilities and one rest home are located in Swansea. Freetown has no long-term care facilities (Massachusetts Department of

Housing and Community Development, 2002). We received scoping comments regarding access to the hospitals in Fall River during operation of the project if the Braga and Brightman Street Bridges need to be closed at the same time during the passage of LNG ships. A discussion of the potential for bridge closures and impacts on traffic is presented in section 4.9.4.

The Fall River Police Department had a 2003 workforce of 210 police officers in uniform, major crime, traffic enforcement, and emergency response units, as well as 45 volunteer personnel in the auxiliary unit. The Fall River Fire Department has eight engine companies, four ladder companies, and one fire rescue with a total of 240 personnel operating out of six fire stations. The Division of Emergency Medical Services operates three medical rescue units. Somerset has 30 law enforcement employees and two fire stations with 31 personnel. Swansea employs 29 full time police officers and 24 part time officers, while Freetown has 17 full time officers and 10 part time officers. The limited number of permanent employees associated with the proposed project would not result in long-term impacts on public services. However, fire and other emergencies at the proposed LNG terminal could require the services of local fire departments and emergency response units.

We received a scoping comment regarding the current capacity of the Fall River fire department to respond to an incident or fire at the LNG terminal. Weaver's Cove Energy has indicated that it would be the first responder to an incident at the terminal, but would rely on the local fire departments to provide public safety and assistance in responding to any emergency. In addition, the LNG ships, tractor tugs, and terminal facilities would be equipped with internal fire-fighting equipment, and the LNG ship crews would be trained to respond to shipboard fires. In accordance with 49 CFR Part 193.2509 and our recommendation in section 4.12.5, Weaver's Cove Energy would develop an emergency response plan and coordinate procedures with local fire departments and other emergency response planning groups, state and local law enforcements, and appropriate federal agencies (see more discussion of emergency response and evacuation planning in section 4.12.5).

We received scoping comments regarding the public costs of ensuring the security of LNG ships as they transit and dock at the LNG terminal. These costs have not yet been determined. The final costs associated with security would be determined after the specific security needs and responsibilities have been established by the Coast Guard through consultations with other federal, state, and local agencies. The specific security-related costs for the proposed project are not yet available. However, as an indication of these costs, KeySpan LNG has estimated the state and local security costs for LNG deliveries to Providence at $40,000 to 50,000 per trip, based on the resources required in the Coast Guard's Vessel Transit Security Plan. The security practices presently employed to secure the LNG vessel transit through Boston Harbor to the Distrigas facility in Everett, Massachusetts, also provide an indication of the potential magnitude of the costs involved. A recent report for Congress (Parfomak, 2003) indicates that the per-ship costs associated with the LNG terminal in Everett, Massachusetts after September 11, 2001 are approximately $80,000, of which $37,500 are covered by local and state governments. Weaver’s Cove Energy has stated that it would be willing to provide funding for the local emergency response services and is continuing its consultations with these agencies. Specifically, Weaver’s Cove Energy stated it would be willing to cover the cost of security in Fall River similar to what Distrigas is providing to the City of Everett. Both pre- and post-September 11, 2001, Distrigas has underwritten the entire cost of fire and police details provided by the City of Everett at the Everett marine terminal during the unloading of LNG ships. Weaver’s Cove Energy has stated that it believes it should be possible to enter into a similar agreement covering the proposed security operations at the Fall River location and during transit of Narragansett Bay. Nevertheless, we have recommended that Weaver’s Cove Energy provide a plan identifying the mechanisms for funding project-specific costs that would be imposed on state agencies and local communities to better define the potential financial burden on these entities (see section 4.12.5).

We received a scoping comment from the President of the Fall River City Council (City of Fall River, 2003) requesting funding for the training of firefighters and suggesting mitigation measures to offset the public services cost to the City (i.e., an annual contribution of $250,000 and two new vehicles for the fire and police departments). Weaver's Cove Energy has indicated that it would consult with the City of Fall River regarding their requests for funding and suggested mitigation measures. See section 4.12 for our recommendation that Weaver's Cove Energy provide a comprehensive plan identifying the mechanisms for funding all project-specific security/emergency management costs that would be imposed on state and local agencies including funding mechanisms for the capital costs associated with any necessary security/emergency management equipment and personnel base.

We received a comment from the presidents of St. Anne's Hospital and Southcoast Hospitals Groups indicating that their facilities would not have the capacity to handle large numbers of casualties in the event of an incident at the LNG terminal. As indicated in section 4.12, we have concluded that potential accidents involving the proposed project are unlikely and that the risk is negligible. Because we realize that the risks associated with hazardous materials can never be entirely eliminated, we have recommended additional mitigation measures in section 4.12, including a requirement that Weaver's Cove Energy develop an Emergency Response Plan prior to any operation of the proposed project. As a result, it is unlikely for an incident to occur that would affect the public. However, in the unlikely event that a low probability, high consequence incident results in large numbers of public injuries or casualties, and the capacity of the local hospitals to handle such an event is exceeded, other medical facilities throughout the region would be called upon for assistance.

4.9.4 Transportation and Traffic

Vehicle Traffic

The LNG terminal site is located directly adjacent to North Main Street and Route 79. Route 79 is a major north-south transportation corridor. The entrance to the site is via New Street off of North Main Street and shares an intersection with the entrance and exit ramps off of southbound Route 79. The entrance and exit ramps from northbound Route 79 to North Main Street are located approximately 1,300 feet south of the existing entrance to the LNG terminal site.

Manual and mechanical traffic counts were obtained over a 72-hour period on North Main Street and the Brightman Street Bridge to determine hourly traffic flow trends during weekdays and Saturdays (Meridian Associates, Inc., 2003). Daily traffic volumes along North Main Street at the primary access intersection to the terminal site are just over 10,000 vehicles per day and 700 vehicles per hour during peak travel times (i.e., weekdays between 7:00 and 9:00 AM and 4:00 and 6:00 PM). The Brightman Street Bridge accommodates approximately four times as much traffic, or over 40,000 vehicles per day and 2,800 vehicles per hour.

The former use of the LNG terminal site as a petroleum products distribution facility is estimated to have generated 245 trips per day, up to 210 of which were truck trips. The ramp intersection between North Main Street and Route 79 immediately adjacent to the existing entrance to the terminal site currently operates at acceptable levels. The existing roadway geometry along North Main Street and the Route 79 intersection provide adequate sight distance and are able to readily accommodate truck-turning movements. The existing entrance to the LNG terminal site at this intersection does not have a traffic signal in place and average accident rates are below district-wide averages. We received comments on the draft EIS from the MassHighway and SRPEDD that this highway interchange does not meet federal highway design standards for interchanges on divided highways. Weaver's Cove Energy has initiated consultation with the MassHighway regarding the interchange. On October 29, 2004, Weaver's Cove Energy and the MassHighway discussed potential improvements that could be implemented at the interchange, but no formal recommendations were made. Potential measures include a flashing beacon on

the southbound ramps of Route 79 and North Main Street and re-striping the travel lanes on the two roads, particularly in the vicinity of the northbound ramps. Weaver's Cove Energy believes that the operational impact from the LNG trucks on the capacity of this interchange would be comparable to the previous trucking use; however, if the MassHighway recommends that improvements are necessary at the interchange, Weaver's Cove Energy has stated that it would provide funding for any reasonable improvements.

The Saturday traffic volumes on North Main Street and the Brightman Street Bridge are approximately 18 to 21 percent lower than weekdays.

Construction activities at the LNG terminal site are estimated to generate 700 vehicle trips per day related to construction employees (based on the peak workforce of up to 350 workers traveling to and from the site during LNG terminal construction and dredging activities) and 80 vehicle trips per day related to construction equipment and materials delivery. The majority of the workers would likely access the site via Route 79, although workers residing within Fall River may access the site via North Main Street. It is expected that construction workers would park in a temporary parking lot on the northern parcel of the site, and be bussed to the main construction area. Access to this parking lot would be via North Main Street, approximately 0.3 mile north of the existing main entrance to the site. No temporary construction roads are proposed for the LNG terminal. These increased traffic levels would be temporary and limited to the period of construction (about 3 years) at the LNG terminal site.

The traffic during operation at the LNG terminal would vary depending on the market demand of the LNG and the availability of specialized LNG trucks needed to distribute the product. The facility is expected to operate 24 hours per day, 7 days per week, and peak site activity would vary throughout the day and week depending primarily on the schedule of ship arrivals. An LNG ship is expected to arrive at the terminal every 5 to 7 days. Approximately 50 LNG truck trips and 70 employee vehicle trips are estimated per day during average operating conditions, which would be lower than the estimated historic traffic volumes at the site and represent only a very small increase in the existing road traffic. Weaver's Cove Energy expects that the LNG trucks would use the New Street site entrance at the North Main Street/Route 79 entrance intersection. Employees and visitors would use an entrance located about 0.4 mile north on North Main Street, which would reduce the amount of traffic at the truck entrance intersection (see figure 2.2.1-1). The anticipated traffic volume resulting from operation of the LNG terminal, even during peak operation periods, would not significantly increase the existing traffic volumes on local area roadways or be significantly higher than the estimated previous volumes when the Shell Oil facility was operational. No alterations of or improvements to the existing roads around the LNG terminal sites would be required by the project.

The existing Brightman Street Bridge is a bascule bridge located approximately 1 mile south of the LNG terminal site. This bridge must be opened to allow passage of vessels exceeding its limited 30-foot-high clearance, including vessels that have historically served the oil terminal on the site. The horizontal clearance width of the existing bridge is 98 feet (HNTB Companies, 2003). Demolition of the existing bridge (including the bridge abutments) would be necessary to accommodate the LNG ships. A new bascule bridge is being constructed approximately 1,500 feet north of the existing bridge as part of the reconstruction and relocation of Highway 6. This new bridge would have a vertical clearance height when closed of 60 feet and a horizontal clearance width of 200 feet. The new bridge would need to be opened to allow the arriving and departing LNG ships to pass.

We received comments on the draft EIS indicating that construction of the new bridge and demolition of the existing bridge are behind schedule and would not be completed by the time Weaver's Cove Energy proposes to begin operating the LNG terminal. Weaver's Cove Energy has indicated that it expects demolition of the existing bridge will be completed by 2008. This, however, is inconsistent with information we received in a letter on October 13, 2004, from the MassHighway, which indicates that

construction of the new Brightman Street Bridge and demolition of the existing bridge is currently expected to be completed some time in 2010. Based on this schedule, it appears that the proposed LNG terminal would not be able to receive any LNG and thus not be able to send out any natural gas until some time in 2010.

The existing Brightman Street Bridge has been opened an average of 860 times per year from 2000 to 2002, with the majority of these openings for pleasure craft during the June through September recreational boating season. At current marine traffic levels, openings of the new bridge are expected to decrease by as much as 80 percent (SRPEDD, 2003c). Thus, even with the additional openings of the new bridge required for the 50 to 70 LNG ships per year, the number of openings of the new bridge would be substantially lower than the current number of bridge openings of the existing bridge.

We received scoping comments and comments on the draft EIS regarding the potential for the Braga Bridge (Interstate 195) to be closed to traffic due to security concerns at the same time as the Brightman Street Bridge is open to allow ship passage, and the potential for these closures to affect the travel of emergency services and ambulances across the Taunton River to medical facilities in Fall River. The Braga Bridge is approximately 8,000 feet or 1.5 miles south of the new Brightman Street Bridge. If it is determined that the Braga Bridge needs to be closed during ship transit, Weaver's Cove Energy has indicated that it would adjust its ship transit plans to prevent the simultaneous closings of the two bridges. This could be accomplished by slowing or briefly halting the vessel between the two bridges, thereby allowing the vessel to completely clear one bridge with traffic flow resuming before the Brightman Street Bridge is opened to accommodate passage of the ship. In order to ensure that the potential impacts on emergency vehicles traveling to medical facilities in Fall River are reduced, we have recommended that any security plans make allowances to have at least one of the Braga and Brightman Street Bridges open to traffic during passage of LNG ships and that consideration be given to scheduling bridge closures to avoid peak traffic periods (see section 4.12.5.2).

We also received comments on the draft EIS expressing concern regarding the potential impacts on traffic and the local economies that would occur if the Mount Hope and Pell (Newport) Bridges are closed to traffic during LNG vessel passage. During the Coast Guard's recent security workshops, workshop participants determined that it would not be necessary to close the bridges (except for the Brightman Street Bridge, which would be "closed" to road traffic every time any large ship passes) unless the threat condition or current intelligence raises a concern about security issues. While bridge closures are one of the many tools available to the Coast Guard, other alternatives to a complete bridge closure under consideration include closing the outboard lanes only, placing law enforcement officials on the bridge at strategic locations, or employing technology that provides suitable security alternatives.

Weaver's Cove Energy completed a traffic analysis to identify the potential impacts on traffic if the Pell (Newport) Bridge, Mount Hope Bridge, Braga Bridge, and Brightman Street Bridge are closed during passage of LNG ships (MDM Transportation Consultants, Inc., 2004). The study used an automated traffic recorder to quantify the regional traffic using these bridges. In addition, these traffic counts were used to estimate potential delays and queuing (back-up) distances at the bridges based on how long each bridge might be closed to traffic. Table 4.9.4-1 lists the traffic volume at each bridge and the potential maximum distance and average duration of traffic back-ups in the event that the bridges would need to be closed to all traffic during passage of LNG ships. Values in the table represent peak season traffic volumes. Maximum back up distance and average traffic delays would be less during non-peak season periods. However, maximum traffic delays for some vehicles would be longer than the average delays listed on the table.

TABLE 4.9.4-1

Existing Traffic Volume and Impacts of Bridge Closures

Traffic Data	Pell (Newport) Bridge	Mount Hope Bridge	Braga Bridge	Brightman Street Bridge
Weekday Morning Peak Hour				
Volume	2,630	1,665	6,140	2,720
Percent of Daily Traffic	8.5	7.0	7.5	6.7
Peak Flow/Direction	61%/EB	66%/NB	53%/WB	65%/EB
Peak Season Backup Length and Time a/, b/	EB – 0.34 mi/4.2 min WB – 0.30 mi/4.1 min (Route 114/138 on-ramp) WB – 0.12 mi/3.4 min (Route 238 on-ramp)	SB – 0.32 mi/5.1 min NB – 0.33 mi/5.2 min (Route 138/Boyd's Lane) NB – 0.27 mi/5.0 min (Route 114 (Bristol Ferry Road))	EB – 0.59 mi/6.1 min WB – 0.24 mi/4.9 min (Central Street on-ramp) WB – 0.36 mi/5.3 min (Route 138 on-ramp) WB – 0.30 mi/5.1 min (I-195 Westbound Mainline)	EB – 0.49 mi/9.8 min (Route 6 Eastbound Mainline) EB – 1.14 mi/12.1 min (Route 138 on-ramp) WB – 0.23 mi/8.8 min (Route 79 Southbound Ramp) WB – 0.50 mi/9.8 min (Davol Street Ramp)
Weekday Evening Peak Hour				
Volume	2,790	2,165	6,400	3,600
Percent of Daily Traffic	9.0	9.2	7.8	8.8
Peak Flow/Direction	62%/WB	52%/SB	53%/EB	59%/WB
Peak Season Backup Length and Time a/, b/	EB – 0.22 mi/3.8 min WB – 0.52 mi/4.9 min (Route 114/138 on-ramp) WB – 0.20 mi/3.7 min (Route 238 on-ramp)	SB – 0.62 mi/6.2 min NB – 0.32 mi/5.2 min (Route 138/Boyd's Lane) NB – 0.26 mi/4.9 min (Route 114 (Bristol Ferry Road))	EB – 0.68 mi/6.4 min WB – 0.34 mi/5.2 min (Central Street on-ramp) WB – 0.37 mi/5.3 min (Route 138 on-ramp) WB – 0.23 mi/4.8 min (I-195 Westbound Mainline)	EB – 0.45 mi/9.6 min (Route 6 Eastbound Mainline) EB – 0.98 mi/11.5 min (Route 138 on-ramp) WB – 0.47 mi/9.7 min (Route 79 Southbound Ramp) WB – 1.14 mi/12.1 min (Davol Street Ramp)
Saturday Midday Peak Hour				
Volume	1,955	1,680	5,360	2,440
Percent of Daily Traffic	8.0	8.0	7.3	7.6
Peak Flow/Direction	56%/EB	58%/NB	54%/WB	53%/WB

TABLE 4.9.4-1 (cont'd)

Existing Traffic Volume and Impacts of Bridge Closures

Traffic Data	Pell (Newport) Bridge	Mount Hope Bridge	Braga Bridge	Brightman Street Bridge
Peak Season Backup Length and Time a/, b/	EB – 0.20 mi/3.7 min WB – 0.26 mi/3.9 min (Route 114/138 on-ramp) WB – 0.10 mi/3.4 min (Route 238 on-ramp)	SB – 0.39 mi/5.4 min NB – 0.30 mi/5.1 min (Route 138/Boyd's Lane) NB – 0.21 mi/4.9 min (Route 114 (Bristol Ferry Road))	EB – 0.51 mi/5.8 min WB – 0.24 mi/4.8 min (Central Street on-ramp) WB – 0.33 mi/5.2 min (Route 138 on-ramp) WB – 0.23 mi/4.8 min (I-195 Westbound Mainline)	EB – 0.31 mi/9.1 min (Route 6 Eastbound Mainline) EB – 0.62 mi/10.2 min (Route 138 on-ramp) WB – 0.24 mi/8.9 min (Route 79 Southbound Ramp) WB – 0.80 mi/10.9 min (Davol Street Ramp)

a/ Distance and duration of traffic backups are based on a 6-minute closure of the Pell (Newport) Bridge, an 8-minute closure of the Mount Hope Bridge, an 8-minute closure of the Braga Bridge, and a 16-minute closure of the Brightman Street Bridge. The closure times are based on the bridges being closed up to 5 minutes in advance of ship arrival and the estimated speed of the ships as they pass under the bridges (1.25 to 6 minutes depending on the bridge). Up to an additional 5 minutes is included for the closure of the Brightman Street Bridge.

Back up length represents the maximum queue extent or distance traffic would be backed up for the closure period

Backup time represents the average delay for a vehicle impacted by a bridge closure. The average delay time represents a motorist arriving at the midpoint of a bridge closure period and includes travel time to the bridge through the queue once the bridge is re-opened.

b/ Some traffic backups would be distributed to secondary roads that connect with the main bridge roads. These connecting roads are shown in parentheses. All other traffic backups would occur on the main bridge roads.

EB = Eastbound; WB = Westbound; NB = Northbound; SB = Southbound.

Source: MDM Transportation Consultants, Inc., 2004

As shown in table 4.9.4-1, the potential impacts on traffic are expected to be minor in the event that the three fixed bridges are closed during passage of LNG ships. At the Pell (Newport) Bridge, the longest average traffic delay would likely occur in the westbound lanes during weekday evenings, with traffic backing up onto the Route 114/138 on-ramp (4.9 minutes). At the Mount Hope Bridge, the longest average traffic delay would likely occur during weekday evenings in the southbound lanes at the approach to the bridge (6.2 minutes). At the Braga Bridge, the longest average traffic delays would likely occur during weekday evenings in the eastbound lanes (6.4 minutes). The longest average traffic delay at the new Brightman Street Bridge would be 12.1 minutes both during weekday mornings in the eastbound lanes, with traffic backing up onto Route 138, and in the westbound lanes with traffic backing up onto the Davol Street ramp. Delays experienced by some motorist near the front of the queues could last at least as long as the length of the time each bridge is closed, which Weaver's Cove Energy estimates would be 6 minutes at the Pell Bridge, 8 minutes at the Mount Hope and Braga Bridges, and 16 minutes at the Brightman Street Bridge. However, the delays at the Brightman Street Bridge would be similar to those that occur associated with the current transit of coal vessels and the previous transit of large oil tankers. In addition, as discussed above, because the new Brightman Street Bridge would have a higher vertical clearance, the number of openings of the new bridge is expected to be substantially lower, even with the addition of 50 to 70 LNG ships per year.

Weaver's Cove Energy has stated that it would develop a Traffic Management Program in consultation with the MassHighway, the Rhode Island DOT, the Coast Guard, the Massachusetts State Police, and other local authorities if any project approval is received from the EOEA and the FERC. Additional discussion of shipping transportation and safety is provided in section 4.12.5.

Construction of the pipelines would involve 60 to 140 workers along three spreads, for up to 280 vehicle trips per day from these spreads. Additional vehicle traffic would result from equipment or material deliveries into and out of the pipe yard each day. The pipe yard would be located adjacent to the meter and regulation station site for the Northern Pipeline in Freetown, which would be within the Riverfront Business Park. Many of the roads adjacent to the pipeline rights-of-way are narrow and may not be able to easily accommodate high volumes of construction workers' vehicles. The parking of vehicles along these roads could increase traffic congestion. Weaver's Cove Energy would minimize the number of vehicles traveling and parking on local roads. Weaver's Cove Energy has indicated that some construction workers would be bussed to the construction sites from a central parking location. Other specialized workers (e.g., welders, supervisors) would access the construction sites by their vehicles as necessary.

Traffic may also be slowed where construction of the pipeline requires minor detours for short periods of time, which may be the case at road crossings or where construction occurs beneath existing roads. Lane closures, and resulting traffic impacts, may also result in areas along the Western Pipeline where the pipeline would be installed adjacent to existing roadways. Weaver's Cove Energy would schedule construction activities involving work within roadways and at specific crossings to avoid commuter traffic and minimize potential impact on school bus schedules. Work involving crossings of individual driveways and private roadways would be coordinated with residents to minimize potential interference with access. Weaver's Cove Energy would also weld sections of pipeline needed at road crossings before excavating the trench to minimize the amount of time the trench is open. Road crossings would generally be completed within a 12-hour period. Traffic lanes and home access would be maintained except during brief periods for laying pipeline. Steel plates would be available at all times so that a temporary platform could be made across the trench should the need arise (e.g., for emergency vehicles). All roadway surfaces would be restored to the specifications of the local or state authorities. Impacts on local traffic would be temporary and limited to the period of construction.

No impacts on traffic would occur along the pipeline routes as the result of pipeline operations.

Ship Traffic

Many commercial vessels utilize Narragansett Bay, Mount Hope Bay, and the Taunton River. Tankers and cargo ships call on various industrial facilities along the waterfront in Fall River and Somerset. Coast Guard data for 2002 indicates 723 ocean-going vessels entered Narragansett Bay and 112 of these vessels proceeded to Fall River or Somerset. The 112 ships transiting up Mount Hope Bay and the Taunton River consisted of:

- 60 coal ships calling on Brayton Point or Montaup Power Plants;
- 11 chemical carriers calling on Borden & Remington;
- 18 general cargo vessels calling on the Fall River State Pier; and
- 23 passenger ships calling on the Fall River State Pier.

Cruise ships have also frequently entered Narragansett Bay. Between May and October 2002, approximately 25 cruise ships were anchored off Newport. These ships typically entered the bay in the morning and sailed again later in the same day. As noted above, 23 passenger ships called on the Fall River State Pier between the months of June and October 2002 but the trade is reported to have been discontinued.

There are also several ferries and water taxi services that transit Narragansett Bay and utilize the channel that would be used by LNG ships. Ferry service between Providence and Newport is provided from May 1 through October 31, with five daily trips during weekdays and six daily trips on weekends. Service is provided between Bristol and Prudence Island with five daily trips during the week and six daily trips on the weekend during the summer months. In the winter months, the number of trips between Bristol and Prudence Island is two for both weekdays and weekends. Service between Newport and Jamestown occurs from late April to late October with eight daily trips on weekdays and nine daily trips on weekends. There is also ferry service between Newport and Block Island and between Point Judith and Block Island. The Newport to Block Island ferry runs one daily trip on both weekdays and weekends. Normal ferry service between Point Judith and Block Island consists of two to three daily trips on both weekdays and weekends from October through June and 8 daily trips on weekdays and ten daily trips on weekends from July through September. There is a high-speed ferry between Point Judith and Block Island that runs from May 13 to October 12, with six daily trips on both weekdays and weekends. Lastly, there is a high-speed ferry between Quonset Point and Martha's Vineyard that runs from May through October. Normal ferry service during the peak season, June through Labor Day, consists of two to three daily trips on both weekends and weekdays. During non-peak season, the schedule consists of one or two trips on both weekends and weekdays. Many of these ferry routes cross or use the federal channel that would be transited by LNG ships traveling to and from the proposed LNG terminal.

Construction of the proposed LNG terminal and dredging of the federal channel would not be expected to interfere with commercial ship traffic. Because the temporary mooring of the dredge and work barges would occupy only a small portion of the federal channel at any given time, this equipment would not present a significant obstruction to navigation. In addition, transit and mooring of the work barges would be required to comply with applicable COE and Coast Guard regulations. To mitigate potential impacts on ship traffic, Weaver's Cove Energy would develop a Navigation Work Plan to ensure the safe passage of waterborne commercial and recreational traffic during the proposed dredging operations and pipeline installation.

Operation of the LNG terminal itself would not affect commercial shipping in Narragansett Bay, Mount Hope Bay, or the Taunton River. None of the structures to be constructed as part of the ship berth or unloading facilities would be located within the navigation channel. Navigational marking and operation of the structures would be conducted in accordance with applicable Coast Guard and COE regulations.

The existing commercial ship traffic in Narragansett Bay includes LPG carriers and a variety of fuel and oil tankers; therefore, the addition of LNG ships would be generally consistent with existing uses. As is currently the case for LPG tankers, the Coast Guard would enforce a safety and security zone around the LNG ships during transit and berthing, which would increase the frequency with which safety and security zone could affect other marine traffic and could increase the number of delays experienced by other commercial ship traffic. Additional information on the Coast Guard's safety and security zone and the anticipated effect of the project on commercial ship traffic is provided in section 4.12.5.

Weaver's Cove Energy estimates that about 50 to 70 ships per year would pass through Narragansett Bay and enter Mount Hope Bay and the Taunton River to deliver its cargo to the LNG terminal. The LNG ships would use existing deep-draft shipping lanes within the bays. The transit time for an LNG ship once it enters Narragansett Bay to the time it is berthed at the terminal is estimated to be just over 4 hours (see table 4.9.4-2).

TABLE 4.9.4-2

Estimated LNG Ship Transit Time Associated with the Weaver's Cove LNG Project a/

Direction/ Action	Begin	End	Distance	Average Speed	Estimated Time
Inbound					
Transit	Entry of Narragansett Bay b/	Pell Bridge	3.9 nautical miles (nm)	10 knots	23 minutes
	Pell Bridge	Sandy Point	6.4 nm	10 knots	38 minutes
	Sandy Point	Braga Bridge	8.6 nm	5 knots	103 minutes
	Braga Bridge	Proposed Turning Basin	2.0 nm	3 knots	40 minutes c/
Turning/ Berthing	Not Applicable (NA)	NA	NA	NA	60 minutes
Total			20.9 nm		264 minutes (4.4 hours)
Outbound					
Unberthing/Turning	NA	NA	NA	NA	60 minutes
Transit	Proposed Turning Basin	Braga Bridge	2.0 nm	3 knots	40 minutes c/
	Braga Bridge	Sandy Point	8.6 nm	6 knots	86 minutes
	Sandy Point	Pell Bridge	6.4 nm	10 knots	43 minutes
	Pell Bridge	Entry of Narragansett Bay b/	3.9 nm	12 knots	20 minutes
Total			20.9 nm		249 minutes (4.2 hours)

a/ Estimates are based on a 145,000 m^3 LNG ship.

b/ For the purposes of this estimate, entry of Narragansett Bay is considered to be the crossing line between Beavertail Point and Brenton Point.

c/ The inward and outward times between the Braga Bridge and the proposed turning basin assumes that traffic on the Braga Bridge would not be stopped or if it is stopped, that it would not be necessary to slow or stop the LNG ship between bridges. Weaver's Cove Energy estimates that normal transit would provide adequate time to ensure resumption of traffic flow across the Braga Bridge before the Brightman Street Bridge traffic would be stopped to allow opening of the bridge and ship transit.

During operation, the safety and security zone (generally 2 miles ahead and 1 mile astern) around transiting LNG ships could inconvenience and result in delays of other commercial ship traffic in the area. The safety and security zone enforced around each LNG ship and around the ship unloading facility while a ship is docked would widen the area restricted to boaters. This could cause additional impacts on recreational boating and fishing, as well as commercial fishing activities, but these impacts would be temporary during ship transit (see section 4.8.6.2).

A task force of waterway users and stakeholders, including representatives of the Coast Guard, has begun an assessment of current risk factors and mitigation measures for such risks on commercial activities and recreational boating in the Narragansett Bay area. The task force completed a study titled *Ports and Waterways Safety Assessment Workshop Report.* This initial report identified the potential for economic impacts to occur on the Narragansett Bay area as a result of closure of the waterway north of Prudence Island, Rhode Island. The report also identified existing mitigation measures to address this issue, and potential new measures that could be implemented by members of the task force. See section 4.12.5 for additional discussion of shipping safety during operation of the proposed project.

We estimate that the delay to a ship scheduled to depart from an existing Fall River berth due to inward passage of an LNG ship in the navigation channel would be between 60 and 90 minutes. To estimate the potential cost of ship delays, we multiplied the estimated costs per hour of shipping delays used by the COE in the EIS for the Providence River Maintenance Dredging Project by the hours of potential shipping delays per year due to LNG shipments estimated in a study prepared by Moffatt and Nichol International (MNI) for the KeySpan LNG Facility Upgrade Project (Moffatt & Nichol International, 2004). The COE estimated that the cost of a 1 hour shipping delay was $1,700. Adjusting this estimate upward for inflation at a rate of about 3 percent per year since the COE's analysis, we estimate that the current cost of a 1 hour shipping delay would be about $2,300.[17] Using 2001 and 2002 shipping data from the COE, the MNI study did not specifically assess current shipping delays experienced by vessels en route to Fall River or the incremental effect of adding LNG ship traffic to the existing ship traffic to Fall River, but it did assess the incremental increase in shipping delays that would result from the addition of LNG ship deliveries to Fall River if the KeySpan LNG facility was also receiving LNG shipments. The MNI study suggests that LNG ships transiting to Fall River could increase annual total shipping delays by about 20 hours per year. By multiplying this anticipated increase in annual shipping delays due to LNG ships (which is 20 hours assuming no ships currently experience delays[18]) by the estimated costs per hour of a shipping delay ($2,300), we estimate that LNG shipments to the proposed LNG terminal could increase the collective cost of shipping to Fall River by about $46,000 per year.

Train Traffic

An existing railroad track owned and operated by CSX is located adjacent to the LNG terminal site. The railroad is currently used for mixed freight service to the City of Fall River, typically consisting of one short train per day. In 1995, the MBTA proposed converting the existing railroad to a high-speed commuter rail line between New Bedford and Boston. Weaver's Cove Energy would consult with CSX to develop measures to ensure that railroad operations are not adversely affected by construction and operation of the proposed project facilities. See section 4.8.3.1 for additional discussion of the proposed commuter rail line.

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[17] This estimate is probably conservative because the COE's estimate of $1,700 was based on the cost of a 35 foot draft, double hulled oil tanker, which is likely a higher per hour cost than the cost of ships calling on Fall River.

[18] This assumption is conservative because deep draft vessels currently calling on Fall River likely experience delays due to tidal conditions and the need to travel to the port on a rising tide.

4.9.5 Property Values

Comments were received at Weaver's Cove Energy's open houses and during the scoping process regarding property devaluation and impacts to homeowners insurance caused by the presence of an LNG storage tank. The LNG terminal would be constructed on a brownfield site that is zoned for industrial use and was previously used to store and distribute petroleum products. The immediately abutting properties are all also zoned for industrial use.

Weaver's Cove Energy developed a voluntary real estate buyout/easement program for two areas adjacent to the LNG terminal site. The purpose of the program was to both offer compensation to property owners who feel they may be inconvenienced during construction activities and to preserve the existing character and uses of the properties. Block A is directly east of the railroad tracks that are east of the southern parcel of the terminal site. This area is zoned for industrial use and includes 25 lots that are owned by 14 property owners. The area includes 1 diesel engine/truck repair business, 1 commercial laundry, and 1 storefront property, 1 vacant parcel made up of 4 lots, 10 single-family homes, 2 two-family homes, and 1 three-family home. Weaver's Cove Energy has offered to purchase these properties at a price above current market appraisal or a market appraisal conducted immediately before the sale closes. Block B is east of North Main Street and is zoned "general residence." The area includes 15 parcels that are owned by 13 property owners, and includes 11 single-family homes, 1 two-family home, 2 vacant parcels, and 1 lot with a two-car oversized garage. The property owners in this area were offered a series of cash payments in return for a commitment to maintain their property in its present condition and use.

Weaver's Cove Energy consulted with real estate experts regarding the impact of the proposed LNG terminal and pipelines on property values (Giroux, 2003; Appraisal Consultants of New England Corporation, 2003). The proposed facilities are not anticipated to negatively impact property values. The values of properties proximate to the site may already reflect their location near an industrially zoned parcel that supported a large petroleum products storage and distribution terminal from its construction in the 1920s to the mid 1990s. The petroleum storage and distribution facility at its peak stored up to 64,000,000 gallons of petroleum products in 35 storage tanks. Product was distributed throughout the region via truck, rail, and dedicated pipeline. It was during this time period that many of the residential areas and commercial businesses in the vicinity of the site were developed.

Property values in areas proximate to the existing LNG storage facility on Bay Street in Fall River were also studied. The results of this study indicated that the Bay Street LNG facility has not deterred residential development in surrounding areas. Several new homes have been constructed in the vicinity of the facility since its activation in 1970. A condominium project is scheduled to be constructed next to the facility in the near future. In addition, a survey of recent sales in the area indicates that property values or price increases have not been diminished because of the facility.

KeySpan LNG commissioned a market analysis to assess the impacts of the LNG terminal and LNG ships associated with the Distrigas LNG terminal have had on surrounding property values in Everett, Massachusetts. The market analysis, conducted by KTR Newmark LLC, reviewed home sales occurring within a 2-mile radius of the existing Distrigas LNG facility from 1985 to 2004. Thirty-three single family home sales were surveyed in the market area surrounding the facility. The results of the market analysis indicated that all properties in this area experienced an average annual appreciation of 14 percent for the period between 1985 and 2004, as compared to 12.8 percent, 17.7 percent, and 14.9 percent for Massachusetts, the Boston area, and Middlesex County, respectively. For the period between 1995 and 2004, the average annual price increase in the market area around the Distrigas LNG terminal was 15.7 percent, which exceeded the average increases of 12.9 percent, 15.6 percent, and 13.4 percent for Massachusetts, the Boston area, and Middlesex County, respectively.

A real estate study performed by the Real Estate Counseling Group of Connecticut, Inc. for a planned Granite State Gas facility in Wells, Maine also supports the findings of the above studies (Real Estate Counseling Group of Connecticut, 1995). In this study, local tax assessors were contacted in four New England communities in the proximity of existing LNG storage facilities (Haverhill, Ludlow, and South Yarmouth, Massachusetts; and Tilton, New Hampshire) as well as communities where LNG storage facilities had been recently built (North Carolina, Georgia, and Indiana) and asked: 1) whether they had received property owner requests for lower valuations due to the presence of an LNG facility; and 2) whether the presence of a storage tank was a factor they considered in doing their valuations. The study concluded that in no case did the planned LNG facilities play a role in the assessment and that no requests for lower valuations had been made or granted.

A 1993 study conducted by the Argonne National Laboratory examined the economic impacts of the presence of "noxious" facilities on local wages and property values (Clark and Nieves, 1993). Eight types of these facilities were studied: nuclear power plants; coal-, gas-, or oil-fired power plants; military chemical weapons sites; hazardous waste sites; refineries; chemical weapon storage facilities; former storage sites that are now contaminated; and LNG facilities. The study examined the effects of 262 facilities on standardized 1,000 square-mile areas across the United States. Eleven of these were LNG facilities. Thirteen of the 262 facilities were located in New England. The results of the study concluded that the presence of 5 of the 8 types of "noxious" facilities have a significantly negative effect on property values and a positive effect on wages. However, the study concluded that the presence of an LNG facility did not have a significant positive or negative effect on either wages or property values (Clark and Nieves, 1993).

Another study by McCluskey and Rausser (2001) evaluated the potential for perceived risk to affect property values. This study analyzed the dynamics between media coverage, distance from the facility, and perceived risk per their effect on property values. The results of this study revealed that the greater the perceived risk, as generated mainly through media coverage, and the closer the property to the facility or site, the greater the negative impact on property values. This study suggests that a facility like the proposed LNG terminal, which has been covered extensively by the press and is perceived as a safety risk, could impact property values near the facility (McCluskey and Rausser, 2001). However, Weaver's Cove Energy reported that recent home sales near the facility appear to be comparable both in terms of days on the market and sale price as a percentage of asking price as other homes in the city as a whole.

Based on the location of the LNG terminal on an existing industrially zoned site and the information from these general and site-specific studies, we do not believe that the LNG terminal would negatively affect property values in the surrounding area. Because the pipeline routes are predominantly located within existing utility corridors, operation of these pipelines is also not expected to have a measurable impact on property values.

Another concern voiced by residents and property owners is the effect of the LNG terminal on homeowner insurance rates and the availability of insurance coverage. In response to these expressed concerns, Weaver's Cove Energy consulted with insurance advisors who have indicated that the LNG terminal would not have an impact on homeowner insurance rates. Homeowner insurance rates are generally set on a county-wide basis, with individual rate adjustments made to reflect the age and value of the property and the claims record of the owner; insurance rates are not based on the surrounding landscape or structures at the local level. However, insurance companies may reject coverage in an area based on high risks. Typically in Massachusetts, insurance coverage is denied when a property is in a poor state of repair or located along the coast where it would be vulnerable to storms. The properties in the vicinity of an industrial facility may be older and not as well maintained. These types of factors would affect the availability of insurance coverage, not the presence of the facility itself (Giganti Insurance, 2004). In cases when insurance coverage is denied, basic property insurance is available from

the Massachusetts Property Insurance Underwriting Association through its Fair Access to Insurance Requirements Plan.

4.9.6 Tax Revenues

Construction and operation of the project would have beneficial impacts on local sales tax revenue. The total revenue of the City of Fall River in 2002 was $140,686,971. Federal and state educational aid accounts for 48.9 percent of that amount, and other state receipts account for another 14.2 percent. Fall River property taxes currently account for 25.7 percent of its revenue ($36,156,552).

Operation of the Weaver's Cove LNG Project would contribute anticipated annual tax revenues of $3,000,000, which would make Weaver's Cove Energy the largest single taxpayer in Fall River. Construction of the pipeline would modestly increase tax revenues through an annual ad valorem tax of $150,000.

As discussed in section 4.8.2, the Harbor Plan recommends that dredging of the federal navigation channel be conducted and estimates that the cost would be $4.7 million in public funds. Weaver's Cove Energy would fund the initial and maintenance dredging of the federal navigation channel necessary to accommodate LNG ships. As a result, the Weaver's Cove LNG Project would have a beneficial economic impact on the City of Fall River because the City would not have to commit the public funds necessary to conduct these dredging activities.

4.9.7 Environmental Justice

Executive Order 12898 on Environmental Justice requires that each federal agency address disproportionately high and adverse health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. As part of the preparation of this EIS, the NEPA review process must provide opportunities for effective community participation and involve consultation with affected communities. If the proposed action will result in significant adverse effects to minority or low-income populations or Native American tribes, the NEPA analysis should address those impacts as part of the alternatives analysis and identify appropriate mitigation measures to address the effects.

Massachusetts' Environmental Justice Policy focuses on enhancing opportunities for residents to participate in decision making, enhancing review of large new sources in environmental justice neighborhoods,[19] ensuring all facilities comply with existing regulations, and encouraging economic growth in neighborhoods where there is existing infrastructure, in particular where there is an opportunity to clean up a contaminated site (brownfield). Although the EOEA has indicated that the proposed facilities do not trigger the requirements for enhanced notification and outreach pursuant to its Environmental Justice Policy, it has encouraged Weaver's Cove Energy to engage in significant public outreach efforts in nearby communities and asked that the EIS include a summary of any community meetings sponsored by Weaver's Cove Energy.

As discussed in section 1.5, Weaver's Cove Energy made efforts to develop its project in consultation with residents in neighboring communities and to evaluate the potential impacts of the project on those communities. Interested parties were given opportunities to participate in the NEPA review process, such as participating in the public scoping meeting for the draft EIS, submitting written comments on the project to the FERC, and informing the FERC of its interest in receiving copies of

[19] Environmental justice areas are defined under Massachusetts' Policy as communities with a median annual household income at or below 65 percent of the statewide median income, 25 percent of residents who are foreign-born, or 25 percent of residents who lack English language proficiency.

public documents related to the project. In addition, interested parties were given the opportunity to comment on the draft EIS, and we have responded to these comments in this final EIS. As part of its public outreach program, Weaver's Cove Energy has:

- published its Notice of Environmental Review in two Fall River newspapers *The Herald News* and the *Fall River Spirit,* as well as in the *Somerset Spectator* and the Portuguese language community newspaper *O Jornal*;
- distributed about 3,700 notices to residents and business owners within a 1-mile radius of the LNG terminal site which publicized the public scoping meeting that was held on July 29, 2003;
- held informational open houses on July 22 and July 29, 2003 for the benefit of community members; and
- maintained project and contact information on its website (www.weaverscove.com), operational since July 31, 2003.

In addition to these efforts by Weaver's Cove Energy, the FERC staff has participated in meetings and consultations with federal, state, and local agencies, issued its NOI, and, in conjunction with the staff of the MEPA Office of the EOEA, held a scoping meeting on July 29, 2003 in Swansea, Massachusetts to receive comments on the project (see section 1.6). The comments we received during the scoping process are summarized in the table provided in Appendix C, and are addressed throughout this document. We have also continued to consult with agencies, conducted two public comment meetings on the draft EIS, and received numerous oral and written comments on the draft EIS, which we have responded to in this document (see Appendix K).

Environmental Justice Areas and Potential Impacts

We received several comments regarding the environmental justice of siting the proposed facilities in Fall River. To address these concerns, we identified environmental justice areas in the vicinity of the proposed project and conducted an analysis of potential impacts that could disproportionately affect these areas.

To identify potential environmental justice areas, we reviewed available state, county, and municipal statistics regarding median income and poverty levels. Table 4.9.7-1 provides the general ethnic mix of the counties and cities that would be affected by the proposed project. Table 4.9.7-2 provides the general economic status of these counties and cities. As shown on these tables, the percentages of minority populations within the cities and towns that would be affected by the project are lower than the state averages. However, the median household income in the City of Fall River is lower than the state median household income and the percentage of persons living below the poverty level in Fall River is higher than state percentage.

We also reviewed environmental justice maps provided to us by the EPA that illustrate environmental justice communities as defined under federal guidelines (see figure 4.9.7-1). We determined from these sources that the closest environmental justice area is located in the City of Fall River directly southeast of the LNG terminal site. Other environmental justice areas are located in Fall River along the shore of the Taunton River. We received comments on the draft EIS that our analysis and figure 4.9.7-1 omitted certain environmental justice populations near the proposed LNG terminal site. As stated above, the information on figure 4.9.7-1 is based on information provided by the EPA, which in turn was based on data from the U.S. Census Bureau.

Insert figure

4.9.7-1 Environmental Justice Communities in the Vicinity of the LNG Terminal and Navigation Channel

TABLE 4.9.7-1

Racial/Ethnic Statistics for the Project Area

State/County/City	Racial/Ethnic Group, 2000 (percent)							Persons of Hispanic or Latino Origin (percent) a/
	White	Black	Native American and Alaska Native	Asian	Native Hawaiian and Other Pacific Islander	Persons Reporting Some Other Race	Persons Reporting Two or More Races	
MASSACHUSETTS	84.5	5.4	0.2	3.8	<0.1	3.7	2.3	6.8
Bristol County	91.0	2.0	0.2	1.3	<0.1	3.1	2.3	3.6
Fall River	91.2	2.5	0.2	2.2	<0.1	1.4	2.6	3.3
Somerset	98.2	0.2	0.1	0.5	<0.1	0.2	0.8	0.5
Swansea	97.9	0.4	0.1	0.4	<0.1	0.3	1.0	0.6
Freetown	96.2	0.7	0.2	0.6	<0.1	1.1	1.2	0.7

a/ People who identify themselves as Hispanic or Latino may be of any race. Thus, the percent Hispanic should not be added to the percentage for racial categories.

Source: U.S. Department of Commerce, U.S. Census Bureau, State and County QuickFacts (www.census.gov).

TABLE 4.9.7-2

Economic Statistics for the Project Area

State/County/City	Median Household Income (1999)	Persons Below the Poverty Level (1999) (percent)	Households Receiving Public Assistance (percent)
MASSACHUSETTS	$50,502	9.3	2.9
Bristol County	$43,496	10.0	3.9
Fall River	$29,014	17.1	6.5
Somerset	$51,770	4.0	1.9
Swansea	$52,524	4.9	2.9
Freetown	$64,576	5.0	1.2

Source: U.S. Department of Commerce, U.S. Census Bureau

Potential impacts that could disproportionately affect environmental justice areas during construction and operation of the project include visual impacts from the presence of the LNG storage tank, traffic impacts associated with vehicle traffic during construction and operation of the project, air quality and noise impacts, and impacts on public safety from potential incidents at the LNG terminal and in the navigation channel. A summary and analysis of these impacts as they may pertain to environmental justice is presented below. More detailed assessments of visual resources, traffic, air quality and noise, and reliability and safety are included in sections 4.8.7, 4.9.4, 4.11, and 4.12 of this final EIS.

As discussed in section 4.8.7, the primary visual impact of the project on the surrounding areas would be the LNG storage tank. The new tank would be larger than the tanks previously located on the site and would be highly visible from a number of locations in the City of Fall River and the Town of Somerset, including the environmental justice area directly southeast of the LNG terminal site (see figure 4.9.7-1). To the extent possible, Weaver's Cove Energy would provide some visual screening of the tank by constructing a landform east of the tank and implementing a landscape design plan with plantings that are native to the area. In addition, because Weaver's Cove Energy would be cleaning up and removing the existing facilities on the site, some beneficial impacts on the viewshed could occur. The nearby environmental justice areas would not bear disproportionately higher visual impacts because the impact would affect each of the surrounding communities equally.

The increased amount of vehicular traffic on North Main Street and Route 79 during construction of the LNG terminal and Northern Pipeline would affect the environmental justice area southeast of the project site (see section 4.9.4). The effects of this traffic would be temporary and limited to the period of construction. During operation, Weaver's Cove Energy indicated that LNG trucks would use the New Street site entrance at the North Main Street/Route 79 entrance intersection, while employees and visitors would use an entrance located about 0.4 mile north on North Main Street. The anticipated traffic volume resulting from operation of the LNG terminal, even during peak operation periods, would not significantly increase the existing traffic volumes on local area roadways or be significantly higher than the estimated previous volumes when the Shell Oil facility was operational. Additionally, Weaver's Cove Energy is in discussions with the MassHighway regarding potential improvements at the Route 79 and North Main Street intersection (see section 4.9.4) that, if implemented, could improve the existing intersection Therefore, the nearby environmental justice area is not expected to be disproportionately affected by the increase in traffic.

As discussed in section 4.11.1, operation of the proposed project would result in air emissions from three sources: LNG ships and tugs, LNG trucks, and stationary equipment (heaters and emergency engines) associated with the LNG facility. However, the operational air emissions from the LNG terminal would not cause or significantly contribute to a violation of an ambient air quality standard; therefore, the environmental justice areas would also not be disproportionately affected by the project.

As discussed in section 4.11.2, increases in sound levels would occur during construction and operation of the LNG terminal facilities. During construction, increases in sound levels would occur primarily during daylight hours and are not expected to significantly contribute to existing noise levels. Dredging and dredge stabilization, however, would occur up to 24 hours per day for the entire 3-year construction period. Since these activities would potentially exceed noise regulations, we have recommended that Weaver's Cove Energy prepare a noise mitigation plan that would reduce noise impacts on the surrounding communities, including those with environmental justice populations. During operation of the terminal, noise would be generated by LNG trucks and stationary equipment including pumps, compressors, motors, heaters, and fans. The additional traffic from LNG trucks arriving and departing via Route 79 would have minimal impact on the ambient noise levels in the adjacent environmental justice areas. The stationary noise source would be predominantly the four operating LNG sendout pumps. As shown in table 4.11.2-5, the preliminary noise analysis shows that the future increase in noise levels to the nearby environmental justice community would be comparable to, and in some cases lower than, those in the other surrounding areas. We have also recommended that Weaver's Cove Energy conduct post-construction noise surveys to ensure operation of the facilities does not exceed applicable noise regulations; therefore the nearby environmental justice areas are not expected to be disproportionately affected by an increase in noise levels during operation of the project.

In the event of an incident at the LNG terminal, environmental justice areas near the navigation channel and the LNG terminal could be affected. As discussed in section 4.12.4, the project would comply with all applicable building and safety codes and thermal radiation and vapor dispersion exclusion zone requirements designed to protect public safety. No prohibited activities would be allowed within these exclusion zones. The facilities would also include fire detection and suppression equipment and an earthen dike that would contain any spill of LNG at the terminal site. In spite of all the safety measures that would be incorporated into the design and operation of the facilities, any incident at the proposed terminal would not disproportionately affect the environmental justice areas. As shown on figure 4.9.7-1, LNG ships would pass low-income and minority populations that are within 1 mile of the navigation channel. However, these LNG ships would also pass communities along the navigation channel in Rhode Island that are among the wealthiest in that state. The potential for an incident onboard an LNG ship would be borne equally by all communities along the navigation channel; therefore, the environmental justice areas in the City of Fall River would not be disproportionately affected.

In summary, we do not believe construction and operation of the proposed project would result in disproportionate adverse impacts on environmental justice. The project would involve the redevelopment of an existing brownfield site consistent with its historic use and with the City of Fall River's development plan. In addition, the project is expected to generate a number of temporary and permanent employment opportunities, taxes and other revenue streams within the Fall River area, and, with the use of appropriate mitigation measures, would not result in significant adverse impacts on the local environment and natural resources. Although some of the neighborhoods in the vicinity of the LNG terminal can be characterized as having lower incomes than average, the potential impacts described above would affect all of the communities surrounding the LNG terminal, and would not disproportionately impact only the environmental justice areas.

HUD-assisted Housing Developments

We also received comments regarding the proximity of HUD-assisted developments and the impact of siting the LNG terminal in the vicinity of these developments.[20] The siting of HUD-assisted developments is restricted based on the presence of nearby hazardous material operations; however, there are no requirements for the siting of hazardous materials operations in relation to existing HUD-assisted developments.

4.9.8 Recreation and Special Uses

The economic importance of Narragansett Bay has been identified and evaluated in several papers including *The Economic Importance of Narragansett* Bay by Tyrell et al. (1994); *Narragansett Bay Summit 2000, Marine Recreation and Tourism in Narragansett Bay: Critical Values and Concerns, Working Draft* by Colt et al. (2000); and *The Economic Value of Narragansett Bay, A Review of Economic Studies* by Pacheco and Tyrell (2003). Economically important activities associated with the bay include tourism, recreational boating and fishing, and commercial fishing. The total estimated annual value of all outdoor recreational activities in Rhode Island was estimated at about $6.7 billion, of which about $2 billion was associated with bay-related outdoor recreation activities (Tyrell and Harrison, 1999, as cited in Colt et al., 2000; and Tyrell and Harrison, 2000, as cited in Pacheco and Tyrell, 2003). The net economic value of sailing alone has been estimated at $165 million (Colt et al., 2000). Additionally, on an average annual basis, it has been estimated that about 300,000 recreational anglers make about 1 million fishing trips annually in Rhode Island waters and the revenues from these activities are about $150 million (DeAlteris et al., 2000, as cited in Pacheco and Tyrell, 2003). As discussed in sections 4.8.6.2 and 4.12.5.2, construction and operation of the proposed facilities would impact recreational boating and fishing during dredging and the arrival, unloading, and departure of LNG ships. This effect would be limited primarily to the summer months when the bay and its tributaries are most heavily used. While some recreational boaters may be inconvenienced or even experience delays if they are traveling in the opposite direction of LNG ships in the narrowest parts of the ship route, we do not believe this would have a significant economic impact on recreation within the Narragansett Bay watershed.

The majority of the LNG transit from the mouth of Narragansett Bay to the proposed LNG terminal would be through Rhode Island waters. The Rhode Island commercial fishery supports approximately 4,500 license holders. The direct dockside value of commercial landings has fluctuated widely over the last 10 years between a high of $86 million recorded in 1999 and a low of $69 million in 2003. Landings of shellfish, lobster, and ground fish provide the mainstay of the industry. The total value of the industry, however, when domestic sales, exports, purchase of supplies and services, and other generators of economic activity are factored in, is estimated to be in excess of $500 million (R.I. Seafood Council, as cited in DEM, 2004) and perhaps as high as $700 million annually (DeAlteris et al., 2000, as

[20] The nearest HUD-assisted development is a 100-unit elderly housing complex approximately 3,200 feet from the center of the proposed LNG tank. In addition, there is state-funded affordable low income family housing approximately 1,850 and 2,900 feet from the center of the proposed LNG tank.

cited in Pacheco and Tyrell, 2003). Tyrell et al. (1994) estimated that the value of the catch from Narragansett Bay in 1993 was approximately $24 million. Shellfish, particularly Northern quahog are the most abundant and commercially important species in Narragansett Bay and account for the majority of the revenues from the annual catch (Tyrell et al., 1994). Lobster is the second most important commercial fishery in Narragansett Bay (Tyrell et al., 1994), which in 1994 averaged about $2.5 to $3.0 million annually. Commercially important finfish in the bay include winter flounder, scup, bluefish, striped bass, tautog, and menhaden. Tyrell et al. (1994) estimated that the annual value of the finfish catch attributable to the bay from 1984 to 1994 ranged between $1.1 and $1.4 million annually, but accounted for less than 5 percent of the annual commercial finfish landing in Rhode Island. The potential effects of the project on commercial fishing and shellfishing are discussed in section 4.8.6.2 and 4.12.5.2. In general, these effects would be primarily limited to a temporary disturbance of fishing and shellfishing activities within the area encompassing the moving safety and security zone during the passage of the LNG ships, which would not likely have a significant economic impact on commercial fishing and shellfishing within Narragansett Bay.

4.10 CULTURAL RESOURCES

Section 106 of the NHPA (16 USC 470) requires the FERC to take into account the effects of its undertakings (including issuance of a certificate) on properties listed, or eligible for listing, on the NRHP and to provide the ACHP an opportunity to comment on its undertakings. Weaver's Cove Energy, as a non-federal party, is assisting the FERC in meeting its obligations under section 106 and the implementing regulations in 36 CFR 800.

4.10.1 Results of the Cultural Resources Surveys

LNG Terminal

Aboveground Cultural Resources

Weaver's Cove Energy conducted a survey to identify aboveground historic properties that could be affected by construction of the LNG terminal, and submitted the results to the FERC and the Massachusetts State Historic Preservation Office (SHPO) (Epsilon, 2003a, 2003b, 2003c, 2003d). Weaver's Cove Energy broadly defined the area of potential effects (APE) to include both the 73-acre terminal site and its viewshed. The viewshed was defined as any area within a 1-mile radius of the LNG terminal site from which the proposed facilities would be visible. In total, the APE measured approximately 129 acres in extent and included five discontinuous parcels along the east and west banks of the Taunton River (three in Fall River and two in Somerset) in addition to the LNG terminal site. We concur with this definition of the APE.

The survey combined background research with a field investigation. The background research identified three previously recorded properties in Fall River (Wm. B. Canedy House, Border City Mills, and Sagamore Mills No. 1 & 3) and one previously recorded property in Somerset (the Montaup Power Plant). The field survey visited each of these resources and identified five more properties: four in Fall River (two structures on New Street, the Lower North Main Street area, and St. John's Cemetery) and one in Somerset (the Riverside Avenue South area). The structures on New Street are located on the LNG terminal site and the other structures are located within the viewshed.

Three of the properties documented by Weaver's Cove Energy are listed in the NRHP: Wm. B. Canedy House, Border City Mills, and Sagamore Mills No. 1 & 3. The Wm. B. Canedy House is a federal style, single-family dwelling constructed circa 1806. Border City Mills and Sagamore Mills No. 1 & 3 are both large mill complexes constructed in the last quarter of the nineteenth century. The proposed project would be visible from Border City Mills and Sagamore Mills No. 1 & 3, and partially visible from the Wm. B. Canedy House.

Weaver's Cove Energy recommended four of the remaining properties as eligible for listing in the NRHP: the Montaup Power Plant, the Lower North Main Street area, St. John's Cemetery, and the Riverside Avenue South area. The Montaup Power Plant is an electrical generating facility constructed between 1923 and 1925. The Lower North Main Street area is defined as a district encompassing 12 individual structures (9 contributing to eligibility and 3 non-contributing), including the Wm. B. Canedy House; the other structures consist of a school (Wiley School) and 10 dwellings (7 contributing), all constructed during the nineteenth or early twentieth centuries. St. John's Cemetery contains over 500 marked burials ranging in date from 1850 to 1986, with most dating from the mid to late nineteenth century. The Riverside Avenue South area is defined as a district encompassing 47 residential and commercial structures that date from the late nineteenth to early twentieth centuries. The proposed project would be visible from the Montaup Power Plant, the Riverside Avenue South Area, and the Lower North Main Street Area, and only minimally visible from St. John's Cemetery.

Weaver's Cove Energy recommended the two structures located along New Street on the LNG terminal site as ineligible for listing in the NRHP. These resources consist of a 1920s era office building and a 1950s era garage. Both structures would be demolished during construction of the LNG terminal.

Weaver's Cove Energy conducted an analysis of existing visual conditions at and within the viewshed of the properties that are listed in or recommended eligible for the NRHP. The purpose of this analysis was to determine if the viewsheds of these properties contributed to their historical or architectural significance. Existing modern structures, industrial facilities, and/or transmission towers were identified within the viewsheds at each of these properties, and research indicated that viewshed was a character defining feature at only one of the properties (Riverside Avenue South area). As a result, Weaver's Cove Energy concluded that the viewsheds do not contribute to the significance of the Wm. B. Canedy House, Border City Mills, Sagamore Mills No. 1 & 3, the Montaup Power Plant, the Lower North Main Street area, and St. John's Cemetery.

Weaver's Cove Energy recommended that the viewshed of the Riverside Avenue South area contributed to its historical and architectural significance. Many of the residential structures contained within the area were positioned to take advantage of views towards the Taunton River. Nevertheless, the viewshed of the area historically included unobstructed views of industrial facilities, including Border City Mills, Sagamore Mills No. 1 & 3, and the existing petroleum storage tanks on the LNG terminal site.

In a letter dated September 25, 2003, the SHPO indicated that the survey methods were "reasonable" and found the "survey products…technically adequate" (Massachusetts Historical Commission (MHC), 2003d, 2004a). We concur. At present, additional consultation with the Massachusetts SHPO is required.

Terrestrial Archaeological Resources

Weaver's Cove Energy conducted an archaeological reconnaissance survey of the southern and northern parcels of the proposed LNG terminal site (Public Archaeology Laboratory (PAL), 2003a, 2003b; Graves and Brett, 2003; MHC, 2003c). In a letter dated June 12, 2003, the Massachusetts SHPO determined that the southern parcel "does not retain sufficient integrity to be considered archaeologically sensitive", but found that the northern parcel had the potential to contain intact archaeological deposits (MHC, 2003a).

A subsequent survey of the southern and northern parcels of the LNG terminal site was conducted in October 2003. The investigation documented significant soil disturbance within both parcels due to previous developments. No archaeological sites were identified during the survey, and no additional archaeological investigations were recommended for this area (Graves and Brett, 2003).

Weaver's Cove Energy submitted a report on the survey results to the Massachusetts SHPO (PAL, 2003h, 2003m) and to the FERC. In a letter dated December 17, 2003, the SHPO concurred that no additional archaeological investigations of the LNG terminal site are warranted (MHC, 2003e). We also concur.

Underwater Archaeological Resources

The Rhode Island SHPO indicated that the dredging of the existing federal navigation channel would have "no effect on significant cultural resources" (Epsilon, 2003e; Rhode Island Historical Preservation and Heritage Commission, 2003). We agree. The Massachusetts SHPO and Massachusetts Board of Underwater Archaeology (BUAR) indicated that it was not necessary to survey the existing federal navigation channel or those portions of the turning basin that have been previously dredged

(Epsilon, 2003a; MHC, 2003a, 2003b; BUAR, 2003). However, both the Massachusetts SHPO and BUAR recommended that Weaver's Cove Energy conduct a marine archaeological reconnaissance survey of those areas within the proposed turning basin that were not dredged previously.

Weaver's Cove Energy conducted a marine archaeological reconnaissance survey of the previously non-dredged portions of the proposed turning basin in September 2003 (Robinson and Ford, 2003). No prehistoric or historic cultural resources or evidence of intact marine soils with the potential to contain archaeological remains were identified. Consequently, no additional archaeological investigations of the turning basin were recommended (Robinson and Ford, 2003).

Weaver's Cove Energy submitted a report on the survey results to the Massachusetts SHPO, the BUAR (PAL, 2004a), and to the FERC. In letters dated January 28, 2004 (BUAR, 2004) and February 17, 2004 (MHC, 2004a), the BUAR and SHPO concurred that no additional archaeological investigations of the turning basin are warranted. We also concur.

Pipeline Facilities

Aboveground Cultural Resources

Weaver's Cove Energy conducted an investigation to identify aboveground cultural resources that could be affected by construction of the Northern and Western Pipelines. Weaver's Cove Energy defined the APE for such resources as the proposed meter and regulation stations located at the ends of each pipeline plus their respective viewsheds. The pipelines were excluded from the APE because they would be constructed belowground and would not introduce new visual elements into their respective settings. We concur with this definition of the APE.

No resources were identified as a result of this investigation, and Weaver's Cove Energy recommended that no additional investigations for aboveground cultural resources are warranted (Epsilon, 2003b, 2003c).

Weaver's Cove Energy informed the Massachusetts SHPO in a letter dated September 9, 2003 that no aboveground cultural resources were present within or near the originally- proposed locations of the meter and regulation stations (Epsilon, 2003c). In a letter dated September 25, 2003, the SHPO indicated that the survey methods were "reasonable" and found the "survey products…technically adequate" for this investigation (MHC, 2003d, 2004a). We concur.

Weaver's Cove Energy subsequently conducted supplemental surveys of the Northern Pipeline route and three variations (the Northern Parcel, Golf Course and River Street Variations), a revised location for the meter and regulation station site at the terminus of the Northern Pipeline, and a pipe yard (Graves and Brett, 2004; PAL, 2004b). As a result of these investigations, Weaver's Cove Energy documented a historic cemetery, the Winslow Burial Ground, to the north of the revised meter and regulation station site at the Northern Pipeline's terminus. The cemetery dates from the late eighteenth century and contains at least 41 internments. Although the cemetery would not be impacted physically by construction of the meter and regulation station, Weaver's Cove Energy recommended installing protective fencing along the boundaries of its construction right-of-way in the vicinity of the cemetery "to prevent any inadvertent impacts" to the burial ground.

Weaver's Cove Energy submitted the results of the supplemental surveys to the Massachusetts SHPO (PAL, 2004c, 2004d) and the FERC. In a letter dated August 31, 2004 (MHC, 2004b), the Massachusetts SHPO agreed with the plan to fence the construction right-of-way in the vicinity of the Winslow Burial Ground. We also concur. In addition, the SHPO requested "plans and elevation

drawings of the meter station and photographic simulations for the meter station and Pipeyard in relation to the cemetery".

In a filing dated October 29, 2004, Weaver's Cove Energy provided additional information on the Winslow Burial Ground. Weaver's Cove Energy concluded that the cemetery, which is heavily overgrown and surrounded by dense vegetation, would not be visible from the meter station and pipe yard. Therefore, Weaver's Cove Energy recommended that the burial ground be excluded from the APE for aboveground cultural resources. However, Weaver's Cove Energy has not provided the SHPO with the requested additional information.

Terrestrial Archaeological Resources

Weaver's Cove Energy conducted an archaeological reconnaissance survey of the Northern Pipeline route and the terrestrial portion of the Western Pipeline route including the meter and regulation station sites (PAL, 2003a, 2003b; Graves and Brett, 2003; MHC, 2003c) as recommended by the Massachusetts SHPO (MHC, 2003a, 2003b).

The archaeological reconnaissance survey of the Northern Pipeline route consisted of background research and a limited field inspection. The background research identified two previously recorded prehistoric sites within the pipeline corridor: an Early Archaic period lithic artifact scatter (16-BR-109), and a prehistoric village site with an unidentified cultural/temporal affiliation (16-BR-106). The field investigation was limited to a 0.13-mile-long segment of the pipeline between MP 3.46 and the end of the pipeline. Access to the remainder of the pipeline was denied by the property owners, and field inspections of these areas were not conducted.

The survey indicated that a majority of the examined segment was previously disturbed or had a low potential for containing intact archaeological deposits. A short segment of the pipeline corridor from MPs 3.52 to 3.55, however, was characterized as having a moderate potential for containing intact archaeological remains. No cultural resources were identified as a result of the survey, and Weaver's Cove Energy did not attempt to relocate 16-BR-109 and 16-BR-106.

Although the field inspections did not examine the Northern Pipeline route from MPs 0.0 to 3.46, Weaver's Cove Energy characterized this segment as having a low potential for containing intact archaeological deposits, based on planned construction of the pipeline within an existing and previously disturbed pipeline right-of-way and use of an in-kind/same-trench pipeline replacement method.

As a result of its survey, Weaver's Cove Energy recommended an intensive (locational) archaeological survey of the Northern Pipeline route from MPs 3.52 to 3.55 and no additional survey of the remainder of the route, provided that the installation of the pipeline would be an in-kind/same-trench replacement of the existing naphtha pipeline, and that no new right-of-way beyond the existing pipeline's permanent right-of-way/easement would be used. If a new trench is required, and/or if new right-of-way beyond the existing pipeline's permanent right-of-way/easement is required, intensive (locational) survey was recommended (PAL, 2003i, 2003k, 2003l; Graves and Brett, 2003).

Weaver's Cove Energy submitted a report on the survey results to the Massachusetts SHPO (PAL, 2003h, 2003m), and to the FERC. In a letter dated December 17, 2003, the SHPO concurred with Weaver's Cove Energy that an intensive (locational) archaeological survey is warranted from MPs 3.52 to 3.55 of the Northern Pipeline route and that additional survey of the remainder of the pipeline is unwarranted (MHC, 2003e, 2003f).

In filings dated January 28 and February 5, 2004, however, Weaver's Cove Energy provided additional/new information. The January 28 filing provided corrected alignment sheets updating the location of the naphtha pipeline corridor from MP 3.0 to the terminus of the Northern Pipeline route, and a revision to the location of the meter and regulation station at the terminus of the route. The February 5 filing identified, based on the corrected alignment sheets, a new segment between MP 3.44 and 3.48 of the Northern Pipeline route considered to be archaeologically sensitive. This segment was recommended for intensive (locational) survey. In addition, this filing indicated that Weaver's Cove Energy was unable to provide definitive documentation as to the width of the naphtha easement corridor, and that the proposed construction right-of-way may or may not be co-extensive with it. Weaver's Cove Energy indicated that there may be areas where pipeline removal (and, therefore, same-trench replacement) may not be feasible. Also, Weaver's Cove Energy identified a new pipe storage yard near the Northern Pipeline route which may require survey. As a result of this additional/new information, we recommended that Weaver's Cove Energy adopt the Northern Parcel Variation and the Golf Course Variation (see section 3.5.3), portions of which may require survey.

Weaver's Cove Energy subsequently conducted an intensive (locational) archaeological survey of the archaeologically sensitive areas along the Northern Pipeline route, as well as the revised location for the meter and regulation station at the terminus of the Northern Pipeline (Graves and Brett, 2004). The intensive (locational) survey, which consisted of systematic shovel testing, identified two sites: the Head of Cove 2 and Barnaby Swamp 2 Sites (Graves and Brett, 2004). The Head of Cove 2 Site was characterized as a disturbed scatter of prehistoric lithic artifacts dating from the Late Archaic to Late Woodland periods. Weaver's Cove Energy identified the site as unlikely to contain significant data, and no additional investigation was recommended. The Barnaby Swamp 2 Site consisted of a prehistoric lithic scatter with an unknown cultural/temporal affiliation. Weaver's Cove Energy indicated that the site may contain additional significant information, and either avoidance or further investigation was recommended.

The intensive (locational) archaeological survey was followed by an archaeological reconnaissance survey of the temporary workspace (TWS) and additional temporary workspace (ATWS) along the Northern Pipeline (i.e., areas outside the existing naphtha pipeline corridor) and three variations for the Northern Pipeline (the Northern Parcel, Golf Course and River Street Variations) (PAL, 2004b). The archaeological reconnaissance survey, which combined archival research with a field inspection of the project area, examined approximately 2.91 miles of TWS and ATWS along the Northern Pipeline route and Northern Parcel Variation, as well as the 0.99-mile-long Golf Course Variation and the 0.19-mile-long River Street Variation (PAL, 2004b). As a result of this investigation, 1.23 miles of TWS and ATWS along the Northern Pipeline route and 0.27 miles of the Golf Course Variation were assessed as having a moderate to high potential for containing archaeological resources, and an intensive (locational) archaeological survey of these areas was recommended. The remainder of the Northern Pipeline route and Golf Course Variation, in addition to the entire River Street Variation, was assessed as possessing a low potential for containing intact archaeological deposits, and no additional investigation of these areas was recommended.

Weaver's Cove Energy submitted the results of the intensive (locational) and archaeological reconnaissance surveys to the Massachusetts SHPO (PAL, 2004c, 2004d) and the FERC. In a letter dated August 31, 2004 (MHC, 2004b), the SHPO commented on both investigations. With regard to the intensive (locational) archaeological survey, the SHPO found that the Head of Cove 2 Site is ineligible for listing in the NRHP, but that the Barnaby Swamp 2 Site may be a significant cultural resource. The SHPO concurred with the management recommendations for both sites. Specifically, the SHPO agreed that no additional testing of the Head of Cove 2 Site is warranted, and that either avoidance or a site examination archaeological survey of the Barnaby Swamp 2 Site is appropriate. The SHPO also agreed with the results and recommendations of the reconnaissance archaeological survey, including the

recommendation for an intensive (locational) survey of the archaeologically sensitive areas along the Northern Pipeline route and the Golf Course Variation. We concur with these findings.

Weaver's Cove Energy subsequently conducted the required intensive (locational) survey of the high sensitivity areas along the Northern Pipeline and the Golf Course Variation (Waller and Brett, 2005a), as well as a site examination archaeological survey of the Barnaby Swamp 2 Site (Waller and Brett, 2005b). Fieldwork for the intensive (locational) survey consisted of pedestrian reconnaissance augmented by shovel testing. Five new sites (the CSX#1, CSX#2, ISP#1, ISP#2, and the Taunton River Marsh sites) were identified as a result of this work. All five sites consisted of prehistoric lithic artifact scatters (small amounts of historic materials were also recovered from CSX#1, CSX#2, ISP#2, and the Taunton River Marsh sites). Weaver's Cove Energy concluded that all five sites have limited potential to contain "significant archaeological deposits", and no additional testing of these sites was recommended (Waller and Brett, 2005a). Fieldwork at the Barnaby Swamp 2 Site consisted of shovel testing augmented by unit excavation. The testing failed to document intact archaeological deposits at the site, which was assessed as not eligible for listing in the NRHP. No additional testing of the Barnaby Swamp 2 Site was recommended (Waller and Brett, 2005b).

Weaver's Cove Energy submitted the results of the intensive (locational) and site examination surveys to the Massachusetts SHPO (PAL, 2005), and to the FERC. In a letter dated March 11, 2005 (MHC, 2005), the SHPO commented on these investigations and disagreed with Weaver's Cove Energy's eligibility and management recommendations. The SHPO concluded that the five new sites identified during the intensive (locational) survey may possess research potential, and recommended site examination archaeological surveys at each site. The SHPO assessed the Barnaby Swamp 2 Site as eligible for listing in the NRHP, and recommended either archaeological site examination to better define site context and research potential, or archaeological data recovery at this site. The SHPO also requested an avoidance plan for protecting those portions of the site located outside the APE. Weaver's Cove Energy has not yet conducted the recommended site examination surveys, or prepared data recovery or avoidance plans for the Barnaby Swamp 2 Site.

The reconnaissance survey of the Western Pipeline route indicated that a small portion of the pipeline, between MPs 0.5 and 0.8, was previously disturbed or had a low potential for containing intact archaeological deposits. The remainder of the pipeline was found to have a moderate (MPs 0.8 to 2.2) or high (MPs 2.2 to 2.5) potential for containing intact archaeological remains. No archaeological sites, however, were identified during the survey.

As a result of its investigation, Weaver's Cove Energy recommended an intensive (locational) archaeological survey of the moderate and high sensitivity areas identified between MPs 0.8 and 2.52 of the Western Pipeline. No additional archaeological investigations were recommended for the low sensitivity area identified from MPs 0.5 to 0.8 (Graves and Brett, 2003; PAL, 2003i, 2003k, 2003l).

Weaver's Cove Energy submitted a report on the reconnaissance survey results for the Western Pipeline to the Massachusetts SHPO (PAL, 2003h, 2003m), and to the FERC. In a letter dated December 17, 2003, the SHPO concurred with the survey results and recommendations (MHC, 2003e, 2003f). We also concur.

Weaver's Cove Energy subsequently conducted an intensive (locational) survey of the archaeologically sensitive areas along the Western Pipeline route. Fieldwork for this investigation consisted of systematic shovel testing. Two archaeological resources, the Wetland 3 Find Spot and the Slade Farmstead and Cemetery, were identified as a result of this survey. The Wetland 3 Find Spot consisted of an isolated prehistoric projectile point. No additional investigation was recommended. The Slade Farmstead and Cemetery consisted of the remains of a late nineteenth century farmstead and

associated cemetery. Although the site contained numerous features, such as stone foundation walls, a cellar hole, a possible brick chimney foundation, a stone-lined well, and two marked burials, the majority of these features were found outside Weaver's Cove Energy's proposed construction corridor; only three stone walls, associated berms, and a low density artifact scatter were identified within the construction corridor. Weaver's Cove Energy concluded that the site could contain important information about nineteenth century agricultural sites in the region. Because the majority of the site is located outside the construction corridor, however, no additional archaeological investigation was recommended. Restoration of any stone walls or berms impacted during construction also was recommended.

Weaver's Cove Energy submitted the results of the intensive (locational) survey to the Massachusetts SHPO (PAL, 2004c) and the FERC. In a letter dated August 31, 2004 (MHC, 2004b), the SHPO found that the Wetland 3 Find Spot is ineligible for listing in the NRHP and agreed that no additional investigation is warranted. The SHPO also concurred that the Slade Farmstead and Cemetery may be a significant resource, but recommended either avoidance or a site examination archaeological survey for this resource. We concur with the SHPO.

Weaver's Cove Energy subsequently conducted a supplemental intensive (locational) survey along the Western Pipeline (Waller and Brett, 2005a), in addition to a site examination archaeological survey of the Slade Farmstead and Cemetery (Waller and Brett, 2005c). The intensive (locational) survey examined a new route variation, the Jaffrey Street Variation, and an associated workspace. Fieldwork for this investigation consisted of pedestrian reconnaissance augmented by shovel testing. No sites were identified during the survey (Waller and Brett, 2005a). Shovel testing and unit excavation at the Slade Farmstead yielded a small artifact assemblage dating from the mid to late nineteenth century, but no evidence of intact archeological deposits was discovered. Weaver's Cove Energy assessed the site as not eligible for listing in the NRHP, and no additional testing of the site was recommended (Waller and Brett, 2005c).

Weaver's Cove Energy submitted the results of the intensive (locational) and site examination survey to the Massachusetts SHPO (PAL, 2005), and to the FERC. In a letter dated March 11, 2005 (MHC, 2005), the SHPO concurred with the results of the intensive locational survey, but disagreed with the eligibility and management recommendations for the Slade Farmstead and Cemetery. The SHPO assessed the Slade Farmstead as eligible for listing in the NRHP, but concluded that the site's research potential was exhausted within the APE. Therefore, the SHPO recommended that the project would have no adverse effect on the site. The SHPO also requested an avoidance plan for protecting those portions of the site located outside the APE.

Underwater Archaeological Resources

Weaver's Cove Energy conducted a marine archaeological reconnaissance survey of the Western Pipeline route within the Taunton River as recommended by the Massachusetts SHPO and Massachusetts BUAR (MHC, 2003a, 2003b; BUAR, 2003; Robinson and Ford, 2003). No prehistoric or historic cultural resources and no evidence of intact marine soils with the potential to contain archaeological remains were identified. No additional archaeological investigation of the marine portion of the Western Pipeline route was recommended (Robinson and Ford, 2003).

Weaver's Cove Energy submitted a report on the results of its investigation to the Massachusetts SHPO, the BUAR (PAL, 2004a), and the FERC. In letters dated January 28, 2004 (BUAR, 2004) and February 17, 2004 (MHC, 2004a), the BUAR and SHPO concurred that no additional archaeological investigations of the marine portion of the Western Pipeline are warranted. We also concur.

4.10.2 Native American Consultation

On August 26, 2003, Weaver's Cove Energy sent letters to the Wampanoag Tribe of Gay Head (Aquinnah) and the Assonet Band of the Wampanoag Nation to request comments from each tribe regarding the proposed project (PAL, 2003c, 2003d). In a follow-up telephone call on October 8, 2003 the Wampanoag Tribe of Gay Head (Aquinnah) advised Weaver's Cove Energy that it would defer comment on the project to the Assonet Band of the Wampanoag Nation (PAL, 2003f). In a follow-up telephone call on November 4, 2003, the Assonet Band of the Wampanoag Nation advised Weaver's Cove Energy that it would review the project and requested an on-site meeting (PAL, 2003j). Weaver's Cove Energy agreed to continue its consultation with the tribe and schedule an on-site meeting at a future date.

On August 26, 2003, Weaver's Cove Energy also sent a letter requesting comments on the project from the Massachusetts Commission on Indian Affairs (CIA) (PAL, 2003e). The CIA failed to respond to this letter and to a follow-up telephone call from Weaver's Cove Energy on October 8, 2003 (PAL, 2003g).

4.10.3 Unanticipated Discoveries

Weaver's Cove Energy developed a plan for responding to the unanticipated discovery of historic properties or human remains during construction of its project (*Unanticipated Discovery of Historic Properties of Human Remains*). Weaver's Cove Energy submitted this plan to the Massachusetts SHPO; to date, however, the SHPO has not commented on the plan.

4.10.4 Compliance with the NHPA

Consultation is not complete for the project. Consequently, we have not completed the process of complying with section 106 of the NHPA. The FERC, in consultation with the Massachusetts SHPO, will determine whether construction of the Weaver's Cove LNG Project would adversely affect any historic properties. If a historic property would be adversely affected, mitigation would be proposed and the FERC would notify the ACHP.

To ensure that the FERC's responsibilities under the NHPA and its implementing regulations are met, **we recommend that:**

- **Weaver's Cove Energy defer construction of the LNG terminal and Northern and Western Pipelines and associated aboveground facilities <u>until</u>:**

  a. Weaver's Cove Energy provides the SHPO with the appropriate plans, drawings, and photographic simulations for the meter station and pipeyard in relation to the Winslow Burial Ground, and provides the SHPO's comments on this information;

  b. Weaver's Cove Energy conducts the recommended site examination surveys at the CSX#1, CSX#2, ISP#1, ISP#2, and the Taunton River Marsh sites, and files with the Secretary the evaluation reports and the SHPO's comments on the reports;

  c. Weaver's Cove Energy conducts additional site examination at the Barnaby Swamp 2 Site, and files with the Secretary the report and the SHPO's comments on the report;

d. Weaver's Cove Energy files with the Secretary an avoidance plan for the Slade Farmstead and Cemetery and the SHPO's comments on the plan;

e. Weaver's Cove Energy files with the Secretary and the SHPO any additional required survey and evaluation reports, and any required treatment or avoidance plans, and the SHPO's comments on all reports and plans; and

f. The Director of OEP reviews and approves all cultural resources reports and plans, and notifies Weaver's Cove Energy in writing that it may proceed with treatment measures or construction.

All material filed with the Secretary containing location, character, and ownership information about cultural resources must have the cover and any relevant pages therein clearly labeled in bold lettering: "CONTAINS PRIVILEGED INFORMATION - DO NOT RELEASE."

4.11 AIR QUALITY AND NOISE

4.11.1 Air Quality

Climate

The regional climate of the project area is classified as northern temperate continental. The project area lies in the path of the "prevailing westerlies." This movement system is characterized by extensive masses of contrasting air originating in higher and lower latitudes interacting to produce low-pressure storm systems. Air masses are of three types: cold, dry air from sub-arctic North America; warm, moist air from the Gulf of Mexico and the subtropical Atlantic; and cool, damp air from the North Atlantic. Due to the dominant westerly wind flow, exposure to the North Atlantic air mass is far less in both frequency and duration than exposure to the other air masses.

National Ambient Air Quality Standards

The EPA has established National Ambient Air Quality Standards (NAAQS) for six pollutants: sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter less than 10 microns in diameter (PM_{10}), and lead (Pb). The EPA is currently working to implement a NAAQS for $PM_{2.5}$. The NAAQS were set at levels the EPA believed were necessary to protect human health (primary standards) and human welfare (secondary standards). The federal NAAQS for criteria pollutants are the same as the state standards established by the DEP. The standards established by the DEP are referred to as the Massachusetts Ambient Air Quality Standards (MAAQS). Fall River is in attainment of the NAAQS for all criteria pollutants, except ozone. All of Massachusetts is classified as a "serious non-attainment area" for the 1-hour ozone standard. The DEP has also established a 1-hour NO_2 policy for sources with a potential to emit 250 tons per year (tpy) of NO_2. The proposed LNG terminal would emit less than 250 tpy of NO_2, so the DEP policy is not applicable. The NAAQS/MAAQS along with the appropriate Significant Impact Levels (SILs) and estimated background concentrations for the project area are listed in table 4.11.1-1.

TABLE 4.11.1-1

Ambient Air Quality Standards

Air Pollutant	Averaging Period	Background Level	Primary Standard	Secondary Standard	Percent of NAAQS/MAAQS	Significant Impact Level ($\mu g/m^3$)
Sulfur Dioxide ($\mu g/m^3$)	3-Hour a/	246.3	NA	1,300	19	25
	24-Hour a/	110.0	365	NA	30	5
	Annual b/	13.1	80	NA	16	1
Carbon Monoxide (ppm)	1-Hour a/	12.7	35	35	36	2,000
	8-Hour a/	5.0	9	9	56	500
Nitrogen Dioxide ($\mu g/m^3$)	Annual b/	44.7	100	100	45	1
Ozone c/ (ppm)	1-Hour a/	0.136	0.12	0.12	113	NA
	8-Hour a/	0.113	0.08	0.08	141	NA
Particulate Matter less than 10	24-Hour a/	91.0	150	150	61	5
microns ($\mu g/m^3$)	Annual b/	32.0	50	50	64	1
Particulate Matter less than 2.5	24-Hour a/	37.9	65	65	58	NA
microns ($\mu g/m^3$)	Annual b/	13.3	15	15	89	NA
Lead d/	NA	NA	NA	NA	NA	NA

a/ The second high designation indicates that the concentration listed is representative of the second high concentration measured at the monitoring station.
b/ The highest annual average concentration.
c/ All of Massachusetts is classified as "serious" non-attainment for 1-hour ozone standard.
d/ Lead is not monitored in Massachusetts.
$\mu g/m^3$ micrograms per cubic meter
ppm parts per million

Existing Air Quality

Air quality data contained in reports from the DEP Division of Air Quality Control (DAQC) and monitoring data provided by the EPA were reviewed to characterize ambient (background) air quality related to regulated criteria pollutants. The pollutants include SO_2, CO, NO_2, O_3, PM_{10}, $PM_{2.5}$, and Pb. A summary of these data is presented in table 4.11.1-2.

TABLE 4.11.1-2

Existing Ambient Air Concentrations

Air Pollutant	Monitoring Station	Averaging Period	1999	2000	2001	Background Level
Sulfur Dioxide ($\mu g/m^3$)	Fall River	3-Hour a/	193.9	246.3	159.8	246.3
	Fall River	24-Hour a/	55.0	110.0	57.6	110.0
	Fall River	Annual b/	10.5	13.1	13.1	13.1
Carbon Monoxide (ppm)	Providence	1-Hour a/	8.1	6.5	12.7	12.7
	Providence	8-Hour a/	5.0	4.6	4.0	5.0
Nitrogen Dioxide ($\mu g/m^3$)	Providence	Annual b/	44.7	37.6	37.8	44.7
Ozone c/ (ppm)	Fairhaven	1-Hour a/	0.125	0.101	0.136	0.136
	Fairhaven	8-Hour a/	0.109	0.09	0.113	0.113
Particulate Matter less than 10 microns ($\mu g/m^3$)	Providence	24-Hour a/	61.0	91.0	86.0	91.0
	Providence	Annual a/	29.0	29.0	32.0	32.0
Particulate Matter less than 2.5 microns ($\mu g/m^3$)	Fall River	24-Hour a/	37.9	29.6	37.0	37.9
	Fall River	Annual b/	11.8	11.7	13.3	13.3
Lead d/	NA	NA	NA	NA	NA	NA

a/ The second high designation indicates that the concentration listed is representative of the second high concentration measured at the monitoring station.
b/ The highest annual average concentration.
c/ All of Massachusetts is classified as "serious" non-attainment for 1-hour ozone standard.
d/ Pb is not monitored in Massachusetts.
$\mu g/m^3$ micrograms per cubic meter
ppm parts per million

Air Quality Control Regions

Air Quality Control Regions (AQCRs) were established by the EPA and local agencies, in accordance with section 107 of the CAA, as a means to implement the CAA and comply with the NAAQS through state implementation plans (SIPs). The AQCRs are intra- and interstate regions such as large metropolitan areas where the improvement of the air quality in one portion of the AQCR requires emission reductions throughout the AQCR. Fall River is located in the Metropolitan Providence Interstate AQCR.

Regulatory Requirements for Air Quality

The proposed LNG terminal would generate air emissions through both short-term construction activities and long-term operation of the stationary emission units at the facility. Emissions from all phases of construction and operation of the emission units would be subject to applicable state and federal air regulations.

The new stationary air emission sources associated with operating the proposed LNG terminal are listed in table 4.11.1-3.

TABLE 4.11.1-3

Emission Source Information

Air Emission Source (quantity)	Heat Rating (MMBtu/hr)	Horsepower Rating	Energy Source
Water/Glycol heaters (12)	59 (each)	NA	Natural Gas
Emergency Generator (1)	8	1,160	Diesel Fuel
Diesel Fire Pump (1)	1.21	175	Diesel Fuel

MMBtu/hr million British thermal units per hour

Air emission sources in the Commonwealth of Massachusetts are regulated at the federal level by the CAA, as amended, and at the state level by the CMR. The federal regulations established as a result of the CAA and the CMR that are potentially applicable to the project include:

- New Source Performance Standards (NSPS);
- New Source Review (NSR)/Prevention of Significant Deterioration (PSD) review;
- Title V Operating Permits;
- National Emission Standards for Hazardous Air Pollutants (NESHAPs);
- Federal Class I Area Protection;
- General Conformity; and
- State Regulations.

New Source Performance Standards

NSPS regulations (40 CFR 60) establish pollutant emission limits and monitoring, reporting, and recordkeeping requirements for various emission sources based on source type and size. The NSPS apply to new, modified, or reconstructed sources.

Subpart Dc of 40 CFR 60 applies to small industrial, commercial, or institutional steam generating units that are modified, constructed, or reconstructed after June 9, 1989 and have maximum heat input rates of more than 10 MMBtu/hr but less than 100 MMBtu/hr. Subpart Dc establishes specific emissions limits for SO_2 (for coal and oil fired units) and PM (for coal fired units). The proposed boilers would not be oil or coal-fired, so the emission limitations would not be applicable. However, Subpart Dc would be applicable for reporting and recordkeeping requirements.

Subpart Kb of 40 CFR 60 potentially applies to any volatile organic liquid storage unit that is modified, constructed, or reconstructed after July 23, 1984 and has a capacity of 75 m^3 or greater. Subpart Kb applicability is dependent on the construction date, size, and vapor pressure of the storage vessel and its contents. Subpart Kb applies to new tanks, unless otherwise exempted, that have a storage capacity between 75 m^3 (19,813 gallons) and 151 m^3 (39,890 gallons) containing VOCs with a maximum true vapor pressure greater than or equal to 15.0 kilopascals (kPa) or storage capacity greater than or equal to 151 m^3 containing VOCs with a maximum true vapor pressure greater than or equal to 3.5 kPa. The LNG storage tank would operate at approximately -260° F and the prominent VOC (propane) has a vapor pressure of 0.0007 kPa at this storage temperature. Therefore, the LNG storage tank would not be subject to NSPS Subpart Kb. However, the LNG storage tank would have a closed vent system comparable to those required by Subpart Kb. The boil-off gas from the tank would be collected and routed to the boil-off gas compressors for recovery to prevent fugitive emissions to the atmosphere.

Prevention of Significant Deterioration

Title I of the CAA establishes guidelines for the preconstruction/modification review of large air emission sources. Construction of sources in attainment areas must be reviewed in accordance with the PSD regulations. To be classified as a new major PSD source, the potential emissions from the source must be: either greater than 100 tpy for any pollutant regulated by the EPA under the CAA for sources that are among the 28 source categories listed in section 169 of the CAA, or greater than 250 tpy for any pollutant regulated by the EPA under the CAA for sources that are not among the 28 source categories listed in section 169 of the CAA. A Best Available Control Technology (BACT) analysis and detailed dispersion modeling are required if a facility is classified as a major PSD source.

Fossil fuel boilers (or combination thereof) totaling more than 250 MMBtu/hr heat input are identified in the list of 28 source categories in section 169 of the CAA; therefore, the applicability threshold for PSD review for the proposed LNG terminal is 100 tpy. Table 4.11.1-4 presents the annual maximum potential emissions from the proposed LNG terminal and relevant PSD and NSR threshold criteria.

TABLE 4.11.1-4

Operating Air Emissions Summary for Proposed LNG Terminal a/

	NO_2		CO		SO_2		$PM_{10}/PM_{2.5}$		VOC		Pb	
Emission Unit (Quantity)	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr
Water/Glycol heaters (12) b/	31.1	7.7	42.0	10.5	1.7	0.4	24.6	6.1	12.0	3.0	1E-03	4E-04
Fire Pump (1) c/	0.3	1.7	0.1	0.4	9E-03	0.1	0.1	0.4	0.1	0.4	9E-07	6E-06
Emergency Generator (1) c/	2.1	13.8	0.6	3.9	0.1	0.4	0.4	2.5	0.4	2.9	6E-06	4E-05
Land-Based Total Emissions	33.5	23.2	42.7	14.8	1.8	0.8	25.1	9.0	12.5	6.3	1E-03	4E-04
Operating Permit Threshold	50	NA	100	NA	100	NA	100	NA	50	NA	10	NA
PSD Threshold Criteria	NA	NA	100	NA	100	NA	100	NA	NA	NA	100	NA
LNG Ships While Docked	13.5	---	0.7	---	66.4	---	5.3	---	0.9	---	Neg. d/	---
Total Terminal Emissions	47.0	---	43.4	---	68.2	---	30.4	---	13.4	---	1E-03	---
NSR Threshold	50	NA	NA	NA	NA	NA	NA	NA	50	NA	NA	NA

a/ Emissions of beryllium, mercury, sulfuric acid mist, asbestos, vinyl chloride, fluorides, hydrogen sulfide, total reduced sulfur, reduced sulfur compounds, CFCs, halons, and ozone depleting substances are negligible.

b/ The calculations for the Water/Glycol heaters assume 12 heaters operating at maximum capacity (59 MMBtu/hour/unit) for short-term emissions and 11 heaters operating at maximum capacity for the entire year (8,760 hours) for annual emissions.

c/ Emergency Generator and Fire Pump potential emissions calculations based on 300 hour per year operation.

d/ The lead emissions from the LNG ships were not provided by Weaver's Cove Energy and are assumed to be negligible (Neg.) with respect to the PSD major source thresholds.

NO_2 nitrogen dioxide
CO carbon monoxide
SO_2 sulfur dioxide
PM_{10} particulate matter less than 10 microns in diameter
$PM_{2.5}$ particulate matter less than 2.5 microns in diameter
VOC volatile organic compound
Pb lead

lb/hr pounds per hour
tpy tons per year

As shown in table 4.11.1-4, the maximum emissions from the proposed LNG terminal would be less than 100 tpy for each of the criteria pollutants. Therefore, the proposed LNG terminal would not be a major source and would not be subject to PSD review.

Non-attainment New Source Review

Title I of the CAA establishes guidelines for the preconstruction/modification review of large air emission sources. Construction of sources in non-attainment areas must be reviewed in accordance with the NSR regulations. As discussed above, the entire Commonwealth of Massachusetts is classified as a serious non-attainment area for ozone (40 CFR 81.322). There are special requirements for sources of VOC and NO_x, the two ozone precursors that are regulated by section 182(f) of the CAA. Ozone NSR in Massachusetts is required for new major stationary sources that emit more than 50 tpy of NO_x or VOC. Stationary sources are defined by 310 CMR 7.00 Appendix A to include any marine vessel emissions while docked at the facility. Therefore, the LNG ship emissions that would be generated while docked at the LNG terminal are included in table 4.11.1-4. Because the land-based and docked ship emissions would total less than 50 tpy of NO_x and VOC, the LNG terminal would not be subject to NSR.

Title V Operating Permits

Title V of the CAA requires states to establish an air operating permit program. The requirements of Title V are outlined in 40 CFR 70 and the permits required by these regulations are often referred to as Part 70 permits. Massachusetts has incorporated this program in 310 CMR 7.00 Appendix C of its Air Pollution Control Regulations.

If a facility's potential to emit exceeds the criteria pollutant or hazardous air pollutant (HAP) thresholds, the facility is considered a major source. The major source threshold level for an air emission source in Massachusetts is 100 tpy for PM_{10}, SO_2, and CO and 50 tpy for NO_x and VOC. The major source HAP thresholds for a source are 10 tpy of any single HAP or 25 tpy of all HAPs in aggregate. Potential HAP emissions from the proposed LNG terminal (in aggregate) would be 5.37 tpy, which are below the major source thresholds.

As shown in table 4.11.1-4, the potential emissions for each pollutant at the proposed LNG terminal do not exceed the Title V threshold limits. Therefore, the LNG terminal would not be a major source of air emissions and would not require a Part 70 permit. Massachusetts has not established a minor source operating permit program. However, the DEP would require an Air Plan Approval for the project (discussed below), which would constitute authorization to construct and operate the proposed air emission sources.

National Emission Standards for Hazardous Air Pollutants

The NESHAPs, codified in 40 CFR Parts 61 and 63, regulate HAP emissions. Part 61 was promulgated prior to the 1990 Clean Air Act Amendments (CAAA) and regulates only eight types of hazardous substances (asbestos, benzene, beryllium, coke oven emissions, inorganic arsenic, mercury, radionuclides, and vinyl chloride).

The 1990 CAAA established a list of 189 HAPs; resulting in the promulgation of Part 63. Part 63, also known as the Maximum Achievable Control Technology (MACT) standards, regulates HAP emissions from major sources of HAP emissions and specific source categories that emit HAPs. Part 63 defines a major source of HAPs as any source that has the potential to emit 10 tpy of any single HAP or 25 tpy of HAPs in aggregate.

LNG storage and processing facilities are not one of the source categories regulated by Part 61; therefore, the requirements of Part 61 are not applicable to these types of facilities. Part 63 establishes HAP emission standards for marine vessel loading operations (Subpart Y); oil and gas production facilities (Subpart HH); natural gas transmission and storage facilities (Subpart HHH); industrial,

commercial, and institutional boilers and process heaters (proposed as Subpart DDDDD); and reciprocating internal combustion engines (Subpart ZZZZ). These subparts establish requirements for major sources of HAPs only. As indicated above, the potential HAP emissions (in aggregate) from the LNG terminal would be 5.37 tpy. The single largest HAP emitted by the terminal would be hexane with a potential to emit of 5.12 tpy. Therefore, the LNG facility would not be a major source of HAPs and would not be subject to the NESHAPs.

Federal Class I Area Protection

The United States Congress designated certain lands as Mandatory Federal Class I (Class I) areas in 1977. Class I areas were designated because the air quality was considered a special feature of the area (e.g., national parks or wilderness area). These Class I areas, and any other areas that have been redesignated Class I areas since 1977, are given special protection under the PSD program. The PSD program establishes air pollution increment increases that are allowed by new or modified air pollution sources. If the new source is required to comply with PSD program requirements and is near a Class I area, the source is required to determine its impacts at the nearby Class I area(s). The source is also required to notify the appropriate federal land manager(s) for the nearby Class I area(s).

As determined previously, the proposed LNG terminal would not be subject to the PSD regulations. Therefore, the Federal Class I area protection provisions would not apply to this project.

General Conformity

A conformity analysis must be conducted if a federal action will generate emissions that will exceed the conformity thresholds levels (*de minimis*) of the pollutant(s) for which an air basin is in nonattainment. A conformity analysis must show that the emissions will conform to the SIP and will not reduce air quality in the air basin, which can be demonstrated through offsets, SIP provisions, or modeling. Emissions from sources subject to NSR or PSD requirements are exempt and are deemed to have conformed. The requirements for a conformity analysis are listed in 40 CFR Parts 6, 51, and 93, and became effective March 15, 1994.

The EPA had designated the Commonwealth of Massachusetts as a “serious non-attainment area” for the 1-hour ozone standard. A federal conformity analysis is required for any project in a “serious non-attainment area” that would result in combined direct and indirect emissions of either NO_x or VOCs equal to or greater than 50 tons per year. However, in April 2004, the EPA designated eastern Massachusetts (EMA) as a "moderate non-attainment area" under the 8-hour ozone standard and, after June 15, 2005, the ozone conformity applicability thresholds for this area will be 100 tons per year of NO_x and 50 tons per year of VOC emissions. In previous instances, the Commission has interpreted its authorization to commence construction as the Commission’s final action, which would trigger the effectiveness of its conformity determination. This action would not occur prior to June 15, 2005. As shown in table 4.11.1-5, the maximum emissions of NO_x and VOCs from the proposed LNG terminal are estimated to be 78.0 and 14.2 tons per year, respectively, both of which are below the thresholds requiring a conformity analysis under the 8-hour ozone standard.

We note that the DEP believes applying a 100 ton per year threshold for NO_x after June 15, 2005 constitutes backsliding and is inconsistent with the requirements of the federal Clean Air Act. Therefore, the DEP wants to require any project generating 50 tons per year or more of NO_x emissions after June 15, 2005 to meet the General Conformity criteria under 40 CFR Part 51.858.

TABLE 4.11.1-5

Total NO_x and VOC Emissions for the Weaver's Cove LNG Project

Source	Service	Pollutant	Time/Distance	Units	Emissions	Units
INDIRECT EMISSIONS (assuming 7,000 LNG trucks per year, each having a 1.2 miles roundtrip)						
LNG Trucks	Idling (1hour)	NO_x	7,000	hours/year	0.1	tons/year
LNG Trucks	Idling (1hour)	VOC	7,000	hours/year	negligible	tons/year
LNG Trucks	Driving	NO_x	8,400	miles/year	0.1	tons/year
LNG Trucks	Driving	VOC	8,400	miles/year	negligible	tons/year
LNG Ships & Tugs	Transport	NO_x			16.2	tons/year
LNG Ships & Tugs	Transport	VOC			0.2	tons/year
LNG Ships & Tugs	Unloading	NO_x			28.1	tons/year
LNG Ships & Tugs	Unloading	VOC			1.5	tons/year
Total Indirect		NO_x			44.5	tons/year
Total Indirect		VOC			1.7	tons/year
DIRECT EMISSIONS (based on proposed BACT controls)						
Heaters		NO_x	8,760	hours/year	31.1	tons/year
Heaters		VOC	8,760	hours/year	12.0	tons/year
Fire Pump		NO_x	300	hours/year	0.3	tons/year
Fire Pump		VOC	300	hours/year	0.1	tons/year
Emergency Generator		NO_x	300	hours/year	2.1	tons/year
Emergency Generator		VOC	300	hours/year	0.4	tons/year
Total Direct		NO_x			33.5	tons/year
Total Direct		VOC			12.5	tons/year
TOTAL PROJECT EMISSIONS						
		NO_x			78.0	tons/year
		VOC			14.2	tons/year

However, the implementation rule adopted by the EPA on April 30, 2004, specifies that areas will not be obligated to continue to demonstrate conformity for the 1-hour standard as of the effective date of the revocation of the 1-hour standard. For a determination effective after June 15, 2005, the EPA would consider the Weaver's Cove LNG Project exempt from the requirements of general conformity as long as the yearly emissions would be below the applicability threshold under the 8-hour standard for the life of the project and provided that the project's emissions of any pollutant would not comprise more than 10 percent of the region's total emissions of that pollutant. As shown in table 4.11.1-6, the Weaver's Cove LNG Project emissions for NO_x or VOC would be approximately 0.21 and 0.05 percent of the projected 2007 total emissions of NO_x and VOC in the EMA. Therefore, no conformity determination is required for this project.

TABLE 4.11.1-6

DEP NO_x and VOC Emission Budgets for the Weaver's Cove LNG Project

Non-attainment Pollutant	EMA 2007 Projected Emissions a/ (tons per summer day)	Weaver's Cove Energy's Projected Emissions \(tons per peak day) b/	Weaver's Cove Energy's Contribution (percent)
NO_x	606	1.3	0.21
VOC	491	0.24	0.05

a/ Source of the 2007 projected emissions; Final Eastern Mass SIP Sept 2, 2002.
b/ Peak day emissions were conservatively calculated by dividing the yearly emissions by 60 LNG ship deliveries.

State Air Plan Approval

The DEP requires an Air Plan Approval for all new facilities meeting specific criteria set forth in 310 CMR 7.02. The regulation prohibits the construction, substantial reconstruction, or alteration of any regulated facility unless the plans, specifications, proposed standard operating procedures, and proposed maintenance procedures for such a facility have been approved by the DEP. It is through this preconstruction permit review process that the DEP implements the key federal and state regulations. In addition, the Air Plan Approval process serves as the state's mechanism for noise impact review (see section 4.11.2 for details). In addition to the requirements set forth in 310 CMR 7.02, the regulations also require the application of BACT for each pollutant regulated as part of the Air Plan Approval. BACT is an emission limitation based on the maximum degree of reduction of any regulated air contaminant that the DEP determines, on a case-by-case basis, is achievable taking into account energy, environmental, and economic impacts.

Weaver's Cove Energy originally proposed the following control technology and emission limitations to constitute BACT for the water/glycol heaters at the proposed LNG terminal:

- Low NO_x combustion to reduce NO_x emissions to 15 ppm;
- Efficient combustion controls to minimize CO, VOC, PM_{10}, and PM; and
- Use of natural gas as the only fuel, minimizing PM_{10} and SO_2 emissions.

We received comments from the DEP regarding Weaver's Cove Energy's proposed emission limitations/controls for the water/glycol heaters and the information that was used as basis for these emission controls. Specifically, the DEP indicated that:

- Weaver's Cove Energy's proposed BACT was inconsistent with the DEP's March 21, 2001 Draft Internal DEP/BWP Best Available Control Technology Guidance and was not approvable;

- Weaver's Cove Energy's BACT analysis underestimated the uncontrolled baseline emission rate of the heaters;

- The DEP recently permitted a similar-sized project at the University of Massachusetts that implemented more stringent emission controls than those proposed Weaver's Cove Energy; and

- Weaver's Cove Energy should implement Selective Catalytic Reduction (SCR) and a CO oxidation catalyst on each of the heaters, which would reduce NO_x and CO emissions, but could result in a slight increase in PM_{10} emissions due to the unreacted ammonia that would result from the use of SCR.

In response to the DEP's comments, Weaver's Cove Energy revised the BACT analysis to include ultra dry low NO_x burners. These burners would meet 9 ppm NOx rather than standard low NO_x burners that would have met 15 ppm NO_x. Weaver's Cove Energy conducted a top-down BACT analysis for the DEP to confirm that these emission controls meet the definition of BACT. The DEP said it would make the final BACT determination prior to issuing an air plan approval for the project, which Weaver's Cove Energy would need prior to commencing construction of the proposed project.

Fugitive Dust and Odor

DEP regulation 310 CMR 7.09 requires that dust- or odor-causing emissions from construction or operation of a fossil fuel utilization facility not cause or contribute to a condition of air pollution. The measures proposed by Weaver's Cove Energy to mitigate potential odors and dust are addressed in the impacts and mitigation section below.

Particulate and Opacity Limits

DEP regulations in 310 CMR 7.02(8)(h), Table 4 limit new fossil fuel utilization facilities with a heat input from 3 to 250 MMBtu/hr heat input to a PM emission rate of 0.10 pounds per MMBtu. The emission rates for all of the LNG terminal's combustion equipment would be below this limit. The opacity limit (310 CMR 7.06) of 20 percent would be met by the facility by burning natural gas and diesel fuel (for emergency equipment).

Air Quality Impacts and Mitigation

Construction of the proposed LNG terminal and pipelines would have temporary adverse impacts on air quality due to fugitive dust emissions. The amount of fugitive dust would depend on the moisture content and amount of stabilizer added to the sediments. Weaver's Cove Energy proposes to control fugitive dust from construction activities at the LNG terminal site by applying water to roads and other areas, using gravel drives and wheel washing stations, as necessary, requiring trucks to be covered to minimize material loss, and by sweeping-up accumulated soils from paved areas at the LNG terminal site regularly**.** Fugitive dust from construction of the pipelines would be minimized by spraying water over the exposed soils as necessary.

Construction of the LNG terminal and pipelines would also result in tailpipe emissions from a variety of sources, including cranes, forklifts, front end loaders, dump trucks, sideboom tractors, graders, generators, vibratory rollers, concrete pumps and trucks, water trucks, and pick-up trucks. The construction vehicle emissions were estimated using two air quality models: MOBILE6 and PART5. These models assume that construction equipment used for dredged material stabilization (e.g., pug mill) would operate 24 hours per day for the entire construction period and equipment used to place and grade the stabilized dredged material (e.g., loaders, dump trucks, vibratory rollers, and graders) would operate less than 12 hours per day. These models also assume that the construction equipment would use transportation-grade diesel fuel containing 0.05 weight percent sulfur. In table 4.11.1-7, the estimated construction tailpipe emissions are compared to regional air emissions estimated by the DEP for intra-agency state implementation plan development and attainment designations.

Impacts associated with construction vehicles are difficult to estimate based on the time and space variant characteristics of the emissions. Estimates are complicated by the fact that the construction equipment would not follow defined paths (such as paved roadways) and would frequently change speed and direction. However, based on the estimated emissions shown in table 4.11.1-7, it appears that construction equipment emissions would be relatively low based on the projected emissions for the region. Furthermore, due to the intermittent and temporary nature of these emissions, their impact on air quality would be minimal. In addition, the primary pollutants emitted by the construction vehicles would be NO_x and CO. The ambient air quality standard for NO_2 is an annual average and the CO standards are significantly higher than any other standards (see table 4.11.1-1). For these reasons, the short-term and intermittent NO_2 and CO emissions from the construction vehicles are not expected to exceed the NO_2 or CO standards.

TABLE 4.11.1-7

Estimated Peak Daily and Total Construction Vehicle Tailpipe Emissions

	NO_x		CO		SO_2		$PM_{10}/PM_{2.5}$		VOC	
Emission Source	tons a/	lb/day	tons a/	lb/day	tons a/	lb/day	tons a/	lb/day	tons a/	lb/day
Construction Equipment LNG Terminal	92.4	286.0	51.0	135.0	0.5	2.0	1.1	9.0	8.3	26.0
Construction Equipment Pipeline	4.7	101.0	5.9	108.0	0.1	2.0	0.1	2.0	0.9	17.0
Construction Total b/	97.1	387.0	56.9	243.0	0.6	4.0	1.2	11.0	9.2	43.0
DEP Regional Estimates c/		3.49E5		1.19E6						5.48E4
Percent of Regional Emissions		0.11		0.02						0.08

a/ These emission levels are representative of the entire construction period.

b/ The total construction emissions are summed for the entire construction period and peak daily emissions. These emission numbers are conservative because peak daily emissions from the LNG terminal and pipeline construction activities are expected to occur at different times during the project, which would result in lower emissions that are presented in the table.

c/ The NO_2 and VOC emission estimates from the DEP represent the projected 2002 summertime construction and mining emissions in Bristol County, MA (NO_x - 174.3 tons/day and VOC - 27.4 tons/day). The emissions were estimated by the DEP in the September 2002 *Eastern Massachusetts Supplement to the July 1998 Ozone Attainment State Implementation Plan Submittal*, Appendix 2, Table 1. The CO emissions are based on the average between the DEP estimated wintertime emissions for 1999 (571 tons/day) and the DEP projected 2012 CO emissions (617 tons/day) for the entire state of Massachusetts for non-road engines. These CO emissions were estimated by DEP in an intra-agency policy deliberations background document dated September 2000.

NO_2 oxides of nitrogen
CO carbon monoxide
SO_2 sulfur dioxide
PM_{10} particulate matter less than 10 microns in diameter
$PM_{2.5}$ particulate matter less than 2.5 microns in diameter
VOC volatile organic compounds
lb/day pounds per day

Diesel engine emission standards and mandatory reductions in diesel fuel sulfur content have been adopted that would reduce emissions from heavy duty construction vehicles. However, the diesel sulfur fuel reductions are not required until mid-2006, and the engine emission standards would be implemented in two stages that are not scheduled to be completed until 2007. To decrease emissions in the immediate future, the EPA and DEP have both created voluntary diesel retrofit program to encourage the use of various technologies such as diesel particulate filters and oxidation catalysts. In its comments, the EPA suggested that Weaver's Cove Energy should implement the same controls that were required by the Connecticut DOT for the I-95 New Haven Harbor Crossing Corridor Improvement Program. These controls require all construction equipment with diesel engines greater than or equal to 60 Hp in size that are on the project for more than 30 days to be outfitted with emission control devices (such as oxidation catalysts) and/or use clean fuels. These controls also limit the idling of diesel vehicles to three minutes or less. Weaver's Cove Energy has agreed to abide by the performance standards set forth in the DEP diesel retrofit program which may result in the implementation of similar controls to those used in the New Haven Harbor Crossing Corridor Improvement Program. Because use of low sulfur diesel, diesel particulate filters, and oxidation catalysts have been demonstrated to significantly reduce the SO_2, PM_{10}, CO, and VOC emissions from engines, **we recommend that:**

- **Weaver's Cove Energy use transportation grade (0.05 weight percent sulfur) or better diesel fuel in all construction equipment, including dredging equipment, for the proposed project, evaluate the feasibility of using catalysts and diesel particulate filters on this equipment, and placing idling limits on the construction vehicles to further reduce PM_{10}, CO, and VOC emissions.**

Operation of the LNG terminal would result in air emissions from three sources: LNG ships and tugs, LNG trucks, and stationary equipment (heaters and emergency engines) associated with the LNG facility. The estimated emissions from the LNG ship and tugs during each delivery of cargo are summarized in table 4.11.1-8.

TABLE 4.11.1-8

Estimated Air Emissions from the LNG Ships and Tugs a/

	PM_{10}		SO_2		NO_x		CO		VOC	
Source	lb/delivery	tpy	lb/delivery	tpy	lb/delivery	tpy	lb/delivery	tpy	lb/delivery	tpy
Tugs b/	46	1.3	23	0.7	996	29.9	104	3.2	25	0.7
LNG Ship Arrival, Departure, and Maneuvering c/	7	0.2	75	2.3	29	0.9	12	0.3	2	0.1
LNG Ships While Docked d/	178	5.3	2,213	66.4	451	13.5	25	0.7	29	0.9
Total	231	6.8	2,311	69.4	1,476	44.3	141	4.2	56	1.7

a/ These estimates represent the emissions for the entire delivery process. The emissions included in the applicability of NSR are only the emissions generated while the ships are docked at the terminal.
b/ The tug emissions are representative of new tugs using diesel fuel with 0.05 weight percent sulfur.
c/ These emissions are based on the LNG ships using 75 percent boil-off gas and 25 percent fuel oil (1.5 weight percent sulfur).
d/ The emissions from the LNG ships are based on an estimated fuel oil sulfur content of 1.5 weight percent.
NO_x oxides of nitrogen
CO carbon monoxide
SO_2 sulfur dioxide
PM_{10} particulate matter less than 10 microns in diameter
VOC volatile organic compounds
lb/delivery pounds per LNG ship delivery
tpy tons per year

Ships are anticipated to deliver LNG to the proposed terminal approximately 50 to 70 times per year (each delivery lasting up to 18 to 24 hours). The EPA recommended that the speed of the marine vessels should be reduced to mitigate impacts of marine vessel emissions. The EPA also suggested that the LNG ships should be required to use cleaner fuels, such as LNG boil-off gas, when in transit close to land. The ships used to transport LNG to and from the terminal would be escorted by and under the jurisdiction of the Coast Guard. As such, the Coast Guard, not Weaver's Cove Energy, would dictate the speed of the LNG ships within Mount Hope Bay and the Taunton River. However, the LNG ships would be expected to travel at relatively slow speeds in these areas, averaging about 5 knots in Mount Hope Bay and about 3 knots in the Taunton River. Since the LNG ships would not be dedicated solely to the project, Weaver's Cove Energy does not have the authority or ability to control the fuels burned by the ships at or near the shore. The EPA also requested we evaluate the potential for LNG ships to use electric power during berthing to reduce marine vessel emissions. We do not think this is feasible for safety reasons since the ships would need to keep their equipment running to enable the ship's captain to react quickly in an emergency. The EPA also requested that we evaluate the feasibility of retrofitting tug engines to generate less pollution. Weaver's Cove Energy has indicated that the tugs would either be units currently on order for tug owners/operators or they would be ordered specifically for service at the LNG terminal. For either scenario, the tugs would be subject to the IM MARPOL Annex VI regulation for NO_x emissions and 40 CFR Part 94 of the EPA regulations for criteria pollutant emissions from marine engines. Therefore, the tugs would conform to the highest current standards and would not require any retrofitting. In addition to the MARPOL regulation and 40 CFR 94, EPA issued a final rule in June 2004 to reduce diesel engine emissions from non-road sources such as marine vessels (40 CFR Parts 1039. 1048, 1051, 1065, and 1068). This rule includes a sulfur content limit for locomotive and marine diesel fuel of 500 ppm starting in June 2007 and 15 ppm starting in June 2012. Because the tugs would

not begin operation until at least 2008, the maximum sulfur content in the tug fuel would be 500 ppm (0.05 percent by weight).

Due to the limited number of ships and the short time frame of each visit, marine vessels are only expected to be present a fraction of the time (about 12 percent of the year). Due to the short and infrequent duration of LNG ship presence, the impacts from these vessels are expected to be minimal. In addition, the total emission of SO_2 and NO_x (the primary pollutants generated by the ships) in the regional air basin are expected to decrease as a result of natural gas being used in place of other fossil fuels such as coal and fuel oil. Nevertheless, these emissions have been assessed with the LNG truck and stationary LNG terminal equipment emissions (heaters and emergency engines emissions) discussed below.

It was assumed for the truck traffic that:

- up to twelve trucks would be standing in the queue during peak operating periods with a maximum of 100 trucks being loaded per day;
- the LNG truck loading bays would always be full;
- the estimated loading time would be 1 hour; and
- the estimated number of trucks per year would be 7,000.

The PM_{10} emission rates for the trucks were estimated using the EPA PART5 emission estimation model and the CO and NO_x emissions from the trucks were estimated using the MOBILE6 emissions estimation model. The estimated PM_{10}, SO_2, NO_x, and CO emission rates from PART5 and MOBILE6 (in units of grams per mile and grams per vehicle-hour) were used to assess the ambient air impacts from the truck traffic. The truck traffic emissions were modeled using the mobile source model CAL3QHC.

The emissions from the LNG ships, tugs, and LNG terminal stationary sources (listed in table 4.11.1-3) were modeled using the EPA industrial source complex short term version 3 (ISCST3) modeling program. The heaters and the emergency equipment were modeled in separate model runs because the units would not operate simultaneously. The impacts from the emergency generator and fire pump were similar to or lower than the impacts from the heaters; therefore, the predicted impacts from the heaters were used to assess the impacts of the LNG stationary sources of emissions on air quality. The results of the CAL3QHC and ISCST3 modeling were combined and compared to the applicable NAAQS. These results are summarized in table 4.11.1-9. The modeling results shown in table 4.11.1-9 are based on NO_x emissions of 15 ppm and PM_{10} emissions of 0.01 lb/MMBtu from the heaters. Weaver's Cove Energy has since reduced the proposed NO_x emission limit for the heaters to 9 ppm and the PM_{10} emissions guarantee to 0.00865 lb/MMBtu, resulting in ambient air impacts below the levels shown in table 4.11.1-9. As shown in this table the air emission from the trucks and stationary sources at the proposed LNG terminal would not cause a violation of any ambient air quality standard.

TABLE 4.11.1-9

Potential Air Quality Impacts from Operation of the Proposed LNG Terminal

Pollutant	Averaging Period	Total ISCST3 and CAL3QHC Concentration a/ ($\mu g/m^3$)	Monitored Background Concentration b/ ($\mu g/m^3$)	Total Predicted Concentration c/ ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	Concentrations Relative to Standard (percent)
NO_x	Annual	20.7	45	65.7	100	65.7
SO_2	3-Hour	874	246	1,120	1300	86.2
	24-Hour	149.4	110	259.4	365	71.1
	Annual	3.6	13	16.6	80	20.8
CO	1-Hour	1,176	14,732	15,908	40,000	39.8
	8-Hour	338	5,800	6,138	10,000	61.4
PM_{10}	24-Hour	52.3	91	143.3	150	95.5
	Annual	6.1	32	38.1	50	76.2

a/ The impacts from the LNG truck emissions were estimated based on the increased impact provided by Weaver's Cove Energy in a combined assessment of the LNG terminal heaters and the LNG trucks over the impact estimated from the heaters alone. The impacts from the truck emissions would be minor relative to the heaters and marine vessel emissions.

b/ The background concentrations are based on local monitoring data (see "Existing Air Quality" in section 4.11.1).

c/ The total predicted concentration is the sum of the background concentration and the modeled concentration. This concentration must remain below the applicable NAAQS.

NO_x oxides of nitrogen
CO carbon monoxide
SO_2 sulfur dioxide
PM_{10} particulate matter less than 10 microns in diameter
VOC volatile organic compounds
$\mu g/m^3$ micrograms per cubic meter

During the EIS scoping process, we received comments regarding the potential risk of incidental ingestion, inhalation, or dermal contact with the soils and dredged material on the LNG terminal site. As discussed in section 4.2.2, Weaver's Cove Energy proposes to cover most of the southern parcel with stabilized dredged material. The primary potential for ingestion, inhalation, or dermal contact with this material would be during construction, when dredged material placement and grading activities are in progress. To assess the human risks of these activities, Weaver's Cove Energy conducted a Method 3 Risk Assessment. The assessment, which is discussed in more detail in section 4.2.2, concluded that the proposed activities would pose no risk to workers or citizens on or in the vicinity of the construction site. To minimize the potential for incidental ingestion, inhalation, or dermal contact with the stabilized dredged material, Weaver's Cove Energy would control dust emissions during construction, revegetate exposed soils, and install permanent fencing around the facility following construction.

We also received comments regarding the potential for objectionable odors to be released from the dredged material. The greatest potential for odors would be shortly after the dredged material is brought to the surface and when it is still wet. Weaver's Cove Energy plans to stabilize the dredged material shortly after excavation by mixing with Portland cement. This would significantly reduce any odors emanating from the dredged material (Nimenskern, 2004). If objectionable odors persist after the addition of Portland cement, Weaver's Cove Energy could add lime to the stabilized dredged material for additional odor mitigation. Because the potential for development of objectionable odors is uncertain, and because the dredging program would last for up to three years, **we recommend that:**

- **Weaver's Cove Energy develop a nuisance odor complaint and abatement plan to investigate and address complaints related to odor emissions from the dewatered and stabilized dredged sediments. The plan should include procedures for adjacent landowners to contact a Weaver's Cove Energy representative regarding objectionable odors, a process for investigating and addressing the complaints, and**

a description of mitigative measures that would be implemented to abate the problem. The nuisance odor complaint and abatement plan should be filed with the Secretary prior to construction. In addition, Weaver's Cove Energy should include any odor complaints in the weekly status reports filed with the FERC. The report should include a discussion of how odor complaints were resolved.

Other comment letters expressed concern about the long-term effects of leaks and fumes from the LNG terminal operations. The facility would operate as a closed system and natural gas would not be vented to the atmosphere during normal operations. Natural gas would also not be flared. Furthermore, natural gas is non-toxic and non-carcinogenic.

The odorant (ethyl mercaptan) that would be added to the natural gas would be stored onsite in a closed system that would be filled by tanker truck approximately once every 4 to 8 months. Because this refill rate is much less frequent than a drum or cylinder system, the potential for an accidental release is reduced. The vapors from the storage system would be recycled to the delivery tanker truck during filling operations to eliminate emission to the atmosphere.

4.11.2 Noise

Noise Environment

Project-related noise would affect the local environment during construction of the proposed LNG terminal and pipelines and during operation of the LNG terminal. At any location, both the magnitude and frequency of environmental noise may vary considerably over the course of the day and throughout the week. This variation is caused in part by changing weather conditions and the effects of seasonal vegetative cover. Two measures used by federal agencies to relate the time-varying quality of environmental noise to its known effect on people are the 24-hour equivalent sound level ($L_{eq(24)}$) and the day-night sound level (L_{dn}). The $L_{eq(24)}$ is the level of steady sound with the same total (equivalent) energy as the time-varying sound of interest, averaged over a 24-hour period. The L_{dn} is the average of the daytime sound level (L_{day}) and the nighttime sound level (L_{night}) with 10 decibels of the A-weighted scale (dBA) added to the L_{night}, to account for people's greater sensitivity to sound during nighttime hours. L_{day} is the average sound level from 7 AM to 10 PM. L_{night} is the sound representative of the location between the hours of 10 PM and 7 AM. The Commonwealth of Massachusetts uses the sound level that is exceeded more than 90 percent of the time (L_{90}) to estimate the impact of proposed projects.

In 1974, the EPA published *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*. This publication evaluates the effects of environmental noise with respect to health and safety. The document provides information for state and local governments to use in developing their own ambient noise standards. The EPA has determined that in order to protect the public from activity interference and annoyance outdoors in residential areas, noise levels should not exceed an L_{dn} of 55 dBA. The FERC has adopted this criterion for new compression and associated facilities and it is used here to evaluate the potential noise impact from operation of the LNG terminal. An L_{dn} of 55 dBA is equivalent to a continuous noise level of 48.6 dBA for facilities that operate at a constant level of noise. The DEP regulates noise as an air contaminant under 310 CMR 7.10, which prohibits "unnecessary emissions" of noise. The DEP administers this regulation through Noise Policy DAQC 90-001 dated February 1, 1990. The policy limits a source to a 10-dBA increase in ambient measured L_{90} at the project property line and at the nearest residence. The policy also prohibits "pure tone" conditions in which the sound level at the octave band center frequency exceeds the levels of the two adjacent octave bands by three or more decibels.

Figure 4.11.2-1 shows the topography surrounding the LNG terminal site. The LNG terminal site is relatively flat and bounded by the Taunton River to the west. The topography along the river to the south and north of the LNG terminal site is also relatively flat. Following construction, the topography of LNG terminal site would be similar to current conditions with the exception of an approximately 100-foot-tall landform that would be constructed north and east of the process area.

Existing land uses surrounding the proposed LNG terminal site include a mixture of industrial, transportation, corridor, commercial, open space, and residential uses. There are several noise sensitive areas near the site, including the closest noise sensitive areas (NSAs) listed in table 4.11.2-1 and shown on figure 4.11.2-2.

TABLE 4.11.2-1

Noise Sensitive Areas Near the Proposed LNG Terminal Site

NSA	Distance (feet) and Direction a/	Town/City	Description
NSA 1	1050 South	Fall River	Residence, Border City Mills Apartment Building on Weaver Street, adjacent to Highway 79
NSA 2	1250 East	Fall River	Residence on Alton Road
NSA 3	2000 Southeast	Fall River	Residence, Highlander Nursing and Rehabilitation Center
NSA 4	3250 East	Fall River	Residence on Bradley Court
NSA 5	2600 Northeast	Fall River	Residence on North Main Street
NSA 6	2400 Northwest	Somerset	Residence on Riverside Avenue
NSA 7	3000 Southwest	Somerset	Residence on Owen Avenue
NSA 8	1950 East	Fall River	Wiley Elementary School

a/ Distance and direction is relative to the center of the proposed LNG storage tank
NSA Noise sensitive area

An ambient sound survey of existing noise levels at the NSAs was conducted between September 5 and 9, 2002. The purpose of the sound survey was to document the existing acoustical environment at the NSAs prior to operation of the LNG terminal. This noise study included short-term and long-term noise measurements. Short-term weekday and weekend noise measurements were made during daytime and nighttime hours for a duration of 20 minutes. The short-term noise measurements were taken at each NSA location on Thursday, September 5 between 12:30 PM and 4:00 PM (weekday - daytime), on Saturday, September 7 between 10:45 AM and 2:30 PM (weekend - daytime), on Friday, September 6, 2003 between 12:00 AM and 3:15 AM (weekday - nighttime), and Saturday, September 7, 2003 between 12:00 AM and 3:15 AM (weekend - nighttime). Long term noise measurements were taken at NSAs 1, 2, and 3 from noon on Thursday, September 5 until noon Monday, September 9.

Insert Figure

4.11.2-1 Area Topographic Map

Insert Figure

4.11.2-2 Noise Sensitive Areas

Because noise impacts are most significant when existing background noise is lowest, the lowest noise levels measured for each location were used to assess the ambient noise impact of the project. The lowest L_{dn} calculated for the three 24-hour periods (midnight to midnight) at each continuous noise monitor was used to estimate the L_{dn} for other NSAs.[21] Based on noise data and the types of noise sources surrounding the various NSAs, the L_{dn} measured at NSA 1 was used as the existing L_{dn} for NSAs 6, and 7, the L_{dn} measured at NSA 2 was used as the existing L_{dn} for NSAs 5 and 8, and the L_{dn} measured at NSA 3 was used as the existing L_{dn} for NSA 4. The L_{90} calculated from the short-term noise measurements for NSA 1, NSA 2, and NSA 3 were compared to the L_{90} calculated for the continuous (long-term) noise measurements at these locations to validate the use of the short-term measurements for demonstrating compliance with the DEP noise regulation. The short-term noise measurements compared well with the continuous noise measurements; therefore, the short-term noise measurements were included in determining the representative L_{90} for each NSA. The L_{90} and L_{dn} values established by the noise study are summarized in table 4.11.2-2.

TABLE 4.11.2-2

Existing Noise Levels at the Closest Noise Sensitive Areas (dBA)

Location	L_{90}	L_{day}	L_{night}	L_{dn}
NSA 1	43	54.9	51.1	58.3
NSA 2	41	60.3	56.9	64.0
NSA 3	47	53.6	51.7	58.4
NSA 4	39	53.6	51.7	58.4
NSA 5	42	60.3	56.9	64.0
NSA 6	43	54.9	51.1	58.3
NSA 7	39	54.9	51.1	58.3
NSA 8	51 a/	60.3	56.9	64.0

a/ L_{90} at NSA 8 (Wiley Elementary School) is based on the lowest daytime noise measurement at NSA 2
dBA decibels of the A-weighted scale
L_{eq} 24-hour equivalent sound level
L_{day} daytime sound level
L_{night} nighttime sound level
L_{dn} day-night sound level

Noise Impacts and Mitigation

Construction of the LNG facilities would occur over a 3-year period. Construction of the LNG terminal, dredging, and dredged material reuse would take place during the entire construction period. The construction of the ship unloading facility would take approximately 12 months and would occur in the middle of the project schedule. Construction of the pipelines, including the Taunton River crossing, would take approximately 10 months at the end of the construction period. The noise associated with these construction activities would be intermittent, as equipment would be operated on an as-needed basis. Construction activities at the LNG terminal and also along the pipeline routes would generate short-term increases in sound levels predominately during daylight hours, when the most significant construction activities would occur. The most prevalent sound source would be the internal combustion engines on the construction equipment. Some of the equipment would be electric powered, reducing the total noise from construction equipment. The maximum noise levels from the impact pile-driving at the nearest residence (1,250 feet away) would be approximately 76 dBA at the higher force. Pile-driving

[21] Weaver's Cove Energy estimated the L_{dn} for the five NSAs where 24-hour monitoring was not conducted by comparing the short-term monitoring data collected at these sites to the long-term continuous monitoring data that was collected for NSAs 1, 2, and 3. Weaver's Cove Energy then selected the noise level at NSAs 1,2, or 3 that was most representative of the short-term monitoring result collected at the five NSAs.

activities would be restricted to daytime hours to prevent nighttime noise impacts. The estimated noise levels generated by other construction equipment are provided in table 4.11.2-3.

TABLE 4.11.2-3

Noise Levels from Various Construction Equipment/Activities

Equipment/Activity	Noise Level (dBA) at 50 feet
Backhoe a/	82
Mobile Crane a/	81
Truck a/	80
Generator a/	79
Clamshell dredge b/	67 at 250 feet
Tugs b/	82

a/ Noise level data are based on BBN, 1977
b/ Noise levels based noise estimates from the May 1998 Final Environmental Impact Statement/Environmental Impact Report and Final Feasibility Study prepared by the Port of Oakland and the U.S. Army Corps of Engineers for the Oakland Harbor Navigation Improvement (50-foot) Project
dBA decibels of the A-weighted scale

Dredging and dredge stabilization would occur up to 24 hours per day for the entire 3-year construction period. Dredging would include the use of tugs and excavators while dredged material offloading and stabilization would include conveyors, a pug mill, and two hydraulic excavators. The estimated noise impact from the dredged material offloading and stabilization would be 67 dBA at the nearest residence in Fall River (875 feet away) and 59 dBA at the nearest residence in Somerset (2,250 feet away). This equates to nighttime noise level increases of 16.0 dBA at the nearest residence in Fall River and 8.6 dBA at the nearest residence in Somerset. These noise estimates do not include any reductions from the earthen berm and landform that would be constructed onsite. This berm and landform would be expected to provide a minimum noise reduction of about 10 dBA at noise receptors east of the terminal site. The noise reduction would be dependent on the size and location of the landform relative to the noise receptor and the construction activity. The landform would require approximately 24 months of development before it could sufficiently reduce noise. Therefore, Weaver's Cove Energy may install temporary noise barriers or other mitigation until such time as the landform is sufficient to effectively reduce noise if it is determined that this noise mitigation is necessary to comply with the FERC noise standard of 55 dBA L_{dn}. The dredging equipment would be moving periodically; however, the most significant period of time at any one general location would be in the turning basin. The dredging equipment operating in the turning basin would be located as close as 650 feet from residences in Somerset and 1,300 feet from residences in Fall River. Using the noise levels in table 4.11.2-3, we performed an analysis to estimate the maximum noise impact from dredging operations (assuming one dredge and one tug). Based on this analysis, we estimate the maximum noise level attributable to the dredging equipment would be 62.3 dBA at the nearest residence in Somerset and 56.2 dBA at the nearest residence in Fall River. This equates to nighttime noise increases of 11.5 dBA and 6.3 dBA at the nearest residents in Somerset and Fall River, respectively. Because the dredging and dredged material stabilization activities would potentially exceed 55 dBA L_{dn} at the nearest NSA and would potentially occur 24 hours per day for approximately 3 years, **we recommend that:**

- **Weaver's Cove Energy prepare a noise mitigation plan to ensure that the dredging, offloading, and stabilization operations do not contribute more than 55 dBA L_{dn} to the ambient noise level at any noise sensitive area and file the plan with the Secretary <u>prior to construction</u>.**

Construction of the proposed pipelines would require operating construction equipment close to residential areas. These pipeline construction activities would occur during daylight hours, six days per week. Pipeline construction is like having an assembly line, with crews conducting separate but sequential activities, each generally proceeding at rates ranging from several hundred feet to a mile per day. Depending on the distance between each crew in the assembly line, construction activities in any one area could last from several weeks to several months on an intermittent basis. On some portions of the pipeline routes, the stovepipe technique would be used to install the pipelines (see section 2.4.2.2). This technique would result in more intense construction activities for a shorter period in select areas. While receptors in the immediate vicinity of the construction activities would experience an increase in noise, this effect would be temporary and local. Nighttime noise would not be expected to increase because pipeline construction activities would be limited to daytime hours except under special circumstances where additional time is required to complete an activity to minimize a safety hazard prior to leaving the site for the day. The average noise level generated by the construction equipment that would be used for pipeline construction activities ranges between about 79 and 82 dBA at a distance of 50 feet. The noise from construction activities would be dominated by the loudest piece of equipment. The closest residence is approximately 15 feet from the proposed pipeline centerline. Conservatively assuming an average noise level of 82 dBA at 50 feet, the maximum noise level at this residence would be approximately 92.5 dBA. A 92.5 dBA noise level for eight hours a day is equivalent to an L_{dn} of 87.7 dBA. Because noise levels diminish rapidly with distance, this noise level would be of limited duration and would decrease significantly as the construction equipment moves away from the residence.

Stationary equipment and mobile sources would generate noise during operation of the proposed LNG terminal. About 50 trucks per day would load LNG at the LNG terminal. Because these trucks would arrive and depart via Route 79, this additional traffic would have minimal impact on the ambient noise levels. The stationary noise generating equipment at the LNG terminal would include pumps, compressors, motors, heaters, and fans. The predominant stationary noise source would be the four operating LNG sendout pumps. Frequency-specific data were not available from the prospective equipment manufacturers; therefore, expected sound power levels were calculated from the literature using the expected size or capacity of the equipment (Hoover & Keith, 1981). The expected noise levels for each stationary source and the sound transmission losses for the proposed control measures are listed in table 4.11.2-4.

All of the noise generating equipment at the proposed LNG terminal would be located inside an insulated metal enclosure except the LNG sendout pumps, water cooler fans, and air injection system cooling fans. In addition to the insulated enclosure, an earthen landform is proposed for the east side of the site. The landform would be at least 40 to 50 feet taller than the top of any on site noise source and, therefore, would reduce the level of direct noise experienced at the nearby NSAs.

Noise impacts were estimated using spreadsheet-based calculations. The reference sound power level data were decreased with distance from the source to the receptor through geometric spreading and atmospheric absorption. The calculations include anticipated noise reduction from the enclosure and the landform. The results of this analysis are summarized in table 4.11.2-5.

The maximum predicted L_{dn} and L_{90} that would result from operation of the LNG facilities would be 40 and 46.4 dBA, respectively, and would occur at NSA 6. In addition, the predicted L_{dn} and L_{90} increases would be no more than 0.3 and 1.8 dBA, respectively, at any noise sensitive area. The noise level attributable to the proposed LNG terminal would be less than 55 dBA L_{dn} (i.e., the FERC noise criterion) at all NSAs and the estimated future increase would be less than 10 dBA L_{90} (i.e., the DEP noise criterion) at all NSAs. The proposed LNG terminal would not generate pure tones which are sounds that can be heard as a single pitch. Because the proposed LNG terminal and pipelines do not include the addition of new compressors, a perceptible increase in vibration at any NSA is not anticipated under normal operating conditions.

TABLE 4.11.2-4

Anticipated Noise Levels (dBA) and Sound Transmission Losses at the Proposed LNG Terminal

Equipment	Quantity	Total (dBA)	Octave Band Frequency (Hertz) 31	63	125	250	500	1,000	2,000	4,000	8,000
LNG sendout pumps	4	109	98	99	100	102	102	105	102	98	92
BOG screw compressors a/	3	86	82	84	84	92	85	77	68	59	53
BOG pipeline compressor a/	1	81	87	88	85	83	80	75	68	60	51
Water heater circ. Pumps a/	12	80	89	86	83	81	77	76	69	61	51
Water heaters with blower a/	12	93	112	108	103	97	90	83	76	69	62
Water cooler fans	2	92	103	103	103	93	86	86	81	76	71
Water pump (BOG cool) a/	1	65	74	71	68	66	62	61	54	46	36
Instrument air compressor a/	1	76	92	83	79	74	73	72	68	62	55
Air injection compressors (centrifugal) a/	2	86	98	95	92	89	82	80	76	68	57
Air injection compressors (reciprocating) a/	2	86	91	92	89	88	85	80	73	65	56
Air injection cooling fans	12	100	111	111	111	101	94	94	89	84	79
Air injection cooling pump a/	1	66	76	73	70	68	64	63	56	48	38

a/ These noise sources would be located in an insulated metal building. The noise level data shown above includes the reduction in noise from the insulated building and are representative of the noise level approximately 1.3 feet from the source.

BOG = Boil-off-Gas

TABLE 4.11.2-5

Estimated Noise Impact from Proposed LNG Terminal

NSA	Distance to NSA (feet) a/	Existing Noise Level (dBA) L_{90}	Existing Noise Level (dBA) L_{dn}	Level Attributable to Project (dBA) L_{90}	Level Attributable to Project (dBA) L_{dn}	Total L_{dn} (dBA)	Future Increase (dBA) L_{90}	Future Increase (dBA) L_{dn}
NSA 1	1,050	43	58.3	36	42.4	58.4	0.8	0.1
NSA 2	1,250	41	64.0	27	33.4	64.0	0.2	0.0
NSA 3	2,000	47	58.4	33	39.4	58.5	0.2	0.1
NSA 4	3,250	39	58.4	25	31.4	58.4	0.2	0.0
NSA 5	2,600	42	64.0	21	27.4	64.0	0.0	0.0
NSA 6	2,400	43	58.3	40	46.4	58.6	1.8	0.3
NSA 7	3,000	39	58.3	29	35.4	58.3	0.4	0.0
NSA 8	1,950	51	64.0	24	30.4	64.0	0.0	0.0

a/ Measured from the center of the LNG storage tank to the NSA
NSA noise sensitive area
dBA decibels of the A-weighted scale
L_{90} noise level that is exceeded 90 percent of the time
L_{dn} day night sound level

Because the noise analysis is based on preliminary design, and to ensure that the proposed LNG terminal operates in compliance with these guidelines, **we recommend that:**

- **Weaver's Cove Energy should make all reasonable efforts to assure its predicted noise levels from the LNG terminal are not exceeded at the NSAs and file noise surveys showing this with the Secretary no later than 60 days after placing the LNG terminal in service. However, if the noise attributable to the operation of the LNG terminal exceeds 55 dBA L_{dn} at an NSA or the noise increase exceeds 10 dBA L_{90} at an NSA, Weaver's Cove Energy should file a report on what changes are needed and should install additional noise controls to meet the level within 1 year of the in-service date. Weaver's Cove Energy should confirm compliance with these requirements by filing a second noise survey with the Secretary no later than 60 days after it installs the additional noise controls.**

4.12 RELIABILITY AND SAFETY

Three federal agencies share in the oversight of the safety and security of LNG import terminals: the Coast Guard, the Pipeline and Hazardous Materials Safety Administration of the DOT, and the FERC. The FERC authorizes the siting and construction of LNG import terminals and is the lead federal agency under NEPA to analyze the environmental, safety, security, and cryogenic design of proposed facilities. The Coast Guard has authority over the safety of LNG vessels and the marine transfer area. The Coast Guard also has authority over the security of the LNG vessels and the entire LNG facility. The DOT has exclusive authority to promulgate and enforce safety regulations and standards over the onshore LNG facilities beginning at the last valve immediately before the LNG storage tank(s).

In February 2004, the three participating agencies entered into an Interagency Agreement to assure that they work in a coordinated manner to address the full range of issues regarding safety and security at LNG import terminals, including the terminal facilities and tanker operations, and to maximize the exchange of information related to the safety and security aspects of the LNG facilities and related marine operations. The Interagency Agreement ensures a seamless safety and security review by the three federal agencies.

The operation of the proposed LNG terminal poses a potential hazard that could affect the public safety without strict design and operational measures to control potential accidents. The primary concerns are those events that could lead to an LNG spill of sufficient magnitude to create an offsite hazard. However, it is also important to recognize the stringent requirements for the design, construction, operation and maintenance of the facility as well as the extensive safety systems to detect and control potential hazards.

With the exception of the October 20, 1944 fire at the LNG facility in Cleveland, Ohio, the operating history of U.S. LNG facilities has been free of LNG safety-related incidents resulting in adverse effects to the public or the environment.[22] More recently, an operational accident occurred in 1979 at the Cove Point LNG facility in Lusby, Maryland, when a pump seal failed, resulting in gas vapors entering an electrical conduit and settling in a confined space. When a worker switched off a circuit breaker, the gas ignited, resulting in heavy damage to the building and a worker fatality. Lessons learned from this accident resulted in changing the national fire codes, with the participation of the FERC, to ensure that the situation would not occur again. The proposed facilities would be designed, constructed, and operated in compliance with these codes.

On January 19, 2004, a blast occurred at Sonatrach's Skikda, Algeria LNG liquefaction facility that killed 27 and injured 56 workers. No members of the public were injured. Preliminary findings of the accident investigation suggest that a cold hydrocarbon leak occurred at Liquefaction Train 40 and was introduced to the high-pressure steam boiler by the combustion air fan. An explosion developed inside the boiler fire box which subsequently triggered a larger explosion of the hydrocarbon vapors in the immediate vicinity. The resulting fire damaged the adjacent liquefaction process and LPG separation equipment of Train 40, and spread to Trains 20 and 30. Although Trains 10, 20, and 30 had been modernized in 1998-1999, Train 40 had been operating with its original equipment since start-up in 1981.

Although there are major differences between the equipment involved in the accident and that of the proposal (i.e., high-pressure steam boilers that power refrigerant compressors would not be used here

[22] For a description of the incident and the findings of the investigation, see "U.S. Bureau of Mines, Report on the Investigation of the Fire at the Liquefaction, Storage, and Regasification Plant of the East Ohio Gas Co., Cleveland, Ohio, October 20, 1944, February 1946."

nor are they used at any LNG facility under FERC jurisdiction), the sequence of cascading events identifies potential failure modes that warrant further evaluation. This issue was discussed at the May 5, 2004 cryogenic design and technical review conference conducted in Swansea, Massachusetts, and Weaver's Cove Energy indicated that gas detectors would need to be installed at air intakes. To ensure that all potential hazards are addressed, we have provided a recommendation in section 4.12.2, *Cryogenic Design and Technical Review*, to address this issue.

A discussion of the principal properties and hazards associated with LNG is presented in section 4.12.1. A summary of our preliminary design and technical review of the cryogenic aspects of the LNG terminal is presented in section 4.12.2. Storage and retention systems are discussed in section 4.12.3. An analysis of the thermal radiation and flammable vapor cloud hazards resulting from a credible land-based LNG spill is presented in section 4.12.4, while the safety aspects of LNG transportation by ship are summarized and discussed in section 4.12.5. LNG truck safety issues are examined in section 4.12.6. A discussion on security awareness related to terrorism is presented in section 4.12.7. The reliability and safety issues related to the natural gas pipelines are discussed in section 4.12.8. Additional safety issues identified in scoping are addressed in section 4.12.9. Conclusions on safety issues are in section 4.12.10.

4.12.1 LNG Hazards

LNG's principal hazards result from its cryogenic temperature (-260° F), flammability, and vapor dispersion characteristics. As a liquid, LNG will neither burn nor explode. Although it can cause freeze burns and, depending on the length of exposure, more serious injury, its extremely cold state does not present a significant hazard to the public, which rarely, if ever, comes in contact with it as a liquid. As a cryogenic liquid, LNG will quickly cool materials it contacts, causing extreme thermal stress in materials not specifically designed for ultra cold conditions. Such thermal stresses could subsequently subject the material to brittleness, fracture, or other loss of tensile strength. These hazards, however, are not substantially different from hazards associated with the storage and transportation of liquid oxygen (-296° F) or several other cryogenic gases that are routinely produced and transported in the United States.

Methane, the primary component of LNG, is colorless, odorless and tasteless, and is classified as a simple asphyxiant. Methane could, however, cause extreme health hazards, including death, if inhaled in significant quantities within a limited time. At very cold temperatures, methane vapors could cause freeze burns. Asphyxiation, like freezing, normally represents a negligible risk to the public from LNG facilities.

When released from its containment vessel and/or transfer system, LNG will first produce a vapor or gas. This vapor, if ignited, represents the primary hazard to the public. LNG vaporizes rapidly when exposed to ambient heat sources such as water or soil, producing 620 to 630 standard cubic feet of natural gas for each cubic foot of liquid. LNG vapors in a 5 to 15 percent mixture with air are highly flammable. The amount of flammable vapor produced per unit of time depends on factors such as wind conditions, the amount of LNG spilled, and whether it is spilled on water or land. Depending on the amount spilled, LNG may form a liquid pool that will spread unless contained by a dike.

Once a flammable vapor-air mixture from an LNG spill has been ignited, the flame front will propagate back to the spill site if the vapor concentration along this path is sufficiently high to support the combustion process. An unconfined methane-air mixture will burn slowly, tending to ignite combustible materials within the vapor cloud, whereas fast flame speeds tend to produce flash burns rather than self-sustaining ignition.

LNG is not explosive as it is normally transported and stored. However, LNG vapors (primarily methane) can explode if contained within a confined space, such as a building or structure, and ignited.

There is no evidence, however, suggesting that LNG is explosive in unconfined open areas. Experiments to determine if unconfined methane-air mixtures will explode have been conducted and, to date, have all been negative. Unconfined methane-air mixtures will burn but will not explode. Nevertheless, a number of experimental programs have been conducted to determine the "amount of initiator charge" required to detonate an unconfined methane-air mixture.

Over the years, various parties have occasionally expressed the energy content of an LNG storage tank or LNG ship in equivalent tons of trinitrotoluene (TNT), as an implied measure of its explosive potential. However, such a simplistic analogy fails to consider that explosive forces are not just a function of the total energy content but also of the rate of energy release. For an explosion to occur, the rate of energy release must be nearly instantaneous, such as with a TNT charge initiated by a blasting cap. Unlike TNT or other explosives which inherently contain an oxidizer, an unconfined vapor cloud must be mixed with oxygen within the flammability range of the fuel for combustion to occur. For a large unconfined vapor cloud, the flammability range tends to exist at the mixing zone at the edges of the cloud. When ignited, flame speeds of about 20 to 25 meters per second (66 to 82 ft/sec) and local over pressures up to 0.2 psig have been estimated for methane rich fuels, well below the flame speeds and over pressures associated with explosion.

A rapid phase transition (RPT) can occur when a portion of LNG spilled onto water changes from liquid to gas, virtually instantaneously. Unlike an explosion that releases energy and combustion products from a chemical reaction as described above, an RPT is the result of heat transferred to the liquid, inducing a change to the vapor state. The rapid expansion from the liquid to vapor state can cause locally large overpressures. RPTs have been observed during LNG test spills onto water. In some test cases, the overpressures generated were strong enough to damage test equipment in the immediate vicinity of the LNG release point. The sizes of the overpressure events have been generally small, and are estimated to be equivalent to several pounds of TNT. Such a small overpressure is not expected to cause significant damage to an LNG vessel. However, the RPT may increase the rate of LNG pool spreading and the LNG vaporization rate.

4.12.2 Cryogenic Design and Technical Review

The cryogenic design and technical review emphasizes the engineering design and safety concepts and the projected operational reliability of the proposed facilities. The principle areas of coverage include: materials in cryogenic environments; insulation systems; cryogenic safety; thermodynamics; heat transfer; instrumentation; cryogenic processes; and other relevant safety systems.

Study and evaluation of information for the proposed design and installation of the LNG terminal at Fall River, Massachusetts has been performed by FERC staff. The design and specifications submitted for the proposed facility are considered to be preliminary but would be the basis for any detailed design to follow. A significant amount of the basic design involving final selection of equipment manufacturers, process conditions and safety related issues will be completed in the next phase of project development if authorization is granted by the Commission.

The facility would be located on a relatively small site and Weaver's Cove Energy proposes to use a full containment LNG storage system to minimize the land area required for storage and spill containment. The protection of the external wall of a full containment storage system could significantly enhance the safety of the product in the event of a credible attack on the facility. The proposed layout of the facility, design features of the process systems, including operating control, safe shut down, monitoring and spill containment, are consistent with the requirements of the proposed installation. Appropriate emphasis has been placed on aspects of reliability, operational ability, and security of the proposed facility.

As a result of the technical review of the information provided by Weaver's Cove Energy in the submittal documents, a number of concerns were raised by staff relating to reliability, operability, and safety of the facility. In response to staff's questions, Weaver's Cove Energy provided written answers prior to the site visit and technical review meeting. Outstanding issues that require resolution are listed below as specific recommendations. Follow up on those items requiring additional action shall be documented in reports to be filed with the FERC.

We recommend that the following measures should apply to the LNG terminal design and construction details. Information pertaining to these specific recommendations should be filed with the Secretary for review and approval by the Director of OEP either: prior to initial site preparation; prior to construction of final design; prior to commissioning; or prior to commencement of service. This information should be submitted a minimum of 30 days before approval to proceed is required.

- **Weaver's Cove Energy should provide a technical review of its facility design that:**

  a. Identifies all combustion/ventilation air intake equipment and the distance(s) to any possible hydrocarbon release (LNG, flammable refrigerants, flammable liquids, and flammable gases).

  b. Demonstrates that these areas would be adequately covered by hazard detection devices and indicate how these devices would isolate or shutdown any combustion equipment whose continued operation could add to or sustain an emergency. Fired heaters should be shut down in the event of an LNG spill, or presence of a flammable vapor cloud.

Weaver's Cove Energy should file this review <u>prior to initial site preparation</u>.

- **Prior <u>to initial site preparation</u>, Weaver's Cove Energy should provide documentation, or a limited waiver, on how the LNG tank would meet NFPA 59A table 2-2.4.1, which requires the distance from the edge of the impoundment to the property line, to be not less than 0.7 times the container diameter. The separation distance from the LNG tank impoundment wall to the property boundaries on the southwestern area of the site where the proposed plant property line abuts the shoreline of the Taunton River does not appear to meet the 0.7 criteria.**

- **<u>Prior to initial site preparation</u>, Weaver's Cove Energy should file a firewater system design that provides for fire water flow to be maintained for a minimum of two hours, in accordance with code requirements. The fire water tank should be automatically filled from the city mains supply and the city mains pressure should be continuously monitored. The fire tank should include an alarm to indicate low pressure. As an alternative, river water may be evaluated for use in the firewater system.**

- **The portion of the planned retaining wall on the riverbank, which is opposite the tanks, shall be designed to ensure the stability of the LNG storage tank in a SSE event. A slope stability analysis shall be conducted in order to ascertain the adequacy of the proposed retaining wall structures. The LNG tank shall be designed to withstand the SSE event as required by 49 CFR Part 193 and NFPA 59A (2001). All other structures shall be designed to withstand the effects of an**

Operating Basis Earthquake, as required by 49 CFR Part 193 and NFPA 59A (2001), and, further, the condition of these structures shall not adversely affect the stability and integrity of the tank in the SSE event. <u>Prior to initial site preparation</u>, Weaver's Cove Energy should file the results of the hydraulic test and stone column field test, and the final LNG storage tank design for seismic review and approval by the Director of OEP.

- **The final design should include a re-evaluation of the use of butterfly valves for high pressure isolation.**

- **The final design of the hazard detection equipment should include redundancy and fault detection and fault alarm monitoring in all potentially hazardous areas and enclosures.**

- **The final design of the hazard detection equipment should provide flammable gas and UV/IR hazard detectors with local instrument status indication as an additional safety feature.**

- **The final design should include a boiloff gas flow measurement system for the LNG storage tank.**

- **The final design should include a reliable measurement system to monitor deflections during the hydraulic test. At a minimum, this system should include two slope indicator ducts which bisect the tank in mutually perpendicular directions, monitoring points at the terminals of these ducts, and other monitoring points along the perimeter of the concrete shell, so that sag, warping, tilt, and settlement can be monitored. Tolerances for sag, tilt, and shell warping should meet or exceed the limits specified by the tank manufacturer.**

- **The final design of the LNG tank carbon steel piping support plates and connections to piping supports should provide adequate corrosion protection. Provisions for corrosion monitoring and maintenance of carbon steel attachments should be included in the design and maintenance procedures.**

- **The final design of the LNG pumps should include discharge flow measurement for minimum flow recycle control.**

- **The final design should include provisions to ensure that hot glycol/water circulation is operable at all times when LNG is present in the LNG booster pump discharge piping or when the temperature in the LNG inlet channel to any vaporizer is below 0°F.**

- **The final design should include detection instrumentation and shut down procedures for vaporizer tube leak, shell side overpressure, or bursting disc failure.**

- **The final design should include temperature measurement of the vaporizer common discharge header, which should alarm the low temperature condition.**

- **The final design should include provisions to recover boil-off gas, under all conditions, in the event that the send out vaporization system is not in operation.**

- **The final design should include automatic isolation valves at the suction and discharge of screw compressors and reciprocating boil-off compressors.**

- **The final design should ensure that air gaps are installed downstream of all seals or isolations installed at the interface between a flammable fluid system and an electrical conduit or wiring system. Each air gap should vent to a safe location and be equipped with a leak detection device that: would continuously monitor for the presence of a flammable fluid; would alarm the hazardous condition; and would shutdown the appropriate systems.**

- **The final design of the relief vent stacks should include Resistance Temperature Detectors capable of measuring low and high temperature.**

- **The final design should ensure that dry nitrogen be supplied for purging cold systems.**

- **The final design should include safeguards to protect above ground fire water piping, including post indicator valves, from inadvertent damage.**

- **The final design should include a fire protection evaluation carried out in accordance with the requirements of NFPA 59A, chapter 9.1.2.**

- **The final design should include procedures for offsite contractors' responsibilities, restrictions, limitations, and supervision of the contractors by Weaver's Cove Energy staff.**

- **Security personnel requirements prior to and during LNG vessel unloading should be filed <u>prior to commissioning</u>.**

- **Operation and Maintenance procedures and manuals, as well as emergency plans, emergency evacuation plan and safety procedure manuals, should be filed <u>prior to commissioning</u>.**

- **The contingency plan for failure of the outer LNG tank containment should be filed <u>prior to commissioning</u>.**

- **Copies of the U.S. Coast Guard security plan, vessel operation plan, and emergency response plan should be provided to FERC staff <u>prior to commissioning</u>.**

- **A copy of the criteria for horizontal and rotational movement of the inner vessel for use during and after cool down should be filed <u>prior to commissioning</u>.**

- **The FERC staff should be notified of any proposed revisions to the security plan and physical security of the facility <u>prior to commencement of service</u>.**

- **Progress on the construction of the LNG terminal should be reported in monthly reports filed with the Secretary. Details should include a summary of activities, problems encountered, and remedial actions taken. Problems of significant magnitude should be reported to the FERC within 24 hours.**

In addition, **we recommend that the following measures should apply throughout the life of the facility:**

- **The facility should be subject to regular FERC staff technical reviews and site inspections on at least a biennial basis or more frequently as circumstances indicate. Prior to each FERC staff technical review and site inspection, Weaver's Cove Energy should respond to a specific data request including information relating to possible design and operating conditions that may have been imposed by other agencies or organizations. Up-to-date detailed piping and instrumentation diagrams reflecting facility modifications and provision of other pertinent information not included in the semi-annual reports described below, including facility events that have taken place since the previously submitted annual report, should be submitted.**

- **Semi-annual operational reports should be filed with the Secretary to identify changes in facility design and operating conditions, abnormal operating experiences, activities (including ship arrivals, quantity and composition of imported LNG, vaporization quantities, boil-off/flash gas, etc.), plant modifications including future plans and progress thereof. Abnormalities should include, but not be limited to: unloading/shipping problems, potential hazardous conditions from offsite vessels, storage tank stratification or rollover, geysering, storage tank pressure excursions, cold spots on the storage tanks, storage tank vibrations and/or vibrations in associated cryogenic piping, storage tank settlement, significant equipment or instrumentation malfunctions or failures, non-scheduled maintenance or repair (and reasons therefore), relative movement of storage tank inner vessels, vapor or liquid releases, fires involving natural gas and/or from other sources, negative pressure (vacuum) within a storage tank and higher than predicted boil-off rates. Adverse weather conditions and the effect on the facility also should be reported. Reports should be submitted within 45 days after each period ending June 30 and December 31.**

- **In addition to the above items, a section entitled "Significant plant modifications proposed for the next 12 months (dates)" also should be included in the semi-annual operational reports. Such information would provide the FERC staff with early notice of anticipated future construction/maintenance projects at the LNG facility.**

- **In the event the temperature of any region of any secondary containment, including imbedded pipe supports, becomes less than the minimum specified operating temperature for the material, the Commission should be notified within 24 hours and procedures for corrective action should be specified.**

- **A foundation elevation survey of the LNG tank should be made on an annual basis.**

- **Significant non-scheduled events, including safety-related incidents (i.e., LNG or natural gas releases, fires, explosions, mechanical failures, unusual overpressurization, and major injuries) and security-related incidents (i.e., attempts to enter site, suspicious activities) should be reported to FERC staff within 24 hours. In the event an abnormality is of significant magnitude to threaten public or employee safety, cause significant property damage, or interrupt service, notification should be made immediately, without unduly interfering with any**

necessary or appropriate emergency repair, alarm, or other emergency procedure. This notification practice should be incorporated into the LNG facility's emergency plan. Examples of reportable LNG-related incidents include:

a. fire;

b. explosion;

c. estimated property damage of $50,000 or more;

d. death or personal injury necessitating in-patient hospitalization;

e. free flow of LNG for five minutes or more that results in pooling;

f. unintended movement or abnormal loading by environmental causes, such as an earthquake, landslide, or flood, that impairs the serviceability, structural integrity, or reliability of an LNG facility that contains, controls, or processes gas or LNG;

g. any crack or other material defect that impairs the structural integrity or reliability of an LNG facility that contains, controls, or processes gas or LNG;

h. any malfunction or operating error that causes the pressure of a pipeline or LNG facility that contains or processes gas or LNG to rise above its maximum allowable operating pressure (or working pressure for LNG facilities) plus the build-up allowed for operation of pressure limiting or control devices;

i. a leak in an LNG facility that contains or processes gas or LNG that constitutes an emergency;

j. inner tank leakage, ineffective insulation, or frost heave that impairs the structural integrity of an LNG storage tank;

k. any safety-related condition that could lead to an imminent hazard and cause (either directly or indirectly by remedial action of the operator), for purposes other than abandonment, a 20 percent reduction in operating pressure or shutdown of operation of a pipeline or an LNG facility that contains or processes gas or LNG;

l. safety-related incidents to LNG vessels occurring at or en route to and from the LNG facility; or

m. an event that is significant in the judgment of the operator and/or management even though it did not meet the above criteria or the guidelines set forth in an LNG facility's incident management plan.

In the event of an incident, the Director of OEP has delegated authority to take whatever steps are necessary to ensure operational reliability and to protect human life, health, property or the environment, including authority to direct the LNG

facility to cease operations. Following the initial company notification, FERC staff would determine the need for a separate follow-up report or follow-up in the upcoming semi-annual operational report. All company follow-up reports should include investigation results and recommendations to minimize a reoccurrence of the incident.

LNG tank siting must be in compliance with NFPA 59A table 2.2.4.1, which requires that the impoundment for tanks larger than 70,000 gallons be located at least 0.7 times the container diameter from buildings and property lines. The separation distance between the outer wall of the proposed LNG storage tank and the property line abutting the Taunton River does not appear to meet this requirement.

In response to recommendation 32 in the draft EIS, Weaver's Cove Energy submitted that its proposed tank location meets the underlying intent of the requirement. NFPA 59A section 2.2.4.1 states that the minimum separation distance between LNG containers and "exposures" shall be in accordance with table 2.2.4.1. NFPA-1 and NFPA-30 define "protection for exposures" as being protection for "structures on property adjacent to liquid storage." Since the adjacent property in question is a river, Weaver's Cove Energy notes that this property cannot contain any permanent structures within 0.7 container diameter of the LNG container impoundment. On September 20, 2004, Weaver's Cove Energy requested that the DOT grant it a limited waiver from the requirement in NFPA 59A section 2.2.4.1, which is incorporated by reference in 40 CFR 193.2051.

4.12.3 Storage and Retention Systems

LNG storage tanks come in a variety of categories. The following are descriptions of the tank designs most commonly used worldwide:

- Single containment cylindrical metal tanks (predominately used in the United States);
- Spherical storage tanks (predominately used in LNG carriers);
- Double containment cylindrical metal inner tank and metal or concrete outer tank (commonly thought of as an LNG tank with a high wall dike);
- Full containment cylindrical metal inner tank and metal or concrete outer tank (Cameron/Hackberry was the first project proposing this design in the United States; Freeport LNG was the second; and currently, numerous LNG projects are proposing this type of tank design);
- Prestressed cylindrical concrete tank with an internal metal membrane (membrane tank). (None in the United States); and
- Cryogenic cylindrical concrete tank; internal cryogenic tank and prestressed concrete outer tank (one operational in the United States; the remainder worldwide).

These tank categories are described in Annex H of the European Standard for LNG facilities (EN 1473) and are summarized below for the LNG storage tanks commonly found in proposals before the Commission.

H.1 Single containment tank

A single primary container and generally an outer shell designed and constructed so that only the primary container is required to meet the low temperature ductility requirements for storage of the product.

The outer shell of a single containment storage tank is primarily for the retention and protection of insulation and to contain the purge gas pressure, but is not designed to contain refrigerated liquid in the event of leakage from the primary container.

An above ground single containment tank shall be surrounded by a bund (dike) wall to contain any leakage. Examples of single containment are given in figure H.1.

H.3 Double containment tank

A double containment tank is designed and constructed so that both the inner self supporting primary container and the secondary container are capable of independently containing the refrigerated liquid stored. To minimize the pool of escaping liquid, the secondary container should be located at a distance not exceeding 6 meters from the primary container.

The primary container contains the refrigerated liquid under normal operating conditions. The secondary container is intended to contain any leakage of the refrigerated liquid, but it is not intended to contain any vapor resulting from this leakage.

Examples of double containment tanks are given in figure H.3. Figure H.3 does not imply that the secondary container is necessarily as high as the primary container.

H.4 Full containment tank

A tank designed and constructed so that both self supporting primary container and the secondary container are capable of independently containing the refrigerated liquid stored and for one of them its vapor. The secondary container can be 1 or 2 meters distance from the primary container.

The primary container contains the refrigerated liquid under normal operating conditions. The outer roof is supported by the secondary container. The secondary container shall be capable both of containing the refrigerated liquid and of controlled venting of the vapor resulting from product leakage after a credible event. Examples of full containment tanks are given in figure H.4.

Insert Figure

H.1 Examples of Single Containment Tanks

Insert Figure

H.3 Examples of Double Containment Tanks

Insert Figure

H.4 Examples of Full Containment Tanks

Single-, double- and full-containment LNG storage tanks have been authorized by the Commission for use at new LNG import facilities or expansions of existing terminals; and single- and double-containment tanks have been constructed and operated. Although construction of full-containment tanks has not yet started in the U.S., approximately 50 have been constructed world wide. During the review of earlier proposals, a number of issues have surfaced concerning the applicability of existing codes and regulations to full-containment tank. Specifically, the term "full containment" does not appear in U.S. codes or standards for LNG facilities, including the Federal Safety Standards in 49 CFR Part 193, NFPA 59A, or API 620. As a result some have made the assumption that to design and construct a full-containment tank in accordance with the European code for LNG facilities (EN 1473) would satisfy the U.S. code and standards.

For example, it has been suggested that thermal exclusion zones are not required for a full-containment tank because EN 1473 does not consider a tank fire scenario for full-containment tanks with a pre-stressed concrete wall and concrete roof. The staffs of FERC and OPS do not agree because neither NFPA 59A nor Part 193 exclude full containment from thermal exclusion zone requirements. As a result, a thermal exclusion zone analysis is required for an LNG storage tank fire at the top of the secondary container (see section 4.12.4).

Further, EN 1473 does not specify a minimum distance to the property line for full-containment tanks because no tank fire scenario is considered. However, NFPA 59A requires a separation of 0.7 times the diameter from the property line. The proposed tank for the Weaver's Cove LNG Project meets the separation requirement.

Another issue regarding the full-containment design is that the tank outer wall (secondary containment) serves as the impoundment, a concept allowed under Parts 193.2161 and 193.2167, and under the "exception" in figure 2.2.2.6 of NFPA 59A. A specific concern is the dual function of the concrete secondary container - it serves both the operational function of holding the insulation and gas pressure, and a safety function of containing liquid in the event of an inner tank failure. Conversely, in single- and double-containment tanks, independent systems provide operational and safety functions. While recognition must be given to the benefits of a concrete secondary container with respect to external events, such as projectiles or small aircraft, its ability to provide the dual functions while retaining its integrity has not been convincingly supported for all scenarios. This becomes increasingly important as proposed site acreage is reduced and buffer zones between adjacent properties are minimized. As such, the FERC staff considers prudent design practice to provide some form of barrier to prevent liquid from flowing to an unintended area (i.e., outside the plant property) in the event that the storage tank primary and secondary containers fail.

Concerns have also been expressed that the barrier could be considered a containment and prohibit certain equipment being located within the barrier and/or may conflict with other parts of the various codes with respect to hazardous and electrical code classifications. Other concerns are that the barrier could be considered an impounding area that would require new thermal and vapor cloud calculations. The purpose of the barrier is to prevent liquid from flowing off the plant property. The intent of the barrier is not to define a containment or impounding area for thermal radiation or flammable vapor exclusion zone calculations or other code requirements.

Weaver's Cove Energy has proposed to install an earthen structure around the LNG tank. The structure would be 15 feet high and would enclose an area of approximately 400 feet by 1,300 feet. The structure's volumetric capacity would exceed 100 percent of the LNG tank's maximum liquid capacity. Rainwater collected by the dike would be drained into a sump and pumped out in accordance with 49 CFR section 193.2173. This barrier would confine LNG on the project property in the event of any hypothetical catastrophic event, and would also prevent process area spills from leaving the plant.

4.12.4 Siting Requirements - Thermal and Dispersion Exclusion Zones

Regulatory Requirements

The LNG facilities proposed in this project must comply with the siting requirements of 49 CFR 193, subpart B. On March 30, 2000, DOT revised 49 CFR 193 to incorporate NFPA 59A (1996 edition) into the LNG regulations. On April 9, 2004, DOT further revised 49 CFR Part 193 to incorporate the 2001 edition of NFPA. The following sections specifically address offsite hazards:

- **Part 193.2001, Scope of Part**, excludes any matter other than siting provisions pertaining to marine cargo transfer systems between the marine vessel and the last manifold or valve immediately before a storage tank.

- **Part 193.2051, Scope**, states that each LNG facility designed, replaced, relocated or significantly altered after March 31, 2000, must be provided with siting requirements in accordance with Subpart B and NFPA 59A. In the event of a conflict with NFPA 59A, then Part 193 prevails.

- **Part 193.2057, Thermal radiation protection**, requires that each LNG container and LNG transfer system have thermal exclusion zones based on three radiation flux levels in accordance with section 2.2.3.2 of NFPA 59A.

- **Part 193.2059, Flammable vapor-gas dispersion protection**, requires that each LNG container and LNG transfer system have a dispersion exclusion zone in accordance with sections 2.2.3.3 and 2.2.3.4 of NFPA 59A.

For the following LNG facilities that are proposed for this project, we have identified the applicable siting requirements from Part 193 and NFPA 59A:

- One 1,260,000-barrel (200,000 m^3) LNG storage tank - Parts 193.2057 and 2059 require the establishment of thermal and flammable vapor exclusion zones for LNG tanks. NFPA 59A section 2.2.3.2 specifies four thermal exclusion zones based on the design spill and the impounding area. Sections 2.2.3.3 and 2.2.3.4 specify a flammable vapor exclusion zone for the design spill, which is determined in section 2.2.3.5.

- Marine cargo transfer system consisting of three 16-inch-diameter unloading arms, a 16-inch-diameter vapor return line, one 30-inch-diameter liquid unloading line to the storage tank, and a 20-inch-diameter vapor return line - Parts 193.2001, 2057, and 2059 require thermal and flammable vapor exclusion zones for the transfer system. NFPA 59A does not address LNG transfer systems.

- Five 2,120 gpm in-tank pumps and five 1,800 gpm sendout pumps - Parts 193.2057 and 2059 require thermal and flammable vapor exclusion zones. NFPA 59A section 2.2.3.2 specifies the thermal exclusion zone and sections 2.2.3.3 and 2.2.3.4 specify the flammable vapor exclusion zone based on the design spill.

- Four vertical shell and tube type vaporizers - Same requirements as for LNG pumps.

The incorporation of the NFPA 59A requirements into Part 193 has resulted in some confusion and possible misinterpretation in applying the siting requirements:

Parts 193.2057 and 2059 require exclusion zones for LNG transfer systems, which are defined to include transfer piping. However, NFPA 59A only requires exclusion zones for "transfer areas" which are defined as the part of the plant where liquids are introduced or removed from the facility such as truck loading or ship unloading areas. The definition of transfer area in NFPA 59A specifically excludes permanent plant piping such as cargo transfer lines. Additionally, NFPA 59A section 2.2.3.1 (2001) specifically excludes transfer areas at the water edge of marine terminals. When the DOT incorporated NFPA 59A into its regulations, it removed the requirement for impounding systems around transfer piping (old Part 193.2149). In the preamble to the final rule, the DOT determined that the most likely sources of leaks within LNG plants are LNG storage tanks, cargo transfer areas, and vaporizers and process equipment, which are all addressed in NFPA 59A section 2.2.1.2. The result is that while Part 193 retains exclusion zones for LNG transfer systems, neither Part 193 nor NFPA 59A requires the impoundment from which to base the calculations. We do not believe that this was the intent, nor do we believe that omitting containment for transfer piping is a sound engineering practice. FERC staff will continue to require containment for all LNG transfer piping within a plant site.

The incorporation of NFPA 59A also changed the way in which design spills and impoundment capacities may be determined. Under section 2.2.2.2, the capacity of impounding areas for vaporization, process, or LNG transfer areas must equal the greatest volume during a 10-minute period from any single accidental leakage source or during a shorter time period based upon demonstrable surveillance and shutdown provisions acceptable to the authority having jurisdiction. Similar criteria appear in section 2.2.3.5 for determining the design spill used in thermal and flammable vapor exclusion zone calculations. Prior to the incorporation of NFPA 59A, the design spill in Part 193 assumed the rupture of a single transfer pipe with the greatest overall flow capacity, for not less than 10 minutes (old Part 193.2059(d)). As a result, the spill rate for vaporization, process, or LNG transfer areas may be assumed to be a "leakage source" rather than a full pipe rupture; however, the spill duration must be 10 minutes unless the authority having jurisdiction (i.e., DOT's Office of Pipeline Safety) determines that a shorter time is acceptable. Again, given the confusion in applying the two requirements, FERC staff will continue to utilize the 10-minute spill criteria at the maximum flow possible for containment sizing. This will ensure that impoundments are sized for a catastrophic failure, while recognizing that less conservative spill scenarios may be appropriate for exclusion zone calculations. In giving recognition to the integrity of all-welded transfer piping, the determination of the single accidental leakage source should be based on an evaluation of all small diameter attachments to the transfer piping for instrumentation, pressure relief, recirculation, etc, and any flanges that may be used at valves or other equipment, in order to determine the largest spill rate. This approach is the result of discussions with DOT OPS concerning the basis for design spills and application to exclusion zone determinations for proposals before the Commission.

Impoundment Systems and Design Spills

Part 193.2181 specifies that the impoundment system serving a single LNG storage tank must have a volumetric capacity of 110 percent of the LNG tank's maximum liquid capacity. For an LNG storage tank of a full containment design, the outer concrete tank wall would serve as the impoundment system and be sized to accommodate 110 percent of the inner tank volume. To be conservative, none of the volume between the inner and outer tank walls that would be occupied by perlite insulation has been included in the outer tank impoundment capacity.

All potential LNG spills occurring from the storage tank withdrawal header, the vaporizer and sendout pump area, the ship unloading line and the truck transfer area would be directed to a central impoundment, located north of the process area. The LNG ship unloading platform and jetty would be constructed of curbed concrete decking, and sloped to drain potential spills toward shore. A curbed concrete pad would be installed beneath the onshore portion of the unloading piping, and a sloped concrete trench used to drain jetty and onshore spills to the central impoundment. Curbed concrete pads

would be installed beneath the sendout pumps, vaporizers, boil-off gas condenser, and all LNG-containing piping. A sloped concrete trench would direct spills into the impoundment and concrete sump. Sloped and curbed concrete pads would also be installed to drain spills from the truck loading racks and the transfer piping.

The central impoundment would consist of an earthen impoundment (140-foot by 140-foot by 5-foot deep) and a concrete sump (59-foot by 59-foot by 4-foot deep). The earthen impoundment with a capacity of 733,090 gallons has been sized to contain a 10-minute, full flow spill from the ship unloading line. The flow rate in this line would be 52,834 gpm, which would correspond to a 10-minute spill volume of 627,127 gallons after accounting for pump runout and the drainage of LNG contained in the pipe. The concrete sump with a capacity of 104,158 gallons has been sized to contain the design spills from the LNG storage tank, transfer piping, and process areas. The total capacity of the central impoundment would be approximately 837,248 gallons.

In accordance with section 2.2.3.5 of NFPA 59A, the design spill for an LNG storage tank with no penetrations below the liquid level is defined as the largest flow from any single line that could be pumped into the impounding area with the tank withdrawal pumps considered to be operating at full rated capacity over a 10-minute period. Although the LNG storage tank would be equipped with five in-tank pumps, Weaver's Cove Energy states that only four pumps would be active under normal operating conditions. The design flow for each of these pumps is 2,120 gpm. With four pumps operating, the volume for a 10-minute spill from the in-tank pump discharge header would be 100,011 gallons, including drainage from the affected piping system. This spill would be contained by the concrete sump. However, since the fifth in-tank pump would not be physically isolated from use during normal operating conditions, it should be included in determining the design spill for the storage tank. The resulting 10-minute spill volume of 124,391 gallons (including drainage from the affected piping system) would overflow the concrete sump but still be contained within the earthen impoundment.

The sendout pumps discharge into a 16-inch-diameter header which supplies LNG to the vaporizers. A 10-minute spill from this header, with five sendout pumps operating, would release approximately 90,000 gallons of LNG, which would be contained in the concrete sump. Weaver's Cove Energy determined that the design spill for the process/vaporization area would be an accidental release from a broken 1-inch instrument connection on the discharge header. The design spill size for this accidental release is 17,600 gallons. A 10-minute spill from the truck station header would release approximately 14,000 gallons of LNG, which would be contained by the concrete sump.

Weaver's Cove Energy also selected the design spill for the marine transfer area as an accidental release from a broken 1-inch instrument connection on the discharge header of the unloading arms, flowing at full capacity for 10 minutes. The design spill size for this accidental release is 4,350 gallons. However, our evaluation of all small diameter attachments to the transfer piping for instrumentation, pressure relief, recirculation, etc, and any flanges that may be used at valves or other equipment, determined that a failure of the 4-inch-diameter valve bypass on the unloading line would be a more appropriate credible accidental leakage source. This design spill of 52,257 gallons would be contained by the concrete sump.

Table 4.12.4-1 presents the impounding area and spill size volume for the various spill scenarios. Since all of the design spills would be directed to the same central impoundment, the largest spill of 124,391 gallons (from the in-tank pump discharge header) would represent the design spill for subsequent exclusion zone calculations.

TABLE 4.12.4-1 **Impoundment Areas**			
Source	Spill Size (gallons)	Impoundment System	Impoundment Size(gallons)
LNG storage tank	52,834,410	Outer concrete tank wall	59,884,318
Ship unloading line	627,127	Central impoundment	837,248
Design spills:			
In-tank pump withdrawal header	124,391	Central Impoundment	837,248
Sendout pumps and vaporizers	17,600 / 90,000	Concrete sump	104,158
Truck transfer area	14,000	Concrete sump	104,158
Ship unloading line - 4" connection	52,257	Concrete sump	104,158

Thermal Exclusion Zone

If a large quantity of LNG is spilled in the presence of an ignition source, the resulting LNG pool fire could cause high levels of thermal radiation. Exclusion distances for various flux levels were calculated according to 49 CFR 193.2057 and section 2.2.3.2 of NFPA 59A, using the "LNGFIRE III" computer program model developed by the Gas Research Institute. NFPA 59A establishes certain atmospheric conditions (0 mph windspeed, 70° F, and 50 percent relative humidity) which are to be used in calculating the distances. However, Part 193.2057 supersedes these requirements and stipulates that wind speed, ambient temperature, and relative humidity which produce the maximum exclusion distances must be used, except for conditions that occur less than 5 percent of the time based on recorded data for the area. For its analysis, Weaver's Cove Energy selected the following ambient conditions to produce the maximum distances: windspeeds of 15 and 26.5 mph; ambient temperature of 12° F; and 50 percent relative humidity. These conditions yield longer distances than the 0 mph wind speed, 70° F ambient temperature, and 50 percent relative humidity specified in NFPA 59A. We agree with Weaver's Cove Energy's selection of atmospheric conditions.

Using these ambient criteria, FERC staff calculated thermal radiation distances for incident flux levels ranging from 1,600 to 10,000 British thermal units per square foot per hour (Btu/ft^2-hr) for an LNG storage tank fire. Since the outer concrete tank provides the required impounding volume, the area of the impoundment is the appropriate parameter for thermal exclusion calculations. The outer concrete tank diameter (270 feet) was used as the pool diameter, with a flame height equal to the top of the outer concrete tank wall (149 feet). Target height was set at ground level (0 feet).

Thermal radiation distances were also determined for a 1,600 Btu/ft^2-hr incident flux level for the design spill of 124,391 gallons (from the in-tank pump discharge header) to the central impoundment. As previously discussed, the spill would overflow the concrete sump but would still be contained by the earthen impoundment. However, the associated thermal radiation exclusion zone would need to be based on the larger surface area of the earthen impoundment rather than on the concrete sump. Due to the larger design spill, the concrete sump would need to be deepened by approximately 9 inches to accommodate the full 124,391 gallons.

Table 4.12.4-2 presents the calculated maximum distances for incident flux levels ranging from 1,600 to 10,000 Btu/ft^2-hr as calculated by FERC staff. Although there are no prohibited activities within the modeled exclusion zones, the calculations for the impoundment sump are based upon a deepened sump with a capacity of 124,391 gallons. Consequently, **we recommend that:**

- **Weaver's Cove Energy revise the design of the impoundment sump to accommodate a design spill from the LNG storage tank in-tank pump discharge header with five pumps operating at maximum capacity. <u>At least 30 days prior to initial site preparation</u>, Weaver's Cove Energy should submit revised calculations showing the 1,600 Btu/ft^2-hr exclusion zone for the altered impoundment sump would meet the requirements of Title 49 CFR Part 193.**

TABLE 4.12.4-2

Thermal Exclusion Zones

Source	Exclusion Area NFPA 59A Section 2.2.3.2(a)	Incident Flux (Btu/ft^2 hr) a/	Exclusion Zone (feet)
(1) Design spill	Property line that can be built upon.	1,600	320
(2) Storage tank impoundment	Outdoor assembly area occupied by 50 or more people.	1,600	995
(3) Storage tank impoundment	Offsite structures used for occupancies or residences.	3,000	775
(4) Storage tank impoundment	Property line that can be built upon.	10,000	445

a/ The 1,600 Btu/ft^2-hr flux level is associated with an exposed person experiencing burns within about 30 seconds. At 3,000 Btu/ft^2-hr, an exposed person would experience burns within 10 seconds, however a wooden structure would not be expected to burn and affords protection to sheltered persons. At 10,000 Btu/ft^2-hr, clothing and wood can ignite spontaneously.

In a Two-Part Report prepared for Fall River and filed as comments on the draft EIS, Dr. Jerry Havens commented that the exclusion zone calculations contained significant errors because a spill from the transfer line from the ship was omitted from the determination of either thermal radiation or flammable vapor exclusion zones. As identified in the previous section, the facility has been designed for all potential LNG spills occurring from the storage tank withdrawal header, the vaporizer and sendout pump area, the ship unloading line and the truck transfer area to be directed to a central impoundment. Exclusion zone calculations are based on the concrete sump, which has been sized to contain the largest of the design spills.

Weaver's Cove Energy states that the 1,600 Btu/hr-ft^2 zone for the storage tank containment fire would extend over Route 79 toward the south, which is under the control of the Commonwealth of Massachusetts. Route 79 does not fall within the restricted usage for this zone, which is for outdoor assembly by groups of 50 or more persons. As a result, there are no restrictions planned for Route 79, and there should be no affect on traffic by the normal operation of the facility including cargo unloading operations. Also, the Massachusetts Highway property on North Main Street is outside the thermal exclusion zones, and the facility would not affect the use of this property.

The 1,600 Btu/hr-ft^2 zone, and part of the 3,000 Btu/hr-ft^2 zone, would also extend over a 1.2-acre property to the south that consists mostly of wetlands. Weaver's Cove Energy refers to this property as the "wedge lot" due to the triangular shape formed by its borders along the Taunton River, the proposed LNG facility, and the steep embankment to Route 79. Under the definitions in 193.2007, Weaver's Cove Energy would need to demonstrate that it or a government agency legally controls all activities on this lot in accordance with Parts 193.2057 and 2059. Consequently, **we now recommend that:**

- **Weaver's Cove Energy provide evidence of its ability to exercise control over the activities that occur within the portions of the thermal exclusion zones that fall outside the site property line. Alternatively, Weaver's Cove Energy may apply to the Department of Transportation for approval of a waiver, from its Title 49 CFR Part 193 regulation, that specifies what alternative mitigation measures or plan Weaver's Cove Energy may provide that would afford an equal or greater level of thermal radiation protection as the requirement for control over activities within the modeled exclusion zones. Weaver's Cove Energy should file this evidence or waiver <u>prior to initial site preparation.</u>**

Weaver's Cove Energy has determined that the last owner of the wedge lot was the Sagamore Manufacturing Company. However, this corporation was involuntarily dissolved in 1983 and did not assign its residual rights to any individual or another corporation. Therefore, the current ownership of the lot is uncertain, and this situation may hinder the efforts of Weaver's Cove Energy to obtain technical "legal control" over the property. In any case, Weaver's Cove Energy believes that the unusable nature of the wedge lot would itself satisfy the regulations.

The wedge lot contains only 0.29 acre of upland and would be virtually inaccessible to an assembly of people. Physically getting onto the property from the state highway would be a challenge due to the steep embankment. The highway was built at an elevation tens of feet above the grade of the surrounding land, including the wedge lot. No access exists underneath the highway, and no easements exist permitting transit through either the highway property or the proposed LNG facility property. It is also unlikely that a large group of people would travel by boat to congregate on the small piece of upland, but if so, that would negatively impact the quality of the wetlands and could require that an action be taken under state wetlands protection regulations. Additionally, based on the Fall River zoning ordinances, section 86-2, this property could not be built upon due to its lack of street line frontage. Given all of these characteristics, no prohibited activities could reasonably occur on the property, and Weaver's Cove Energy requested, on September 20, 2004, that the DOT grant it an exemption or waiver from the requirement of legal control over activities on the wedge lot. This request is pending.

We received comments suggesting that the 1,600 Btu/ft²-hr limit may not be low enough to protect the public from adverse heat exposure. The DOT examined this issue during the rulemaking process which established the use of this criterion. In their Advance Notice of Proposed Rulemaking (Notice No. 77-4, Docket No. OPSO-46), which was used to develop 49 CFR Part 193, the DOT suggested 3.1 kilowatts per square meter (kw/m²)(1,000 Btu/ft²-hr) as an acceptable level for direct human exposure to thermal flux. After the public review period, it was determined that the evidence and information supported the use of 5 kw/m² (1,600 Btu/ft²-hr) as the limit for direct human exposure.

However, some of the comments we received on the proposed Weaver's Cove LNG Project specifically ask for the distance to 1.6 kw/m² (507 Btu/ft²-hr). This flux level is associated with an uncovered person experiencing burns after approximately 3 minutes of continuous exposure. For the LNG storage tank containment fire, this flux level could potentially extend 1,640 feet from the center of the tank. We note that the 507 Btu/ft²-hr flux level would not reach the William J. Wiley Elementary School, the Highlander Rehab and Nursing Center, or the Pleasant View public housing project. Furthermore, Part 193.2057 does not require any exclusions beyond 1,600 Btu/ft²-hr.

<u>Vapor Dispersion Zone</u>

A large quantity of LNG spilled without ignition would form a flammable vapor cloud that would travel with the prevailing wind until it either dispersed below the flammable limits or encountered an ignition source. Sections 2.2.3.3 and 2.2.3.4 of NFPA 59A and Part 193.2059 require that provisions be

made to minimize the possibility of flammable vapors from reaching a property line that can be built upon and that would result in a distinct hazard. Part 193.2059 requires that dispersion distances be calculated for a 2.5 percent average gas concentration (one half the lower flammability limit of LNG vapor) under meteorological conditions that result in the longest downwind distances at least 90 percent of the time. Alternatively, maximum downwind distances may be estimated for stability Class F, a wind speed of 4.5 mph, 50 percent relative humidity, and the average regional temperature. The section allows the use of the DEGADIS Dense Gas Dispersion Model, or the FEM3A model, to compute dispersion distances. Design spills into impounding areas serving LNG containers, transfer systems and piping are to be determined in accordance with section 2.2.3.5 of NFPA 59A.

Potential LNG spills occurring from the storage tank withdrawal header, the vaporizer and sendout pump area, the ship unloading line and the truck transfer area would be directed to a central impoundment, located north of the process area. Since all of these spills would be directed to the same impoundment, the largest spill of 124,391 gallons (from the in-tank pump discharge header) would represent the design spill for determining flammable vapor exclusion zones.

As discussed in the draft EIS, Weaver's Cove Energy used a cold vapor to liquid volumetric ratio of 1:235 and calculated that 3,184,955 cubic feet (ft^3) of cold vapor would result from the vaporization of an in-tank pump withdrawal header spill with four pumps operating. Weaver's Cove Energy claimed that since the entire volume of cold vapor would be contained by the facility's earthen structure, occupying about 45 percent of the 7,171,695 ft^3 capacity, and that the vapor dispersion exclusion zone would not extend beyond the LNG terminal site.

In the previously referenced Two-Part Report prepared for Fall River and filed as comments on the DEIS, Dr. Jerry Havens disputed the assertion that the entire volume of cold vapor would be contained within the main dike impoundment because it would be physically impossible for the vapor from the spill to fill the impoundment without warming and mixing with air while being evolved. As a result he states that the flammable vapor exclusion zone for this design spill should be recalculated using the FEM3A model as authorized by Part 193.

The effects of provisions for containing vapors as a means of mitigating flammable vapor hazards are permitted to be considered in the calculations by NFPA 59A section 2.2.3.3. Increasing the vapor detention capacity can reduce the vapor source strength and correspondingly reduce the downwind distance to the ½ LFL. It is acknowledged that the calculations of vapor overflow rates do not account for the mixing of evolved vapor that is likely to occur over extended periods of time. This can be especially problematic for certain sump/impoundment configurations that allow for longer term vapor retention.

To account for this phenomenon, FEM3A has been recommended as the proper methodology for calculating exclusion zones. However, the actual ability to apply the model at this time is the subject of an ongoing technical dispute in this proceeding. Issues have been raised concerning the availability of the model in the public domain; validation of the model for the low wind speed and stable atmospheric conditions specified in Part 193; and its performance as a unique terrain model that is significantly different than DEGADIS. Regardless of the debate in that proceeding, it must also be noted that the model has not been used in any of the myriad proposals before the Commission. While the issues concerning the model may ultimately be resolved in the proper forum of the technical standards committee or the DOT regulatory process, the model should be viewed as a potential long term solution, rather than in the timeframe of this project.

As a result, FERC staff performed a supplementary vapor dispersion analysis for the design spill by conservatively assuming no earthen structure on the plant perimeter. While the design spill from all five in-tank pumps would be contained within the earthen impoundment, it would overflow the concrete

sump. Due to the increased surface area providing heat for vaporization, the exclusion zone would extend offsite if all vapor retention by the earthen structure surrounding the facility were neglected. Consequently, staff performed additional vapor dispersion modeling in which the concrete sump was deepened by approximately 9 inches to accommodate the full 124,391 gallons. Using these dimensions, SOURCE5 estimated that vapor would overtop the earthen impoundment within 6 minutes with a vapor production rate of 10.9 kg/sec. A transient DEGADIS simulation, with the atmospheric conditions specified by 49 CFR 193, predicts that 2.5 percent average gas concentration would extend 640 feet from the center of the concrete sump. This flammable vapor exclusion zone, based on a revised impoundment sump, would not extend offsite. Consequently, **we recommend that:**

- **Weaver's Cove Energy revise the design of the impoundment sump to accommodate a design spill from the LNG storage tank in-tank pump discharge header with five pumps operating at maximum capacity. <u>At least 30 days prior to initial site preparation</u>, Weaver's Cove Energy should submit revised calculations demonstrating that the flammable vapor dispersion exclusion zone for the altered impoundment sump would meet the requirements of Title 49 CFR Part 193.**

The supplementary analysis performed by FERC staff using DEGADIS does not take into account any effects by topography, such as the vapor retention effects of the earthen structure surrounding the facility. Since this mitigative effect is not included, the results are conservative and indicate that the facility would be in compliance with 49 CFR 193 provided the impoundment sump is revised as recommended.

A secondary issue that needs to be addressed is distance from potential spill locations at the ship unloading area to the earthen dike. While it is an appropriate design philosophy to direct potential spills away from equipment to remote impoundments, it is also relevant to consider the control of vapors produced in the channels or trenches leading to these impoundments. Long trenches increase the surface area available for heat transfer and, correspondingly, increase vapor generation. A number of vapor control options are available including: vapor fences, fixed high expansion foam generators, reduced trench lengths and/or surface area, and additional sumps at intermediate locations along transfer piping. As a result, **we recommend that:**

- **Weaver's Cove Energy examine provisions to retain any vapor produced along the transfer line trenches and other areas serving to direct LNG spills to associated impoundments. Measures to be considered may include, but are not limited to: vapor fencing, intermediate sump locations, or trench surface area reduction. Weaver's Cove Energy should file final drawings, including cross sections, and specifications for these measures with the Secretary <u>at least 30 days prior to initial site preparation</u> for review and approval by the Director of OEP.**

4.12.5 Marine Safety[23]

The February 2004 Interagency Agreement provides the framework for the participating agencies to work in a coordinated manner to address the full range of issues regarding safety and security at LNG import terminals. The FERC closely coordinates its pre-certificate review of the proposal with the Coast Guard, which has authority over the safety of LNG vessels and the marine transfer area as well as the security of the LNG vessels and the entire LNG facility.

[23] This section was written with the cooperation and assistance of the U.S. Coast Guard, Marine Safety Office Providence.

The hazards associated with the marine transportation of LNG differ from land-based hazards. Whereas the land-based facilities have features to both limit the duration of LNG spills and contain credible spill volumes, an LNG spill on water may be unconfined and may vaporize rapidly due to heat input from the water.

The history of LNG shipping has been free of major incidents, and none have resulted in significant quantities of cargo being released (see section 4.12.5.3). No incidents have occurred at existing LNG terminals during the 50 years of operation that resulted in any significant quantities of cargos being released. However, the possibility of an LNG spill from a ship over the duration of the proposed project must be considered. Historically, the events most likely to cause a significant release of LNG were a ship casualty such as:

- a vessel colliding with an LNG ship in transit;
- an LNG ship alliding[24] with the terminal or a structure in Narragansett Bay or Mount Hope Bay;
- a vessel alliding with an LNG ship while moored at the terminal; or
- a grounding sufficiently severe to puncture an LNG cargo tank.

However, the attacks on September 11, 2001, have made the public keenly aware of additional risks that must be considered in the evaluation of marine safety and security:

- a deliberate attack on an LNG ship by a terrorist group.

Any of the above events would have to occur with sufficient impact to breach the LNG ship's double hull and cargo tanks. Previous incidents with LNG ships have primarily involved grounding, and none of these have resulted in the breach of the double hull and subsequent release of LNG cargo.

The following discussion provides a chronology of the LNG ship voyage from the liquefaction facility to the import terminal, disclosing the risks at each step and how they are managed. Details and analysis are provided in subsequent sections.

LNG Vessels and Ocean Voyage

Imported LNG could be obtained from exporting terminals throughout the world and delivered by LNG ships to the proposed terminal. Exporting countries include Algeria, Australia, Brunei, Indonesia, Malaysia, Nigeria, Oman, Qatar, Trinidad, and United Arab Emirates. In 2003, LNG imports to the U.S. included: 72 percent from Trinidad, 12 percent from Nigeria, 10 percent from Algeria, 3 percent from Qatar, 2 percent from Oman, and 1 percent from Malaysia.

The LNG ships used to import LNG to the United States would be constructed and operated in accordance with the IMO Code for the Construction and Equipments of Ships Carrying Liquefied Gases in Bulk, the SOLAS, and 46 CFR 154, which contain the U.S. safety standards for vessels carrying bulk liquefied natural gas. Foreign flag LNG ships are required to possess a valid IMO Certificate of Fitness and a Coast Guard Certificate of Compliance.

[24] "Allision" is the action of dashing against or striking upon a stationary object (e.g., the running of one ship upon another ship that is docked) – distinguished from "collision", which is used to refer to two moving ships striking one another.

In 1993, amendments to the IMO's Code for the Construction and Equipments of Ships Carrying Dangerous Chemicals in Bulk require all tankers to have monitoring equipment with an alarm facility that is activated by detection of over-pressure or under-pressure conditions within a cargo tank. In addition, the cargo tanks are heavily instrumented, with gas detection equipment in the hold and inter-barrier spaces, temperature sensors, and pressure gauges. Fire protection must include the following systems:

- a water spray (deluge) system that covers the accommodation house control room and all main cargo valves;
- a traditional firewater system that provides water to fire monitors on deck and to fire stations found throughout the ship;
- a dry chemical fire extinguishing system for hydrocarbon fires; and
- a carbon dioxide system for protecting machinery including the ballast pump room, emergency generators, and compressors.

As a result of September 11, 2001, the IMO agreed to new amendments to the 1974 SOLAS addressing port facility and ship security. The International Ship and Port Facility Security Code was adopted in 2003 by the IMO. This code requires both ships and ports to conduct vulnerability assessments and to develop security plans. The purpose of the code is to prevent and suppress terrorism against ships, improve security aboard ships and ashore, and reduce the risk to passengers, crew, and port personnel on board ships and in port areas, for vessels and cargos. All LNG vessels as well as other cargo vessels 300 gross tons and larger and ports servicing those regulated vessels must adhere to these IMO and SOLAS standards. Some of the IMO requirements are as follows:

Ships:

- Ships must develop security plans and have a Ship Security Officer.
- Ships must be provided with a ship security alert system. These alarms transmit ship-to-shore security alerts to a competent authority designated by the Administration, which may include the company, identifying the ship, its location and indicating that the security of the ship is under threat or it has been compromised.
- Ships must have a comprehensive security plan for international port facilities, focusing on areas having direct contact with ships.
- Ships may have certain equipment onboard to help maintain or enhance the physical security of the ship.

Port facilities:

- The port facility must have a security plan and a Facility Security Officer (FSO); and
- Certain security equipment may be required to maintain or enhance the physical security of the facility.

Both ships and ports must:

- Monitor and control access;
- Monitor the activities of people and cargo;

- Ensure the security and availability of communications; and
- Complete a Declaration of Security.

LNG Vessel Transit in Narragansett Bay

An internationally recognized Traffic Separation Scheme established by the IMO serves vessel traffic in the approach to Narragansett Bay through Rhode Island Sound. This provides inbound and outbound routes which are separated by a central buffer zone. All foreign-registered and many U.S. flagged large ships entering Narragansett Bay are boarded by a pilot from the Northeast Marine Pilots who directs the entire transit to one of the destination docks at Davisville/Quonset, Newport, the Ports of Providence, Somerset, and Fall River.

LNG ships would access the LNG terminal site via the East Passage of Narragansett Bay and the federal navigation channel in Mount Hope Bay and the Taunton River (see figure 4.12.5-1). One pilot would direct the LNG ship throughout the entire 21-nautical mile transit of Narragansett Bay to the LNG terminal site. According to Weaver's Cove Energy, a second pilot would board the ships prior to the Brightman Street Bridge to assist in transiting through the bridge. A tractor tug would escort the LNG ships up Narragansett Bay to Sandy Point where two additional tractor tugs would join the escort up the federal navigation channel. LNG ships would enter the channel during a rising tide to ensure sufficient water depth for safe navigation. The vessel master would be on the bridge monitoring the pilot's commands and would retain overall responsibility for the safe navigation of the LNG ship. The Coast Guard would have a security boarding team onboard during the transit if required by the Vessel Transit Security Plan. Other security measures during the transit would be carried out in accordance with the Vessel Transit Security Plan (see section 4.12.5.2).

The LNG ship would normally transit Narragansett Bay during daylight hours. Docking, LNG cargo unloading, and undocking would take less than 24 hours. The LNG ship would normally depart during daylight hours on the second day. When leaving the berth, the bow of the LNG ship would be moved forward into the turning basin while the tugs rotate the stern to line the ship up for the exit down the Taunton River.

In addition to the Northeast Marine Pilots, the Coast Guard would control the transit of the LNG vessel through the harbor and while unloading cargo. Typical Coast Guard requirements for other LNG import terminals include 96- and 24-hour advance notification of the vessel arrival at which time Coast Guard personnel would board the LNG vessel offshore for an inspection of the ship safety systems and a security sweep. Other requirements would include: a Coast Guard escort through Narragansett Bay to the dock; establishment of a moving safety and/or security zone around the vessel while en route and during unloading operations; an inspection of the dock safety systems prior to commencing cargo transfer; and monitoring all operations until the vessel departs. Maintaining security of the dock and vessel would be the responsibility of the facility in cooperation with other federal, state and local partners as described in the Facility Security Plan (see section 4.12.7).

insert figure

4.12.5-1 Proposed LNG Ship Route

LNG Vessel Casualties

The operational controls by the Coast Guard and the Northeast Marine Pilots, as well as the characteristics of Narragansett Bay, minimize the possibility of an LNG cargo spill from groundings, collisions, and allisions. The Coast Guard would enforce a moving safety and security zone around the LNG vessel that would clear the channel of all vessels in the vicinity of the LNG vessel to reduce the likelihood of any collisions, including those of the tonnage and speed required to cause an LNG spill (see section 4.12.5.3). The segment of the transit from the mouth of Narragansett Bay through the East Passage to Sandy Point is relatively wide and deep. From Sandy Point through Mount Hope Bay and up the Taunton River to the LNG terminal site, the federal navigation channel has an authorized depth of 35 feet and a minimum width of 400 feet. The generally even and soft bottom without rocky protrusions makes an LNG spill from cargo tanks highly unlikely in a grounding incident. The proposed LNG terminal would be located at the northern end of the federal channel, where large commercial vessel traffic is primarily limited to bi-weekly coal deliveries (about 30 per year) to the Montaup and Brayton Point Power Plants.

To minimize the potential of an inbound LNG vessel alliding with the bridges or other fixed structures, a navigation simulation study was performed at the Marine Safety International (MSI) vessel simulator facility in Middletown, Rhode Island to test navigation in the channel, including all bridge transits and turning of the LNG ship prior to departure (see *Navigation Simulation Studies* in section 4.12.5.1). The simulation program was initially used to determine the feasibility of and dredging requirements for transiting the federal navigation channel with an LNG ship, including transit through the new Brightman Street Bridge. The program is now being used to refine handling techniques, determine the optimum number and power of tugs required, and establish limiting operational parameters such as wind speed and direction. LNG vessel transits through the new Brightman Street Bridge have been successfully simulated in wind speeds of up to 25 knots on the ship beam.

Deliberate Attack on an LNG Vessel

In addition to addressing the potential hazards from LNG vessel casualties, the possibility of a deliberate attack on an LNG ship by a terrorist group must also be considered. Security of the LNG vessel is the responsibility of the owner/operator and the master of the vessel. Security of the LNG vessel facility is the responsibility of the owner/operator of the facility. Protection of the LNG vessel and the import terminal would involve personnel from the Coast Guard, Weaver's Cove Energy security staff, and state and local law enforcement. The Coast Guard would establish a safety and security zone around the LNG vessels in transit and while docked. Only personnel or vessels authorized by the Captain of the Port would be permitted in the safety and security zone.

Weaver's Cove Energy would provide security for the terminal according to a Facility Security Plan prepared under 33 CFR Part 105 and approved by the Coast Guard Captain of the Port (see section 4.12.7). Some of the requirements include:

- a Facility Security Assessment to identify site vulnerabilities, possible security threats, consequences of an attack, and facility protective measures;
- a Facility Security Plan with procedures for responding to security incidents;
- a designated FSO responsible for implementing and periodically updating the Facility Security Plan and Assessment;

- scalable security measures to provide increasing levels of security at increasing Maritime Security (MARSEC) levels;

- security exercises at least once each calendar year and drills at least every 3 months; and

- mandatory reporting of all breaches of security and security incidents.

Security at the facility would be provided by both active and passive systems. The entire site would be surrounded by a protective enclosure (i.e., a fence) with sufficient strength to deter unauthorized access. The enclosure would also be illuminated with not less than 2.2 lux between sunset and sunrise. Intrusion detection systems and day/night camera coverage would identify unauthorized access. A separate security staff would conduct periodic patrols of the plant, screen visitors and contractors, and assist in maintaining security of the marine terminal during cargo unloading. Weaver's Cove Energy would be required to submit their Facility Security Plan to the Captain of the Port at least 60 days prior to commencement of operations. In order to ensure that the responsibilities of Weaver's Cove Energy's security staff enhance overall security, **we recommend that:**

- **Weaver's Cove Energy coordinate with the Coast Guard to define the responsibilities of Weaver's Cove Energy's security staff in supplementing other security personnel and in protecting the LNG ships and terminal.**

A Security Analysis was prepared by Lloyd's Register North America for the project (see section 4.12.5.3). This analysis provides a basis for estimating the potential magnitude of a hazard from a successful terrorist attack, and for developing LNG vessel and waterfront security plans. In addition, the DOE released a study by Sandia National Laboratories, *Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water* (Sandia Report) in December 2004. The report included an LNG cargo tank breach analysis using modern finite element modeling and explosive shock physics modeling to estimate a range of breach sizes for credible accidental and intentional LNG spill events. The analysis of accidental events found that groundings and low speed collisions could result in minor ship damage but not a cargo spill; while high speed collisions could cause a 0.5 to 1.5 m^2 cargo tank breach area. For intentional scenarios, the size of the cargo tank hole depends on the location of the ship and source of threat. Intentional breach areas were estimated to range from 2 to 12 m^2. In most cases, an intentional breaching scenario would not result in a nominal hole of more than 5 to 7 m^2, which is a more appropriate range to use in calculating potential hazards from spills. These hole sizes are equivalent to circular hole diameters of 2.5 and 3 meters.

The methodology described in the ABSG Consulting Inc. (ABSG) study, *Consequence Assessment Methods for Incidents Involving Releases from Liquefied Natural Gas Carriers*, and revised in staff's responses to comments on the report (issued June 18, 2004), was used to calculate the thermal radiation distances for several holes ranging in diameter from 1 meter to 3.9 meters. Using the methodology, we have estimated distances for a nominal 2.5-meter and 3-meter diameter hole to range from 4,340 to 4,810 feet for a thermal radiation of 1,600 Btu/ft^2-hr, the level which is hazardous for persons located outdoors and unprotected, from 3,330 to 3,701 feet for 3,000 Btu/ft^2-hr, an acceptable level for wooden structures, and from 1,970 to 2,174 feet for 10,000 Btu/ft^2-hr, a level sufficient to damage process equipment, for these size holes respectively.

These intentional breach scenarios provide guidance in developing the operating restrictions for LNG vessel movements through the East Passage of Narragansett Bay and the federal navigation channel in Mount Hope Bay and the Taunton River, as well as in establishing potential impact areas for emergency response and evacuation planning. The inbound transit through the East Passage of Narragansett Bay would pass by Newport and Middletown, Rhode Island on the east side, and Jamestown

on the west. After turning at Sandy Point, the LNG vessels would pass by Bristol and Portsmouth in the vicinity of the Mount Hope Bridge. The transit within the federal channel through Mount Hope Bay and the Taunton River would pass by Woodman Street and the south of Fall River, the State Pier near the center of Fall River, and the Braga Bridge, and Somerset, Massachusetts. Some areas of development along the shoreline in these communities could be within a potential transient hazard area during the LNG vessel transit; while parts of North Fall River would be exposed to a potential hazard while the LNG vessel is at the dock and unloading cargo. Assuming an LNG vessel would transit the Taunton River at 3 knots while under tug assist, the adjacent communities would be exposed to a potential transient hazard for less than 30 minutes. In addition, a temporary hazard would exist around the slip during part of the 10- to 12-hour period while the LNG vessel is at the dock and unloading cargo. The operational restrictions to be imposed by the Northeast Marine Pilots on LNG vessel movements through this area, as well as the requirements that the Coast Guard would impose in its operating plan would minimize the possibility of a hazardous event occurring along the vessel transit.

Emergency Response and Evacuation Planning

Prior to commencing service, Weaver's Cove Energy would prepare emergency procedures manuals, as required by 49 CFR Part 193.2509 that provide for: (a) responding to controllable emergencies and recognizing an uncontrollable emergency; (b) taking action to minimize harm to the public including the possible need to evacuate the public; and (c) coordination and cooperation with appropriate local officials. Specifically, section 193.2509(b)(3) requires "Coordinating with appropriate local officials in preparation of an emergency evacuation plan…" Typically, the manuals are prepared at the later stages of the construction process and submitted to the FERC as a requirement prior to placing the facility in service.

While the worst-case scenarios evaluated for the onshore facility in section 4.12.3 and for marine spills in 4.12.5 provide guidance on the maximum extent of potential hazards, they should not be assumed to represent the evacuation zone for *every* potential incident. As with any other fuel or hazardous material, the actual severity of the incident would determine what area needs to be evacuated, if any, rather than a worst-case maximum zone. It is anticipated that the emergency evacuation plans would identify evacuation distances based upon increasing severity of events.

A number of organizations and individuals commented on the need to consider evacuation plans and warning systems. While recognizing that preparing emergency procedures typically occurs at the end of the construction phase rather than at the draft EIS stage, there remain a number of issues concerning the viability of emergency evacuation that have not been satisfactorily resolved. Therefore **we recommend that:**

- **Weaver's Cove Energy develop emergency evacuation routes for the areas along the route of the LNG vessel transit in conjunction with the local emergency and town officials and file the routes with the Commission for review and approval by the Director of OEP prior to initial site preparation.**

In addition, **we recommend that:**

- **Weaver's Cove Energy develop an Emergency Response Plan (including evacuation) and coordinate procedures with local emergency planning groups, fire departments, state and local law enforcement, and appropriate federal agencies. This plan should include at a minimum:**

  a. designated contacts with state and local emergency response agencies;

b. scalable procedures for the prompt notification of appropriate local officials and emergency response agencies based on the level and severity of potential incidents;

c. procedures for notifying residents and recreational users within areas of potential hazard;

d. evacuation routes for residents along the route of the LNG vessel transit;

e. locations of permanent sirens and other warning devices; and

f. an "emergency coordinator" on each LNG vessel to activate sirens and other warning devices.

The Emergency Response Plan should be filed with the Secretary for review and approval by the Director of OEP prior to commencement of service. Weaver's Cove Energy should notify FERC staff of all meetings in advance and should report progress on its Emergency Response Plan at 6-month intervals starting at the commencement of construction.

4.12.5.1 Narragansett Bay and the Ports of Fall River and Somerset

The East and West Passages of Narragansett Bay and Mount Hope Bay combine to form a sizable body of navigable water open to the sea and accessible to large oceangoing vessels of varying types and sizes up to 100,000 tons. Mount Hope Bay is open to Narragansett Bay East Passage about 12 miles from the sea, at Sandy Point. A deepwater federal navigation channel in the Taunton River, which flows into Mount Hope Bay, extends 9 miles northeast to the Ports of Fall River and Somerset, Massachusetts.

An internationally recognized Traffic Separation Scheme established by the IMO serves vessel traffic in the approach to Narragansett Bay through Rhode Island Sound. This provides inbound and outbound routes which are separated by a central buffer zone. All foreign-registered and many U.S. flagged large ships entering Narragansett Bay are boarded by a pilot from the Northeast Marine Pilots, who directs the entire transit to one of the destination docks at Davisville/Quonset, Newport, Providence, Somerset, and Fall River.

Commercial marine traffic enters Narragansett Bay via the inbound separation lane from Rhode Island Sound that leads to the East Passage, past the City of Newport, Rhode Island. A number of vessels, mainly car carriers, proceed to Davisville/Quonset; naval vessels proceed to their base at Newport; and in the summer season, cruise ships proceed to an anchorage off Newport. Most commercial traffic proceeds into Upper Narragansett Bay to the Port of Providence in a federal navigation channel. The COE is in the process of dredging this channel to its authorized depth of 40 feet. A smaller number of vessels turn eastwards and enter the navigation channel leading to Fall River. This federal navigation channel ends in the turning basin adjacent to the proposed LNG terminal site.

LNG ships would access the LNG terminal site via the East Passage of Narragansett Bay and the federal navigation channel in Mount Hope Bay and the Taunton River (see figure 4.12.5-1). From the mouth of Narragansett Bay, the LNG ships would proceed up the East Passage to Sandy Point. This segment of the route is relatively wide (0.25 to 0.75 mile) and deep (60 to 120 feet). At Sandy Point, the ships would turn east and follow the federal navigation channel through Mount Hope Bay and up the Taunton River to the LNG terminal site. At least initially, ships in this segment may be restricted to one-way traffic and daylight only transits. The federal navigation channel has an authorized depth of 35 feet

and a minimum width of 400 feet. The channel was originally dredged in 1920 and was last maintained in the 1970s. Weaver's Cove Energy proposes to conduct maintenance and improvement dredging of the federal navigation channel to accommodate deeper draft LNG ships (see section 2.4.1.3).

One pilot would direct the LNG ship throughout the entire 21-nautical mile transit of Narragansett Bay to the LNG terminal site. Weaver's Cove Energy has indicated that a second pilot would board the ships prior to the Brightman Street Bridge to assist in transiting the bridge. A tractor tug would escort the LNG ships up Narragansett Bay to Sandy Point where two additional tractor tugs would join the escort up the federal navigation channel. The LNG ships would enter the channel during a rising tide to ensure sufficient water depth for safe navigation.

The three tugs would maneuver the LNG vessel to the dock and assist with berthing. At the end of cargo unloading, the tugs would undock the LNG vessel and turn it in the turning basin. At least one tug would remain on standby to assist in emergency situations, for example the breaking of mooring lines and drifting toward Somerset. Other potential emergency situations would be evaluated on a case-by-case basis and would determine if the LNG vessel would remain at the dock, be maneuvered to the turning basin or towed down the Taunton River, depending on the nature of the hazard, weather conditions, tides and other factors. The turning basin would be dredged to -41 feet in order to serve as an emergency area for all tidal conditions, such as times when the channel may not have sufficient depth.

En route to the LNG terminal, LNG ships would pass under or through four highway bridges: Pell Bridge, Mount Hope Bridge, Braga Bridge, and Brightman Street Bridge. The locations of these bridges are shown on figure 4.12.5-1. A new Brightman Street Bridge, located about 0.7 mile downstream of the LNG terminal site, is currently under construction. The existing bridge is being replaced with a bascule-type bridge that is to be completed in 2010. A summary of the bridges and associated vertical and horizontal clearances for ship passage is provided in the following table. The LNG vessels would have about 5 feet vertical clearance for the Mount Hope and Braga Bridges.

TABLE 4.12.5-1

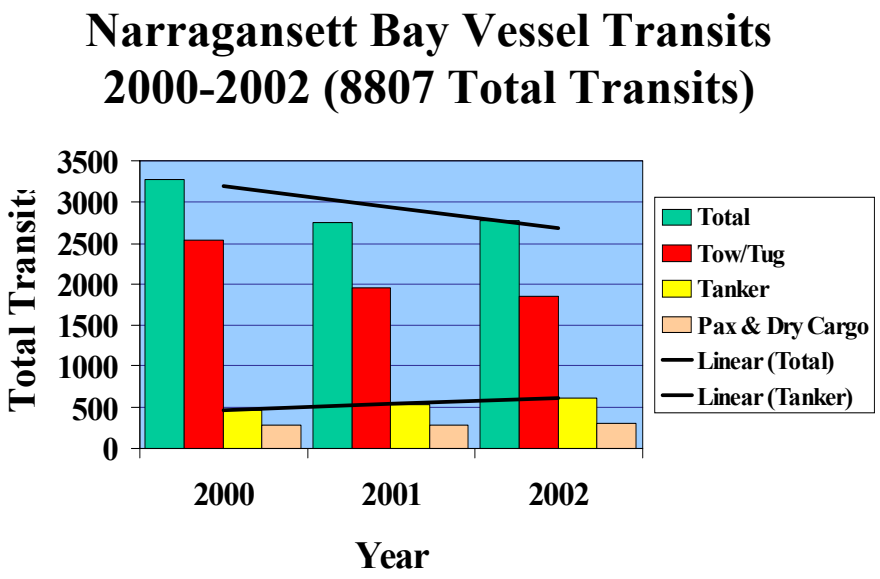
Bridges Along the Proposed LNG Ship Route

Bridge Name	Highway/Road	Horizontal Clearance (feet)	Vertical Clearance (feet)
Pell Bridge	Route 138	1,500	194
Mount Hope Bridge	Route 114	400	135
Braga Bridge	Interstate 195	400	135
Brightman Street Bridge	Brightman Street	200 a/	Unlimited a/

a/ Clearances specified for bascule-type bridge currently under construction.

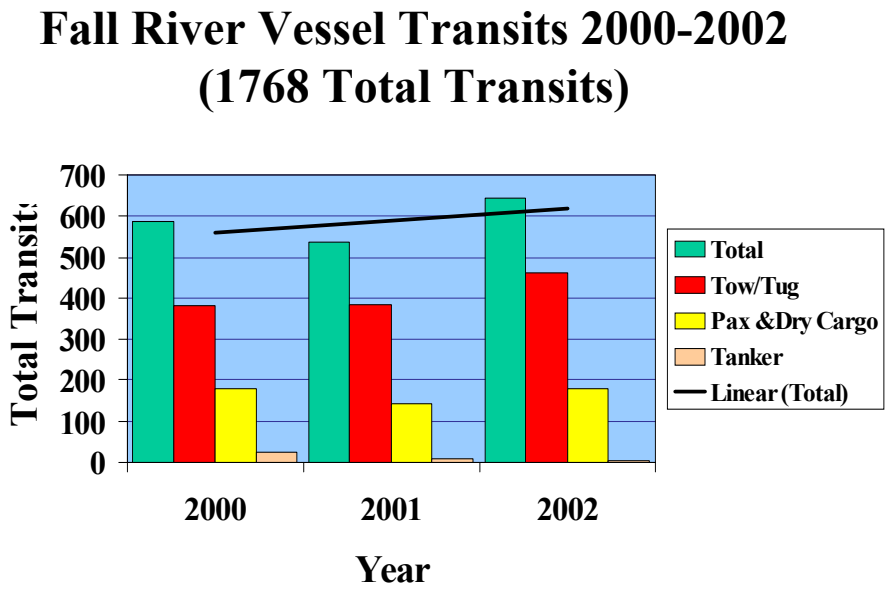
Current Traffic

Data regarding shipping activity in Narragansett Bay are available from multiple sources. The Northeast Marine Pilots, Coast Guard, COE, and Massachusetts Highway District 5 each record various ship movements within the bay. Generally accepted statistics are those provided through the COE's Navigation Data Center annual data for Waterborne Commerce. These statistics were used by the Coast Guard and a cross-section of waterways users during a formal Ports and Waterways Safety Assessment of Narragansett Bay conducted in September of 2004. The statistics below account for both inbound and outbound transits of the federal navigation channels in Narragansett Bay.



PAWSA Narragansett Bay, September 2004

The majority of Narragansett Bay traffic is destined for Providence. The COE's Waterborne Statistics for Fall River for the same period 2000-2002 are:



PAWSA Narragansett Bay, September 2004

The Coast Guard records port calls based on vessels entering a specific zone. In the case of the Coast Guard Marine Safety Office Providence, their zone data covers Rhode Island and Southeastern Massachusetts ports that are entered via Narragansett Bay and also includes the Massachusetts ports of New Bedford and Cape Cod. Analysis of the Coast Guard data for 2002 indicates that 723 vessels entered Narragansett Bay, of which 112 proceeded to Fall River or Somerset. Further analysis by vessel type indicated that of these 112 vessels, 60 were coal deliveries to Brayton Point or Montaup Power Plants, 11 were chemical carriers visiting Borden & Remington, 18 were general cargo vessels berthed at Fall River State Pier, and 23 were passenger vessels also calling at Fall River State Pier.

The COE Navigation Data Center for Waterborne Commerce statistics only records trips in waterways and channels maintained by the COE; therefore, the data do not capture Narragansett Bay traffic proceeding to Newport or Davisville/Quonset because this traffic does not pass any channels that are maintained by the COE. Currently, vessel traffic destined for Davisville/Quonset is limited primarily to car carriers delivering automobiles; these vessels transit Narragansett Bay approximately 60 times per year (accounting for both inbound and outbound transits). All vessels proceeding to Fall River transit the federal navigation channel in Mount Hope Bay and the Taunton River and are, therefore, included in the COE data.

Vessels proceeding to Providence enter a separate navigation channel north of Sandy Point. In 2001, the COE reported a total of 930 inbound vessels proceeding to Providence. This total comprised 64 dry cargo and passenger vessels, 105 tankers, 324 tugs, and 437 non-self propelled barges. The vast majority of the vessels were non-self propelled barges, either towed by tugs or integrated tug-barge units carrying petroleum and petroleum products in domestic trade.

There are several passenger ferry, cruise ship, and water taxi services operating within Narragansett Bay. These vary from year to year depending upon demand and economic conditions. The Narragansett Bay area is a yachting center and contains many marinas, including two upstream from the proposed LNG terminal site. Opening records for the Brightman Street Bridge from 2000 to 2002 give some indication of the recreational traffic in the Taunton River. However, these bridge records only include traffic that cannot pass under the existing bridge's height restriction of 27 feet when in the lowered position. The records were obtained from Massachusetts Highway District 5 Office and were collated for a study commissioned on behalf of the new bridge construction project. Analysis shows the highest number of bridge openings occurred in 2002 with a total of 961 openings. The breakdown was 37 for steamers and motorships, 95 for fishing vessels, 700 for pleasure craft, 226 for tow boats, and 96 for towed craft. The tow boat and towed craft included movements associated with the construction of the new bridge and is, therefore, not regular annual traffic.

To more accurately characterize the local marine traffic, Weaver's Cove Energy conducted a survey in the Mount Hope Bay and the Taunton River over a 3-day period in August 2004. This is traditionally the busiest time of year for recreational traffic and the survey period included the waterfront festival "Fall River Celebrates America". Data was collected at various points, including a monitoring position at the Brightman Street Bridge, which in effect recorded all river traffic passing the proposed LNG terminal site. Traffic was recorded on three consecutive days, nominally between 8 am and 6 pm.

According to this August survey, peak weekend traffic occurred from 12 to 4 PM and consisted of about 30 inbound and 30 outbound craft per hour. Peak weekday traffic occurred from 4 to 6 PM and consisted of about seven inbound and seven outbound craft per hour. Of the total traffic recorded, approximately 82 percent were described as motor craft having an average length of 15 to 25 feet, 15 percent were identified as jet skis, and 3 percent were sailing boats. The only larger traffic recorded was two tugs and barges associated with the construction of the new Brightman Street Bridge. Additional information regarding shipping traffic and bridge openings is included in section 4.9.4.

In conclusion, the shipping data collected from a number of sources produced considerable variation. However, the data do indicate that commercial traffic entering Narragansett Bay averages roughly two to three commercial vessels per day. Commercial traffic in the Taunton River averages one vessel every 2 to 3 days. In addition, the following details and trends were identified and were supported by information on transit schedules provided by Northeast Marine Pilots:

- *Tankers* - Most vessels entering Narragansett Bay are typically 40,000-ton domestic tankers, self and non-self propelled, carrying petroleum products to Providence and East Providence. The trade is evenly spread throughout the year, vessels transit by day and night, and only a few deeper draft vessels require tidal lift. The only tankers entering the Taunton River are small chemical carriers of typical size 9,000 tons visiting Borden & Remington at a frequency of about one per month.

- *Coal Ships* - A total of 60 ships transited the Taunton River channel in 2002 to discharge coal cargoes, averaging 40,000 tons each, with almost equal deliveries to Brayton Point and Montaup Power Plants. Both of these facilities are located in the Town of Somerset. There was a small bias in trade towards the summer months and all transits required tidal lift. These transits were carried out in daylight to aid in the approach to the Brayton Point Power Plant and in the passage through the existing Brightman Street Bridge.

- *Liquefied Petroleum Gas Ships* - An average of 10 to 12 ships per year typically unloaded 20,000 to 30,000 metric tons of LPG per visit at Providence, with most visits occurring from fall to late winter, and all transits entering from Narragansett Bay at Brenton Point are subject to special safety and security measures imposed by the Coast Guard.

- *Car Carriers* - Car carriers transit lower Narragansett Bay and then turn west to offload at Davisville; therefore, they do not proceed towards either Providence or Mount Hope Bay. In 2002, a total of 28 car carriers offloaded at Davisville. These carriers typically berthed after 6:00 a.m. and departed in the afternoon of the same day.

- *Passenger/Cruise Ships* - A total of 23 passenger ships docked at the Fall River State Pier between the months of June and October 2002, but the trade is reported to have been discontinued. In the same year, 25 cruise ships anchored off Newport between the months of May and October. These ships typically entered Narragansett Bay in the morning and sailed again in late afternoon the same day.

- *General cargo* – In 2002, a total of 18 small cargo ships ranging between 1,000 and 3,000 tons called at Fall River. General cargo and dry bulk vessels visited Providence throughout the year at an average of five per month. The largest cargoes were about 40,000 tons, which consisted of scrap iron loaded in Providence.

- *Tugs* - The large number of tugs indicated in the COE data is most likely the result of tugs assisting each of the ships transiting the federal navigation channels, and the large numbers of tankbarge traffic. The Northeast Marine Pilots also confirmed that the integrated tug-barge units also employed additional tugs to assist with berthing. Most currently available local tugs are of the conventional (i.e., non-tractor) type, although one tractor tug did begin service in Narragansett Bay in late 2004. These tugs were not included in the Coast Guard data because they were based locally and were not classified as ships entering the Coast Guard zone.

- *Recreational vessels* - During the summer months, yachting regattas are held within Narragansett Bay. In Fall River for 2002, 82 percent of the Brightman Street Bridge openings were for pleasure and fishing boats and 89 percent of these openings were between May and October.

Future Traffic

The dredging of the federal navigation channel would allow slightly deeper draft and/or fully loaded coal ships to access the existing power plants, and could result in correspondingly fewer vessel transits. The wider opening of the new Brightman Street Bridge would also enable the passage of larger, broader beam coal ships to access Montaup Power Plant, which could also result in fewer vessel transits.

Maintenance dredging of the navigation channel to Providence to restore it to a depth of 40 feet will once again allow deeper draft vessels to enter the port, will reduce delays to vessels that currently have to wait for the correct tidal conditions, and will reduce the need for lightering of certain vessels before entering the port. There is no indication that deepening this channel will result in an increase in the total number of vessels transiting lower Narragansett Bay on passage to Providence.

It is also reasonable to assume that any increase in numbers for specific trades such as car carriers will probably be balanced by a reduction in numbers for other trades such as oil tankers as new, large integrated tug-barge units replace smaller tank barges. The foregoing vessels, although routed through the relatively open water of lower Narragansett Bay, do not enter the channel to Fall River, which the proposed LNG ships would transit.

The proposed project would result in one additional vessel entering Narragansett Bay and transiting the federal navigation channel in Mount Hope Bay and the Taunton River every 5 to 7 days, for a total of about 50 to 70 ships each year. This number of additional ships is similar to the current total number of deep draft coal ships delivering to the Brayton Point and Montaup Power Plants. In addition, KeySpan LNG filed an application with the FERC on April 30, 2004, to upgrade its existing LNG storage facility in Providence, Rhode Island by converting the LNG terminal to a facility capable of receiving marine deliveries. The proposed KeySpan LNG Facility Upgrade Project, if approved, would receive about 50 LNG ships a year, and LNG ship transit to this facility is through Narragansett Bay and the Providence River Harbor and Channel.

The federal navigation channel in Mount Hope Bay and the Taunton River would be dredged by Weaver's Cove Energy to accommodate LNG ships with cargo capacities up to 145,000 m^3. Even taking into account the proposed project's anticipated shipping activity, the channel would remain under utilized. Existing and anticipated future traffic in addition to the project's intended trade would not result in traffic congestion because no commercial ships can proceed up the Taunton River beyond the LNG terminal site due to insufficient water depths. The total utilization of the channel would be approximately 170 to 250 ships per year with no specific seasonality.

Ship Traffic in the Navigation Channel

There are a number of factors that influence the movement of ship traffic in the federal navigation channel in Mount Hope Bay and the Taunton River. These include:

- *Channel Depth and Current* - The channel has a project depth of 35 feet and the private channel leading to the Brayton Point Power Plant has a depth of 34 feet. This results in deep draft ships utilizing tidal lift, approximately 4-foot mean tide in the project area, to transit the channel. Weaver's Cove Energy proposes to dredge the channel to a depth of

37 feet and LNG ships would utilize tidal lift as described in the Dredging Program Report. The current in the channel is low, generally about 0.5 knot, and rarely exceeds 1 knot. Channel transits would be undertaken on a rising tide and timed to minimize current effects in the area of the Brightman Street Bridge.

- *Daytime/Nighttime Transit* - Existing practice is for deep draft vessels to transit the channel only during daylight hours. Weaver's Cove Energy has indicated that LNG ships would initially only transit during daylight hours but, as experience is gained, the option of adopting nighttime transits would be considered in full cooperation with the pilots and the Coast Guard. Nighttime transits could require installation of additional navigational aids and flood lighting of the fender line at the new Brightman Street Bridge.

- *One-Way Traffic* - Arrangements are in place to permit a vessel, scheduled to depart from upper Narragansett or Mount Hope Bays, to commence its outward passage and wait or anchor temporarily at a suitable location, such as Sandy Point, to allow the LPG ship to pass. In this case the total time of the delay would be approximately 60 minutes. It is anticipated that similar one-way restrictions, resulting in similar delays should they coincide with the scheduled movements of another vessel, may be applied by the Coast Guard to the proposed LNG ship transits. It is estimated that the delay to a ship scheduled to depart from an existing Fall River berth due to inward passage of an LNG ship in the navigation channel could be between 60 and 90 minutes.

- *Tugs* - LNG ships delivering cargo to the proposed terminal would have tug support for all phases of arrival and departure, channel navigation, and for standby and fire fighting duties during LNG unloading operations. Although there are established tugboat operations in the Narragansett Bay area, Weaver's Cove Energy would provide dedicated tractor tugs with fire-fighting capabilities. Ownership arrangements are not yet established but the tugs would be contracted to the proposed project for all LNG ship movements and would be available at other times for general shipping movements, such as car carrier berthings, within the Narragansett Bay and Cape Cod areas.

- *Moving Safety and Security Zone* - The Coast Guard currently imposes a moving safety and security zone around LPG ships en route to Providence and would impose a similar zone enforced by a Coast Guard escort for LNG ships. As discussed above, the worst-case effect of this moving safety zone would be an estimated 60 to 90-minute delay to other ships. In the federal navigation channel, any delay would be concurrent with, not in addition to, any delay due to one-way traffic.

- *Reduced Visibility* - The Narragansett Bay area experiences fog mostly during spring and fall months. The fog can be localized with limited visibility in the Newport area and clear visibility in the upper Narragansett Bay and Mount Hope Bay. For berthings that require tidal lift during daylight hours, fog delays could extend to 24 hours.

- *High Winds* - LNG ships present a relatively high wind sail area and their operation in narrow waterways requires specific controls. Based on an analysis of wind data recorded by the PORTS station at Borden Flats, the prevailing winds in Mount Hope Bay are from the southwest and blow almost parallel to both the main channel and to the transit through Brightman Street Bridge. Northeast Marine Pilots have reported that the relatively high ground on both sides of the channel north of the Braga Bridge generally result in reduced wind effects from the conditions recorded at Borden Flats. The most severe limiting conditions would be transverse winds experienced at the transit through

Brightman Street Bridge. The simulation program would be used to determine the limiting conditions of wind strength and direction. Based on initial simulations, Weaver's Cove Energy believes operations could be conducted safely at wind speeds up to 20 knots but that high winds may delay operations for 24 hours six times per year, and for 48 hours once per year. If, in the future, nighttime channel transit is authorized, both wind and fog delays could be reduced to 12 hours due to the availability of both daily tidal cycles.

- *Pilotage* - Northeast Marine Pilots provide pilotage of the LNG ships from the pilot boarding station at the entrance to Narragansett Bay until the LNG ship is secured in the berth at the proposed LNG terminal. As described above, a number of pilots have been involved in the simulation studies to date and additional pilots would be provided the training in the future.

- *Ice Conditions* - Ice occasionally forms on the Taunton River during winter months. During the 2002/2003 winter months, ice formation was observed across the turning basin on three occasions. In 2004, which experienced an unusually long severe cold spell during January, the Taunton River north of the Braga Bridge was completely iced over, with many aids to navigation (buoys) dragged from their station. Ice was of sufficient thickness to disrupt or delay large commercial ships. While Coast Guard icebreaking resources were required in January 2004, the proposed tractor tugs would likely be able to break through the ice formations typically experienced in the Taunton River. Under exceptional winter conditions (such as 2004), Coast Guard cutters with icebreaking capability have entered Narragansett Bay to maintain open navigation channels. Weaver's Cove Energy would seek Coast Guard assistance to supplement the proposed project's tugs in the event of unusually thick ice.

Navigation Simulation Studies

Safe navigation in the channel, including all bridge transits and turning of the LNG ship prior to departure, was evaluated using the marine vessel simulators at MSI in Middletown, Rhode Island. A select number of pilots with Northeast Marine Pilots and a former pilot experienced in LNG ship handling and tractor tug operations have been involved in a simulation program conducted for Weaver's Cove Energy. MSI modeled the navigation channel from Narragansett Bay to the LNG terminal site using data on existing LNG ships of the size and type that could be used to deliver LNG to the proposed terminal.

The MSI facility is being used by the pilots to simulate the entire passage of a 145,000 m^3 LNG ship and its attendant tugs from Narragansett Bay to the berth at the proposed ship unloading facility. The simulation program was initially used to determine the feasibility of and dredging requirements for transiting the federal navigation channel with an LNG ship, including transit through the new Brightman Street Bridge. The program is now being used to refine handling techniques, determine the optimum number and power of tugs required, and establish limiting operational parameters such as wind speed and direction.

The simulation program included rare emergency situations such as tug failure, loss of main engine power on an LNG ship, and escorting an LNG ship backwards down the channel following an aborted inward passage. All of these situations were successfully simulated and are included in a full training program that has been prepared to qualify the Northeast Marine Pilots in the handling of LNG ships and in the optimal utilization of modern tractor tugs. Only pilots who have satisfactorily completed the training course would be hired by Weaver's Cove Energy.

The simulation program evaluated the control of an LNG ship during transit through the new Brightman Street Bridge. Based on the results of these transit simulations, it was determined that transiting the bridge with an LNG ship is fully practical by the pilots who have experience with similar transits through the existing bridge. The new bridge will be equipped with protection piers or cells on approaches from both directions and a fender system on both sides of the 200-foot-wide channel opening. When raised to the open position, the roadway sections will swing upwards and outwards, clear of the channel fender line. LNG ship transit through the bridge would be conducted at a low speed of approximately 3 knots such that the energy of the ship, even in the fully loaded condition, would be less than the design impact energy capacity of the protection cells. The fender system protecting the bridge will be independently mounted at the sides of the channel and located some distance away from the main bridge structure. Weaver's Cove Energy anticipates that the sides of the LNG ships could occasionally contact the fender system panels. As a standard operating procedure, Weaver's Cove Energy would maintain a stock of spare fender panels and immediately replace any damaged panels in cooperation with the bridge owner.

The simulation program was also used to identify the benefits of relocating existing or installing additional navigational aids to enhance the margins of safety of the transits. The recommendations to date include installation of the following navigation aids: two additional buoys on the inward approach to the Mount Hope Bridge; three new buoys and a set of leads for the section of channel immediately upstream of the Braga Bridge; and four new buoys in the section north of the new Brightman Street Bridge, including the expanded turning basin. Weaver's Cove Energy also proposes to finance the installation of a PORTS buoy or equivalent data transmitting device at a location adjacent to the proposed ship unloading facility and turning basin. The nearest PORTS buoy is on Borden Flats at the confluence of the Taunton River channel and the private side channel that serves the Brayton Point Power Plant. The pilots would be equipped with hand-held receivers that allow them to access PORTS data from ships they are piloting. Real-time information from the existing and proposed buoys would be beneficial to navigation in the navigation channel from Borden Flats to the proposed berth.

4.12.5.2 Requirements for LNG Ship Operations

The arrival, transit, cargo transfer, and departure of LNG ships in Narragansett Bay would adhere to the procedures of Operations and Emergency Manuals to be developed by Weaver's Cove Energy in consultation with the Coast Guard Marine Safety Office, Providence, Rhode Island. These procedures would be developed to ensure the safety and security of all operations associated with LNG ship transit and unloading. The manuals would contain specific requirements for the LNG ship, pre-arrival notification, transit through Narragansett Bay, the waterfront facility, cargo transfer operations, Coast Guard inspection and monitoring activities, and emergency operations. The Coast Guard Marine Safety Office Providence would monitor each LNG ship in accordance with these manuals.

Some of the anticipated key provisions of the manuals would be the establishment of a moving safety and security zone for all inbound, outbound, and moored LNG ships; the use of a minimum of three tugs to assist in the Taunton River and to maneuver the ship into the berth; and one tug to remain with the LNG ship while it is moored at the berth.

The Coast Guard regulations in 33 CFR 127, apply to the marine transfer area of waterfront facilities between the LNG ship and the last manifold or valve located immediately before a storage tank. Further, title 33 CFR 127 regulates the design, construction, equipment, operations, inspections, maintenance, testing, personnel training, fire fighting, and security of LNG waterfront facilities. The safety systems, including the communications, emergency shut down, gas detection, and fire protection must comply with the regulations in 33 CFR 127. Under 33 CFR 127.019, Weaver's Cove Energy would

be required to submit two copies of its Operations and Emergency Manuals to the Captain of the Port Providence.

Title 33 CFR 127 separates cargo transfer operations into three distinct phases: Preliminary Transfer Inspection (section 127.315); Declaration of Inspection (section 127.317); and LNG Transfer (section 127.319). These different sections require specific actions to be completed prior to and during the transfer. Additionally, there are specific actions required in the case of a release of LNG (section 127.321).

In accordance with 33 CFR 127.007, Weaver's Cove Energy submitted a Letter of Intent to the Coast Guard on May 12, 2004, conveying its intention to build an LNG facility at the proposed site. On September 1, 2004, the Coast Guard issued a notice in the Federal Register requesting comments on the maritime operation and waterways management aspects of the proposed LNG facility. The original comment period ended on November 1, 2004, and was subsequently extended to January 25, 2005 in response to public requests for additional time to comment on the proposal. Additionally, the Coast Guard Captain of the Port Providence held a public meeting on December 7, 2004, to receive direct public input on the proposal. Upon completion of its review, the Coast Guard would issue a Letter of Recommendation to address the suitability of the Narragansett Bay and the Taunton River for LNG transport with regard to the following items:

- density and character of marine traffic;
- locks, bridges, or other manmade obstruction;
- depth of water;
- tidal range;
- protection from high seas;
- underwater pipes and cables; and
- distance of berthed vessels from the channel, and the width of the channel.

While the Letter of Recommendation would address the suitability of Narragansett Bay and the Taunton River for LNG ship transportation, it would not constitute a final authority to commence LNG operations. It is anticipated that the Coast Guard will decide on a Letter of Recommendation as soon as possible after the Commission issues the final EIS, or wait until after the Commission makes an overall public interest determination of the proposal. Issues related to the public impact of safety and security or exclusion zones are addressed later in the development of the Coast Guard's LNG Vessel Transit Security Plan. An initial plan has been developed in conjunction with state and local law enforcement communities. In addition, the Coast Guard would establish a safety and security zone under 33 CFR 165 for LNG vessels in transit and while docked. Only personnel or vessels authorized by the Captain of the Port are permitted in the safety and security zone.

Results of Coast Guard Security Workshops

The Coast Guard recently completed a series of project-specific security workshops with port stakeholders and federal, state and local agencies. The workshop participants identified measures that would be necessary to responsibly manage the risks associated with LNG traffic. These measures complement the Maritime Transportation Security Act regulations enacted on July 1, 2004. The Coast Guard has identified protocols to mitigate specific risks and created an initial Vessel Transit Security Plan, which will become the basis for appropriate security measures for each Maritime Security threat level. Prior to the LNG vessel being granted permission to enter Narragansett Bay, both the vessel and facility must be in full compliance with the appropriate requirements of the Maritime Transportation Security Act and International Ship and Port Security Code, and the security protocols established by the Captain of the Port in the Vessel Transit Security Plan.

To help gauge local concern with the safety and security of LNG shipments to Rhode Island, the Coast Guard Captain of the Port initiated a series of security workshops beginning in December 2004 with federal, state, local and industry law enforcement stakeholders to weigh preventative measures. Participants considered competent industry studies from ABSG and Sandia National Laboratories to help validate a vulnerability assessment submitted by the applicant. After weighing their concerns, the group was able to identify specific protocols to mitigate risk, which became the baseline for security planning.

As a result of these workshops, the Coast Guard has identified additional resources, public and/or private, to provide suitable afloat, underwater, landside, and aviation security or surveillance capabilities to implement prevention and mitigation strategies necessary for LNG operations. These resources are not currently available in the Captain of the Port Providence area of responsibility. A detailed security plan describing the resources and prevention/mitigation strategies has been provided to the FERC. The plan includes an offshore security sweep by a Coast Guard boarding team, aerial surveillance, and an escort to the dock by armed security boats to enforce a safety and security zone. While the vessel is at the dock, the plan would include a combination of resources including Coast Guard security boats with state and local police details to complement the Facility Security Plan (see section 4.12.7). The details of this security plan have been designated Sensitive Security Information as defined in Title 49 CFR Part 1520. Because any unauthorized disclosure of this plan could be employed to circumvent the security measures, it is not releasable to the public. Additionally, any security plan is a dynamic document that is subject to change with advances in technologies and improvements in intelligence gathering.

The security plan is robust and necessary considering the demographics and configuration of both the transit route and the marine terminal site. Several concerns were raised about the necessity for bridge closures during the transit. The workshop participants have determined it is not necessary to close the bridges unless the threat condition or current intelligence raises a concern about security issues. The law enforcement agencies in the region have demonstrated the capability to manage a bridge closure during transits of LPG vessels in the past. Maintaining that capability is built into the present security plan, should it be required, but this option will only be executed when absolutely necessary.

During the public meetings, several people commented on the cost of applying additional security measures and the potential burden on local taxpayers. To meet its anticipated security responsibilities in Rhode Island, the Coast Guard initiated a formal proposal for additional resources through its internal budgeting process for inclusion in the 2006 appropriations bill. A determination on that proposal is pending. To address the expense for state and local resources, the applicant has proposed to fund un-reimbursed state and local security costs just as the Everett Terminal does today.

We recognize that the initial Vessel Transit Security Plan is a dynamic document that has been prepared well before import operations would commence, and that the port's overall security picture may change over that time period. New port activities may commence, infrastructure may be added, or population density may change. Improvements in technology to detect, deter and defend against intentional acts may also develop. Therefore, **we recommend that:**

- **Weaver's Cove Energy should annually review its waterway suitability assessment for the project; update the assessment to reflect changing conditions; provide the updated assessment to the cognizant Captain of the Port/Federal Maritime Security Coordinator for review and validation; and provide a copy to the FERC staff.**

Impact of Vessel and Facility Security Requirements

The potential impacts to other commercial and recreational boaters can be evaluated for several general security requirements: 1) moving safety and security zones for inbound and outbound LNG

vessels; 2) safety and security zones around a moored LNG vessel; and 3) other measures as deemed appropriate. About 50 to 70 cargo deliveries per year would average about once per week for each inbound and outbound transit. For the upper limit of 70 cargo deliveries per year, the impact would be once every 5 days.

Applying a moving safety and security zone would restrict other vessels 2 miles ahead, 1 mile behind, and approximately 1,500 feet on either side of the LNG vessel. The Captain of the Port currently places similar restrictions on all high-interest vessels by regulation in 33 CFR 165.121. The LNG ships would transit 21-nautical-miles from the entrance of the Narragansett Bay at Brenton Point to the Weaver's Cove LNG terminal. For the first half of this trip, an LNG vessel would travel at an average speed of 10 knots. The LNG vessel would then slow to an average speed of 5 knots from Sandy Point to the Braga Bridge. After that point, it would travel at an average speed of 3 knots through the final 2 nautical miles of the transit. Based on these assumed speeds, it would take about 4 hours for LNG ships to complete the 21-nautical-mile trip from the entrance to the Narragansett Bay at Brenton Point to the proposed LNG terminal. Minimum visibility conditions would have to be satisfied before the LNG ship would be allowed to proceed inbound from the ocean, ensuring that the Coast Guard could adequately monitor the safety and security zone.

The application of the safety and security zone on land has minimal impact. The regulation provides the Coast Guard and local law enforcement personnel with the authority to implement additional control measures within the zone, such as check points, should such action be warranted based on a specific threat or credible intelligence. Additionally, it is important to note that the requirements of 33 CFR 165.121 were designed to apply to any high-interest vessel transiting Narragansett Bay and does not give consideration to safety or security measures that may be applied to mitigate risk. Considering the robust security plan that was devised during the Coast Guard-sponsored workshops, it is likely that LNG-specific security zone regulations will be promulgated.

The Coast Guard would establish a safety and security zone around the Weaver's Cove Energy marine terminal when an LNG vessel is at the dock. The Coast Guard has not defined the size of a restricted zone around a docked LNG ship but has stated that it would make every effort to minimize disruptions to other waterway users. The Coast Guard security zones for this project would not be treated as absolute exclusion zones that would preclude all other vessel movements. Rather, other commercial and recreational vessels may be allowed to transit through the security zones with the permission of the Captain of the Port.. It is also anticipated that any security zone which may be applied to the facility when the unloading berth would be unoccupied would be much smaller and would not adversely impact regular river traffic.

With respect to a 3,000-foot "land and sea" security zone around an LNG vessel at the dock, the Coast Guard has developed a vessel transit security plan that provides the desired level of security without creating unnecessary restrictions (i.e. closing the waterway and evacuating all persons within a 3,000-foot radius would not be acceptable procedures). A number of issues were identified during scoping and the draft EIS comment period regarding the potential of bridge closures: the impact of traffic backups on local roads and highways; compensation for time-sensitive shipments; method of notice; the impact of bridge closures on the ability of emergency vehicle to access Fall River hospitals.

The Coast Guard has completed a series of security workshops involving federal, state and local officials representing law enforcement and emergency response agencies, as well as stakeholders in the maritime community. As part of the review of the LNG vessel transit through Narragansett Bay to the terminal on the Taunton River, the Coast Guard considered what security measures are needed, which may or may not include an order to close one or more of the bridges along the vessel route (see table 4.12.1-1). While bridge closures are one of the many tools available to the Coast Guard, it should not be

assumed that routine bridge closures would be mandatory. Other alternatives to a complete bridge closure under consideration include closing the outboard lanes only, placing law enforcement officials on the bridge at strategic locations, or employing technology that provides suitable security alternatives. We are aware that the Pell (Newport) Bridge has been closed on occasion to vehicular traffic during the passage of LPG ships (the closure lasts about 5 to 7 minutes). Since the new Brightman Street Bridge will be a bascule-type bridge, it must be closed to allow the passage of large ships including LNG vessels, regardless of other security concerns.

The Braga Bridge is approximately 8,000 feet or 1.5 miles south of the new Brightman Street Bridge. If it is determined that the Braga Bridge needs to be closed during ship transit, Weaver's Cove Energy has indicated that it would adjust its ship transit plans to prevent the simultaneous closings of the two bridges. This could be accomplished by slowing or briefly halting the vessel between the two bridges, thereby allowing the vessel to completely clear one bridge with traffic flow resuming before the Brightman Street Bridge is opened to accommodate passage of the ship. Recognizing that closure of both the Braga and Brightman Street Bridges at the same time would temporarily deny emergency vehicle access to Fall River hospitals, **we recommend that:**

- **any security plans make allowance to have at least one of the Braga and Brightman Street bridges remain open during the passage of LNG vessels through the federal navigation channel in the Taunton River and that consideration be given to scheduling bridge closures to avoid peak traffic periods.**

Weaver's Cove Energy completed a traffic analysis to identify the potential impacts on traffic if the Pell (Newport) Bridge, Mount Hope Bridge, Braga Bridge, and Brightman Street Bridge are closed during passage of LNG ships (see section 4.9.4). The study used an automated traffic recorder to quantify the regional traffic using these bridges. In addition, these traffic counts were used to estimate potential delays and queuing (back-up) distances at the bridges based on how long each bridge might be closed to traffic. Table 4.9.4-1 in section 4.9 lists the traffic volume at each bridge and the potential maximum distance and average duration of traffic back-ups in the event that the bridges would need to be closed to all traffic during passage of LNG ships.

As shown in table 4.9.4-1, the potential impacts on traffic are expected to be minor in the event that the three fixed bridges are closed during passage of LNG ships. At the Pell (Newport) Bridge, the longest average traffic delay would likely occur in the westbound lanes during weekday evenings, with traffic backing up onto the Route 114/138 on-ramp (4.9 minutes). At the Mount Hope Bridge, the longest average traffic delays would likely occur during weekday evenings in the southbound lanes at the approach to the bridge (6.2 minutes). At the Braga Bridge, the longest average traffic delays would likely occur during weekday evenings in the eastbound lanes (6.4 minutes). The longest estimated average traffic delays at the new Brightman Street Bridge would be 12.1 minutes both during weekday mornings in the eastbound lanes, with traffic backing onto Route 138, and in the westbound lanes with traffic backing onto the Davol Street ramp. However, the delays at the Brightman Street Bridge would be similar to those that occur associated with the current transit of coal vessels and the previous transit of large oil tankers. In addition, as discussed above, because the new Brightman Street Bridge would have a higher vertical clearance, the number of openings of the new bridge is expected to be substantially lower, even with the addition of 50 to 70 LNG ships per year.

The moving safety and security zone and the safety and security zone at the terminal may affect other commercial, ferry, and recreational traffic using the bay and river. The magnitude of the effect would also be influenced by three other factors: the amount of time it takes to obtain a pilot, other competing ship traffic in the federal navigation channel, and interaction with ferry traffic.

In some areas, the moving safety and security zone could delay the passage of other ships. This presently occurs with LPG vessels which can sometimes delay other vessels using the East Passage or federal navigation channel as they wait or anchor at suitable locations to allow the LPG ship to pass. It is expected that if both the Weaver's Cove Energy and KeySpan LNG terminals are constructed, as many as 100 to 130 LNG ships could potentially move in and out of Narragansett Bay every year. The inbound and outbound traffic of LNG ships moving through either Providence or Fall River could delay other commercial ships in the area.

KeySpan LNG and BG LNG retained MNI to assess the potential impacts of LNG shipping on commercial marine traffic in the Narragansett Bay. MNI reports that about 720 commercial vessels transit the bay each year, and approximately 3 percent of these vessels already experience some delay due to the existing traffic. MNI estimates that if the KeySpan LNG facility was receiving its proposed shipments, a total of about 5 percent of commercial ships using the Narragansett Bay may experience some delay each year. MNI also states that if both the Weaver's Cove Energy and the KeySpan LNG terminals were receiving their proposed shipments, a total of about 6 percent of commercial vessels using the bay may be delayed each year.

Although the traffic impacts due to ships proposed for the Weaver's Cove Energy project were not studied separately, these ships would be expected to have less impact than those analyzed for the KeySpan LNG Facility Upgrade Project. Most commercial vessels using the Narragansett Bay transit to and from Providence and, therefore, would only need to wait for a Weaver's Cove LNG ship while it passed between Sandy Point and the entrance to the Narragansett Bay. A commercial vessel attempting to travel in the opposite direction of an LNG ship in this area may experience a delay of up to about 1 to 1½ hours. However, as is currently done for LPG vessel transits to/from Providence, the ship's agent, the Northeast Marine Plots, and the Coast Guard work together to schedule transits to minimize disruptions to other commercial traffic. Since additional security measures have been implemented for LPG transits post 9/11, there have been no complaints from commercial vessel operators regarding undue or unnecessary delays during LPG transits. The impact on ferry traffic would generally be small because most of the ferry routes only cross the LNG ship route and conflicts could be managed by schedule coordination. The impact on the Providence to Newport ferry could be more significant because the ferry and LNG ships would travel along the same route for several miles. MNI identified this potential conflict in its study and suggested that the impact could be reduced if the Coast Guard allows the ferry to operate outside of the channel and overtake or pass the LNG ship in transit at specific locations. The Coast Guard has indicated that it may grant permission for the ferry to pass the LNG ship or transit through portions of the security zone.

Commercial fishing boats might also be affected by the security zones imposed by the Coast Guard as LNG ships transit the federal navigation channel, particularly if the width of the security zone encompasses the entire width of the waterway. However, the security zone would be a moving zone around the ship, so these impacts would be temporary and of short duration at any given point along the shipping route. In addition, depending on their individual drafts, commercial fishing boats might be able to go around the LNG ships at points that are sufficiently wide for them to be outside of the security zone. To mitigate the impacts of security zones, the Coast Guard would routinely provide Notice to Mariners prior to the arrival and departure of LNG ships as the Coast Guard currently does for LPG vessels and for other activities such as the Tall Ship parades. The notification system employed for safety and security zones consists of broadcasts on radio frequencies used by mariners. This notification may be given from minutes to more than 1 hour before the security zone is enforced. Broadcasts are intentionally not made further in advance for security reasons. Picket boats would also precede the LNG ship to inform vessels of the approaching security zones.

Operation of the LNG terminal could also affect recreational boating and fishing during the weekly transit and unloading of the LNG ships. The safety and security zone around a moored LNG ship may prevent recreational boaters from boating or fishing in the vicinity of the moored ship for approximately 24 hours. In many areas, the waterway that would be traveled by the LNG ships is sufficiently wide to allow recreational craft, which generally are not confined to the federal channel, to navigate around the LNG ships without significant delay. To estimate what kind of delay might result from a passing LNG ship in areas where the waterway is narrower, we identified the locations where the moving safety and security zone has the greatest potential to encompass the entire width of the waterway. We specifically looked for areas where there might be less than approximately 1,500 feet of open water on both sides of the LNG ship route (the anticipated width of the safety and security zone on either side of the ship). These areas include the East Passage between Newport and Jamestown, the Mount Hope Bridge area, and the Taunton River. For an LNG vessel in transit at 10 knots, recreational craft attempting to travel in the opposite direction at a narrow location may need to wait up to 18 minutes for the LNG ship to pass before proceeding on its way. For an LNG vessel in transit at 5 knots, recreational vessels may be delayed for up to 36 minutes. When an LNG vessel would be traveling between the Braga Bridge and the proposed LNG terminal at an average speed of 3 knots, the delay may be up to 60 minutes for boaters docked alongside the Taunton River downstream of the facility. For boaters near or upstream of the facility, an additional 60 minute delay may be experienced while the LNG vessel would be berthed or turned.

The extent of the impact on recreational boaters would depend on the number of boats in the project area during the 50 to 70 days per year that LNG vessels would call on the LNG terminal. These impacts would primarily occur during the peak recreational boating season between about May and September. As noted above, the Coast Guard is expected to use a program of announcements to give advance notice of approaching LNG ships. Weaver's Cove Energy has stated that it is willing to consider limiting ship transits during peak recreational traffic weekend hours and using early morning periods, subject to tidal conditions. With the agreement of the Coast Guard and the pilots, Weaver's Cove Energy would also look to eventually using nighttime transits for the LNG ships, which would further reduce the impact to boaters.

Several commentors have expressed the concern that local communities would have to bear some of the costs of ensuring the security of the LNG facility and the LNG vessel while in transit and unloading at the dock. In response to the need for increased resources, the Marine Safety Office Providence has submitted a Resource Change Proposal to Coast Guard Headquarters that outlines the additional resources required by the local Coast Guard. The potential costs to the states and local communities have not yet been estimated. However, as an indication of these costs, KeySpan LNG has estimated state and local security costs for LNG deliveries to Providence at $40,000 to 50,000 per trip, based on the resources required in the Coast Guard's Vessel Transit Security Plan. The security practices presently employed to secure the LNG vessel transit through Boston Harbor to the Distrigas facility in Everett, Massachusetts, also provide an indication of the potential magnitude of the costs involved. A recent report for Congress (Parfomak, 2003) indicates that the security costs per ship to the Everett facility are approximately $80,000, of which $37,500 is covered by state and local governments. Weaver's Cove Energy suggests that it should be held to a standard similar to that agreed to by Distrigas in respect of Distrigas' LNG terminal in Everett, Massachusetts. Both pre- and post-9/11, Distrigas has underwritten the entire cost of fire and police details provided by the City of Everett at the Everett marine terminal during the unloading of LNG tankers. Distrigas and the Massachusetts Office of Public Safety agreed on a cost sharing proposal regarding increased state expenditures associated with enhanced security measures. Although it has not seen the contents of this agreement, Weaver's Cove Energy believes it should be possible to enter into a similar agreement covering the proposed security operations at the Fall River location and during the transit of Narragansett Bay. Nevertheless, to better define the potential burden on the local communities, **we recommend that:**

- **Weaver's Cove Energy provide a comprehensive plan identifying the mechanisms for funding all project-specific security/emergency management costs that would be imposed on state and local agencies. In addition to the funding of direct transit-related security/emergency management costs, this comprehensive plan should include funding mechanisms for the capital costs associated with any necessary security/emergency management equipment and personnel base. This plan should be filed with the Secretary <u>prior to initial site preparation</u> for review and approval by the Director of OEP.**

4.12.5.3 LNG Ship Safety

Since 1959, LNG has been transported by ship without a major release of cargo or a major accident involving an LNG ship. Starting in 1971, LNG began arriving at the Distrigas facility in Everett, Massachusetts. To date, more than 450 cargoes, with volumes ranging from 60,000 to 125,000 m^3, have been delivered into the Port of Boston without incident. During 2003, a total of 506 billion cubic feet (204 cargos) of LNG was imported into the United States. For 30 years, LNG shipping operations have been safely conducted in the United States.

The world's LNG ship fleet numbers 151, with an additional 57 ships contracted for delivery by 2006. During the last 40 years, LNG ships have made over 33,000 voyages and safely transported over 2.72 billion cubic meters of LNG. This includes over 1,500 voyages to or from United States ports. Currently, all of the ships in the LNG fleet operate under a foreign flag with foreign crews. A foreign flag ship must have a Certificate of Compliance inspection by the Coast Guard to ensure compliance with International safety standards.

History

During the 33,000 voyages that have been completed since the inception of LNG maritime transportation, there have been only eight significant incidents involving LNG ships, none of which resulted in spills due to rupturing of the cargo tanks. These incidents are described below:

- ***Pollenger*** had an LNG spill onto the steel cover of cargo tank number one during unloading at Everett, Massachusetts in April 1979. The spill caused cracking of the steel plate.

- ***Mostafa Ben Boulaid*** had a check valve fail when unloading at Cove Point, Maryland, in April 1979, releasing a small quantity of LNG onto the ship and causing some minor fracture of the deck plating. Activation of the ship's safety systems (i.e., the emergency shutdown system and water spray system), along with excellent response of the crew, kept the incident from propagating, thus minimizing any serious damage.

- ***El Paso Paul Kayser*** grounded on a rock in June 1979 in the Straits of Gibraltar during a loaded voyage from Algeria to the United States. Extensive bottom damage to the ballast tanks resulted; however, the cargo tanks were not damaged, and no cargo was released. The complete cargo of LNG was subsequently transferred to another LNG ship and delivered to its United States destination.

- ***LNG Libra's*** propeller shaft fractured while the ship was en route to Japan with a full cargo in October 1980. The ship was taken under tow, and the cargo was safely transferred to another LNG ship and delivered to its destination.

- ***LNG Taurus*** grounded in December 1980 near the entrance to Taboata Harbor, Japan. The grounding resulted in extensive bottom damage, but the cargo tanks were not affected. The ship was refloated and the cargo unloaded.

- ***Isabella*** had LNG spill onto its deck due to a cargo tank overflow in June 1985, causing severe cracking of the steelwork. The spill had been attributed to a cargo valve failure during discharging of cargo.

- ***Tellier*** was blown from its docking berth at Skikda, Algeria in February 1989 during severe winds causing damage to the loading arms and the ship and shore piping. The cargo loading had been secured just before the wind struck, but the loading arms had not been drained. Consequently, the LNG remaining in the loading arms spilled onto the deck causing fracture of some plating.

- ***Norman Lady*** was struck by the USS Oklahoma City nuclear submarine while rising to periscope depth near the Strait of Gibraltar in November 2002. The 87,000 cubic meter LNG tanker, which had just unloaded its cargo at Barcelona, Spain, sustained only minor damage to the outer layer of its double hull but not to its cargo tanks.

There have also been some incidents that involved the release of small quantities of LNG, such as minor leaks from seals and gaskets, some of which required that operations be temporarily stopped in order to rectify the malfunction.

Vessel Construction

In 1980, at the initial peak of LNG import activity in the United States, the Coast Guard published the report, *Liquefied Natural Gas and Liquefied Petroleum Gas – Views and Practices – Policy and Safety.* The report summarized the Coast Guard's extensive research into the safety hazards of LNG and its view that "...the nature of both LNG and LPG presents an acceptable risk for transportation in maritime commerce." This is due to the fact that LNG ships are well constructed, robust vessels designed to withstand low-energy type incidents that are prevalent in harbors and during docking operations. Moreover, safety measures, both equipment and training, are planned and designed into these LNG ships to prevent or control all types of potential incidents.

The insulation of cargo tanks on LNG carriers is a complex assembly of many layers. The relief valve capacity of LNG carriers is designed to compensate for over-pressure caused by fire. The potential that impingement by a cryogenic liquid could cause brittle fracture of the ship's hull was known to the Coast Guard in the mid-1970s when the U.S. regulation for LNG carriers in 49 CFR Part 154 were being developed. Accordingly, the regulations require the use of special crack-arresting steel in strategic locations throughout the vessel's hull. LNG carriers used in U.S. waters must also be constructed in accordance with the IMO Code for the Construction and Equipments of Ships Carrying Liquefied Gases in Bulk. This standard requires that the vessel inner hull adjacent to the cargo tanks be protected against contact from liquid cargo through a combination of proper material selection, adequate insulation, and use of heating systems.

As required by the IMO conventions and design standards, hold spaces and insulation areas on an LNG carrier are equipped with gas detection and low temperature alarms. These devices monitor for leaks of LNG into the insulation between primary and secondary LNG cargo tank barriers. In addition, hazard detection systems are also provided to monitor the hull structure adjacent to the cargo tank, compressor rooms, motor rooms, cargo control rooms, enclosed spaces in the cargo area, specific ventilation hoods and gas ducts, and air locks.

LNG carriers are equipped with a firewater system with the ability to supply at least two jets of water to any part of the deck in the cargo area and parts of the cargo containment and tank covers above-deck. A water spray system is also available for cooling, fire prevention, and crew protection in specific areas. In addition, certain areas of LNG carriers are fitted with dry chemical powder-type extinguishing systems and CO_2 smothering systems for fighting fires.

Unlike many conventional crude oil tankers, all LNG ships used to deliver LNG to this proposed project would have double-hull construction, with the inner and outer hulls separated by about 10 feet. Furthermore, the cargo tanks are normally separated from the inner hull by a layer of insulation approximately 1-foot thick. As a result, many grounding incidents severe enough to cause a cargo spill on a single-bottom oil tanker would be unable to penetrate both inner and outer hulls of an LNG ship. An earlier Federal Power Commission (FPC, predecessor to the FERC) study estimated that the double-bottom of an LNG ship would be sufficient to prevent cargo tank penetration in about 85 percent of the cases that penetrated a single-bottom oil tanker.

The probability of an LNG ship sustaining cargo tank damage in a collision would depend on several factors – the displacement and construction of both the struck and striking vessels, the velocity of the striking vessel and its angle of impact with the struck vessel, and the location of the point of impact. The previous FPC study estimated the additional protection afforded by the double-hull would be effective in low energy collisions, overall it would prevent cargo tank penetration in about 25 percent of the cases that penetrated a single-hull oil tanker.

In 1995, to assist the Coast Guard in San Juan, Puerto Rico, EcoEléctrica L.P. prepared an analysis of the damage that could result from an oil tanker striking an LNG ship at berth (FERC, 1996). The analysis assumed a 125,000 m^3 LNG ship and an 82,000 dead weight ton tanker carrying number 6 fuel oil without tug assistance. The analysis determined the minimum striking speed to penetrate the cargo tanks of an LNG ship for a range of potential collision angles. The resulting minimum striking speeds are presented in table 4.12.5-2 for the two principal cargo systems.

TABLE 4.12.5-2

Minimum Striking Speed to Penetrate LNG Cargo Tanks

	Minimum Striking Speed (knots)	
Angle of Impact	Spherical Tanks	Membrane Tanks
Greater than 60 degrees	4.5	3
45 degrees	6.3	4
30 degrees	9	6
15 degrees	18	12

For membrane tanks, the critical beam-on striking speed is 3.0 knots, and for spherical tanks, the critical on-beam speed is 4.5 knots. For both containment types, lower angles of impact result in much greater minimum striking speeds to penetrate LNG cargo tanks. In the July/August, 2002 issue of the "LNG Journal", the SIGTTO General Manager provides a table that shows the critical speed necessary for a 20,000-ton vessel to puncture the outer hull of an LNG carrier is 7.3 knots. For a 93,000-ton ship, the impact speed is 3.2 knots. In neither case does such an impact result in damage to the LNG cargo containment system or the release of LNG.

Hazards

In the event of a collision or allision of sufficient magnitude to rupture an LNG cargo tank, it is likely that sparks or flames would ignite the flammable vapors at the spill site. In a grounding of

sufficient magnitude to rupture an LNG cargo tank, the damage would occur under water and the potential for ignition would be less than for collisions or allisions. In this case, an LNG spill would rapidly vaporize on water and form a potentially flammable cloud. If not ignited, the flammable vapor cloud would drift downwind until the effects of dispersion would dilute the vapors below the lower flammable limit for methane. The maximum range of potentially flammable vapors (i.e., the distance to the lower flammable limit) is a function of the volume of LNG spilled, the rate of the spill, and the prevailing meteorological conditions. If the flammable vapor cloud encountered an ignition source, the cloud would burn back to the spill site.

The segment of the transit from the mouth of Narragansett Bay through the East Passage to Sandy Point is relatively wide and deep. From Sandy Point through Mount Hope Bay and up the Taunton River to the LNG terminal site, the federal navigation channel has an authorized depth of 35 feet and a minimum width of 400 feet. The generally even and soft bottom without rocky protrusions makes an LNG spill from cargo tanks highly unlikely in a grounding incident.

The final EIS for the Calcasieu LNG Project (Lake Charles, LA) (September 1976) analyzed the maximum range of a flammable vapor cloud and hazardous radiation levels from an instantaneous one-tank spill. As was consistent with risk analyses at that time and for nearly 25 years thereafter, the instantaneous spillage of one cargo tank was considered to be the "worst case" scenario. Physical constraints on maximum vessel speeds and maximum depths of penetration required to rupture one LNG cargo tank render the possibility of an instantaneous release of more than one cargo tank to be implausible. This is not to imply that the loss of multiple cargo tanks could never occur, but that the extent of the hazard would not exceed that of the instantaneous spillage of one tank.

For an instantaneous one-tank spill with ignition, the final EIS for the Calcasieu LNG Project estimated that a hazardous thermal radiation level of 5,300 Btu/hr-ft^2 would extend 3,595 feet from the center of the spill. For an instantaneous one-tank spill without ignition, the final EIS for the Yukon Pacific LNG Project (FERC, 1995) estimated that potentially flammable vapors could travel up to 3.3 miles with a 10 mph wind and typical atmospheric stability.

In October 2001, the use of a one-tank instantaneous release as the "worst case" scenario was re-examined by Quest Consultants, Inc. (Quest) as part of an effort by the DOE to determine the hazards associated with reopening the Distrigas LNG import terminal following the terrorist attacks of September 11, 2001. It was determined that time-release spills through 1-meter and 5-meter diameter holes would more accurately simulate credible "worst case" damage scenarios. Maximum flammable vapor cloud and radiation hazards were calculated for the two spill scenarios. For a spill on water with ignition, the maximum distance to a radiant flux level of 1,500 Btu/ft^2-hr was estimated to be 1,770 feet. For a spill on water without ignition, a flammable vapor cloud of 2.5 miles was estimated. In November 2003, in response to comments concerning its October 2001 study, Quest clarified that its study only applied to LNG spills resulting from a collision with a large ship in Boston's Outer Harbor where waves would restrict the spreading of LNG on water.

During the past year, there has been an emergence of studies by various parties to define the "worst case" scenario that would result from a deliberate, terrorist attack on an LNG vessel and the subsequent release of cargo. Distances have been estimated to range from 1,770 to 4,200 feet for a thermal radiation level of 1,500 Btu/ft^2-hr. Part of the reason for the apparent discrepancies is the lack of large-scale historical incidents, and the need to extrapolate small-scale field test data to a worst case event. This inevitably leads to differing conservative assumptions among the various parties. For example, some models calculate a time-release cargo discharge through 1-meter or 5-meter diameter holes, while others assume that the cargo tank empties instantaneously.

As a result, the FERC commissioned a study by ABSG Consultants to search and review the literature on experimental LNG spills and on consequence methodologies that are applicable to modeling incidents of LNG spills on water. Further, the goal of the study was to identify appropriate methods for estimating flammable vapor and thermal radiation hazard distances for potential LNG vessel cargo releases during transit and while at berth. The resulting study, *Consequence Assessment Methods for Incidents Involving Releases from Liquefied Natural Gas Carriers*, was released for public comment on May 14, 2004. On June 18, 2004, staff's responses to comments on the consequence assessment methods were issued. As discussed in greater detail in staff's responses, various components of the consequence assessment methodologies were revised based on comments received. The revised study provides the methodology for calculating: 1) the rate of release of LNG from a cargo tank penetration for various sized holes; 2) the spreading of an unconfined LNG pool on water for both continuous spills and rapid (nearly instantaneous) releases; 3) the rate of vapor generation from a unconfined spill on water; 4) thermal radiation distances for LNG pool fires on water; and 5) and flammable vapor dispersion distances.

A detailed evaluation of the consequences of a terrorist attack on a modern membrane LNG tanker was prepared by Lloyd's Register North America for the Weaver's Cove LNG Project and filed under CEII. The study evaluated the consequences of attacks on an LNG ship by missiles and explosives. Finite element analysis was used to evaluate the effect of various sized charges on both the outer and inner hulls. A 1-meter diameter hole of the inner hull at the waterline was found to be the average most probable "worst case" scenario for hazard consequence assessments. This finding is consistent with the attack on the double-hull oil tanker *Limberg* which caused greater than a 5-meter diameter hole on the outer hull but only minor damage to the inner hull. A failure modes and effects analysis was used to understand internal LNG release characteristics; and a residual strength analysis used to investigate damage scenarios for a loaded LNG tanker.

In December 2004, the DOE released a study by Sandia National Laboratories, *Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water*. The report included an LNG cargo tank breach analysis using modern finite element modeling and explosive shock physics modeling to estimate a range of breach sizes for credible accidental and intentional LNG spill events. The analysis of accidental events found that groundings and low speed collisions could result in minor ship damage but not a cargo spill; while high speed collisions could cause a 0.5 to 1.5 m^2 cargo tank breach area. For intentional scenarios, the size of the cargo tank hole depends on the location of the ship and source of threat. Intentional breach areas were estimated to range from 2 to 12 m^2. In most cases, an intentional breaching scenario would not result in a nominal hole of more than 5 to 7 m^2, which is a more appropriate range to use in calculating potential hazards from spills.

The Sandia Report also included guidance on risk management for intentional spills, based on the findings that the most significant impacts to public safety and property exist within approximately 500 meters (1,640 feet) of a spill due to thermal hazards from a fire, with lower public health and safety impacts beyond 1,600 meters (5,250 feet). Large, unignited LNG vapor releases were found to be unlikely, but could extend to 2,500 meters (8,200 feet) for nominal intentional spill.

Cascading damage due to brittle fracture from exposure to cryogenic liquid or fire-induced damage to foam insulation was evaluated and while possible under certain conditions is not likely to involve more than two or three cargo tanks. Cascading events are not expected to increase the overall fire hazard by more than 20 to 30 percent (1,920 to 2,080 meters or 6,300 to 6,825 feet), but would increase the expected fire duration. Rapid phase transitions are possible for large spills but the effects would be localized near the spill source and should not cause extensive structural damage.

The methodology described in the ABSG study and revised in staff's responses to comments was used to calculate the thermal radiation and flammable vapor dispersion distances for several holes ranging

in diameter from 1 to 3.9 meters. Based on the penetration of the largest cargo tank of a 140,000 m^3 LNG ship, a potential spill of 23,000 cubic meters is estimated for the volume of LNG above the waterline. The estimated pool spread results and thermal radiation hazard distances are identified in table 4.12.5-3. Thermal radiation calculations are based on an ambient temperature of 50º F, a relative humidity of 50 percent, and a 20 mile per hour wind speed.

TABLE 4.12.5-3

LNG Spills on Water

LNG Release and Spread				
Hole Diameter	1.0 meter	2.5 meters	3.0 meters	3.9 meters
Hole Area	0.8 square meters	5 square meters	7 square meters	12 square meters
Spill Time	94 minutes	15 minutes	10.6 minutes	6.1 minutes
Pool Fire Calculations				
Maximum Pool Radius	340 feet	817 feet	935 feet	1,103 feet
Fire Duration	94 minutes	15 minutes	10.8 minutes	6.5 minutes
Distance to:				
1,600 Btu/ft^2-hr	2,200 feet	4,340 feet	4,810 feet	5,476 feet
3,000 Btu/ft^2-hr	1,710 feet	3,330 feet	3,701 feet	4,206 feet
10,000 Btu/ft^2-hr	1,040 feet	1,970 feet	2,174 feet	2,459 feet

Flammable vapor dispersion calculations were based on an ambient temperature of 50º F, 50 percent relative humidity, a 4.5 mph wind speed and atmospheric stability class F. Based on a 1-meter diameter hole, an unignited release would result in an estimated pool radius of 420 feet. The unignited vapor cloud would extend to 9,030 feet to the lower flammability limit and 12,300 feet to one half the lower flammability limit. It is important to identify certain key assumptions of conditions that must exist in order to achieve the maximum vapor cloud distances. First it would be necessary for an event to create a 1-meter diameter hole by penetrating the outer hull, the inner hull, and cargo containment without ignition. Far more credible is that the event creating a 1-meter diameter hole would also result in a number of ignition sources which would lead to an LNG pool fire and subsequent thermal radiation hazards. It is also unlikely that a flammable vapor cloud could achieve its maximum distance over land surfaces without encountering an ignition source, and subsequently burning back to the source. Flammable vapor dispersion for larger holes was not performed since, realistically, the cloud would not even extend to the maximum distance for a 1-meter diameter hole before encountering an ignition source.

The inbound transit through the East Passage of Narragansett Bay would pass by Newport and Middletown, Rhode Island on the east side, and Jamestown on the west. After turning at Sandy Point, the LNG vessels would pass by Bristol and in the vicinity of the Mount Hope Bridge. The transit within the federal channel through Mount Hope Bay and the Taunton River would pass by Woodman Street and the south of Fall River, the State Pier near the center of Fall River, and the Braga Bridge, and Somerset. Some areas of development along the shoreline in these communities could be within a potential transient hazard area during the LNG vessel transit; while parts of North Fall River would be exposed to a potential hazard while the LNG vessel is at the dock and unloading cargo.

Assuming an LNG vessel would transit the Taunton River at 3 knots while under tug assist, the adjacent communities located within the 4,340 to 4,810-foot distance to the 1,600 Btu/hr-ft^2 thermal radiation level for a nominal 2.5 and 3-meter diameter hole would be exposed to a potential transient hazard for less than 30 minutes. While transiting the East Passage to Sandy Point at 10 knots, the

transient hazard to shoreside communities would be less than 10 minutes. In addition, a temporary hazard would exist around the slip during part of the 10- to 12-hour period while the LNG vessel is at the dock and unloading cargo. For a spill in the vicinity of the dock, approximately 1,600 to 2,100 buildings, including primarily single-family residences but also some multi-family units, would be within this temporary hazardous area. Also located in this area are the William J. Wiley Elementary School, the Highlander Rehab and Nursing Center, the Pleasant View public housing project, the Border City Mills apartment building, and a MassHighway facility.

In addition, the potential impact on infrastructure and industrial development was also evaluated. A thermal radiation level of 10,000 Btu/ft^2-hr is associated with potential damage to equipment and infrastructure. A fire associated with a potential spill in the vicinity of the Weaver's Cove Energy dock, resulting from a nominal cargo tank hole of an intentional event could expose the Somerset power plant, the proposed LNG storage tank, approximately ½ mile of Route 79, and ½ mile of proposed commuter rail to a thermal radiation level of 10,000 Btu/ft^2-hr for 10- to 15-minutes.

For potential spills at the new Brightman Street Bridge and the Braga Bridge, the number of residences, buildings, schools and other facilities located within the 1,600 Btu/ft^2-hr transient hazard area would be approximately 1,600 to 2,300 and 1,200 to 1,600, respectively. At Fall River near Woodman Street, approximately 800 to 1,200 residences would be located in the transient hazard area. Approximately 100 to 300 residences and buildings, including the Roger Williams University Bristol campus, would be located in the transient hazard area at the Mount Hope Bridge. The western-most portions of the U.S. Naval Station in Newport, including the track and field area, would also lie within a 1,600 Btu/hr-ft^2 transient hazard area. The transient hazard area from an LNG vessel spill in the main channel of the East Passage in the vicinity of Newport and Jamestown would not affect most shoreside areas. However, potential spill locations in deepwater areas outside the main channel and closer to shore were also evaluated. For a spill outside the normal route, an estimated 660 to 720 and 420 to 610 residences in Jamestown and Newport, respectively, would fall within these potential transient hazard areas.

The operational restrictions to be imposed by the Northeast Marine Pilots on LNG vessel movements through this area, as well as the requirements that the Coast Guard would impose in its operating plan will minimize the possibility of a hazardous event occurring along the vessel transit.

By focusing on the "worst case" intentional breach scenarios for LNG transportation, there is a tendency to dismiss the potential hazards for other fuels and products commonly transported on our waterways. Some of the previously identified studies that calculate long hazard distances for LNG cargo fires also estimate similarly long distances for gasoline, propane and jet fuel cargo fires. Also, it should not be assumed that the hazard distances identified are the assured outcome of an LNG vessel accident or attack, given the conservatisms in the models and the level of damage required to yield such large scale releases. Further, these estimated "worst case" intentional breach scenarios should not be misconstrued as defining an exclusionary zone. Rather they provide guidance in developing the operating restrictions for LNG vessel movements in the East Passage of Narragansett Bay and the federal navigation channel in Mount Hope Bay and the Taunton River, as well as in establishing potential impact areas for emergency response and evacuation planning.

4.12.6 LNG Truck Safety

Proposed LNG Truck Operations

The proposed LNG terminal would include four outdoor LNG truck loading stations, each with a weigh scale to prevent overfilling. The truck loading area would be equipped with multiple safety

features, both passive and active. Hazard detection would include combustible gas detectors, low temperature sensors potential spill areas, and UV/IR flame detectors. Hazard control would include wheeled and hand-held dry chemical fire extinguisher and fire water hydrants and monitors. Potential LNG spills would be contained and drained by trenches to a remote impoundment sump. Each trailer would also have a high-level petcock to check the LNG level inside the trailer during filling.

The facility is designed to load a maximum of 100 LNG trucks per day; however, an average of about 50 LNG trucks per day would be the normal usage. In comparison, the former use of the site as a petroleum products distribution facility is estimated to have generated up to 210 trucks per day.

The LNG trucks would enter and exit the highway system via the existing plant entrance and exit ramp off Route 79, directly across Main Street from the plant entrance. This is the same route previously used by petroleum product tankers and no change in road geometry is required to accommodate the LNG trucks. Leaving the site, trucks would have direct access to Routes 79 and 24 and Interstate 195. The trucks loaded at these stations would provide an alternative source of LNG for many of the satellite facilities throughout the Northeast that are presently served by the Distrigas LNG facility, as well as a potential source for industrial customers.

LNG Truck Operations in New England

The transportation of LNG by truck from the Distrigas LNG import terminal in Everett, Massachusetts began in 1971. Approximately 250,000 LNG trucks have been loaded at the facility through the end of calendar year 2001 (see table 4.12.6-1). For the 31-year period, this represents an annual average of 8,056 trucks per year. However, the number of LNG truck loadings can vary significantly from year to year, depending on the severity of the weather and the number of LNG ship cargoes delivered to the Distrigas LNG terminal.

TABLE 4.12.6-1

LNG Truck Loadings at the Distrigas LNG Terminal

Year(s)	Trucks	Max/Year
1971-1979	43,694	
1980-1989	95,027	15,656
1990-1999	83,613	12,885
2000-2001	27,397 a/	16,813 a/
Total	249,731	

a/ Estimated from MMBtu truck sendout data.

LNG deliveries by truck have been made to approximately 25 facilities in the northeast, including LNG peakshaving plants, as well as to large and small satellite plants. While the majority of the deliveries are made to facilities in Massachusetts, Rhode Island, and Connecticut, more distant trips are made north to Lewiston, Maine and south to McKee City, New Jersey. The mean distance between Distrigas and the receiving plant is 70 miles.

One of the satellite facilities presently supplied by Distrigas is the Commonwealth Gas LNG plant in Fall River, which receives an average of 200 LNG truck deliveries per year. Loaded LNG trucks from Everett travel south on Route 24 to Fall River, and follow Route 138 to Bradford Avenue to the terminal site on Bay Street.

Restrictions on LNG trucking have been imposed by some local authorities: curfews when children are arriving or leaving school; routing to avoid congested main streets; avoiding certain bridges where a preferred alternative exists; parking restrictions; and prohibition from tunnels. Restrictions on LNG trucking in Fall River have not been established.

When LNG trucking commenced in 1971, six trucking companies served the Distrigas trade. That number subsequently dropped to two, with well over 90 percent of the Distrigas trade handled by Transgas of Lowell, Massachusetts with the remainder by L.P. Transport of Chester, New York.

LNG truck drivers receive one week of training specific to LNG operations. A licensed, experienced, newly hired driver receives a one day classroom session and one day of hands-on truck yard training, followed by three days of on-the-road operation with a fully qualified and experienced LNG truck driver as co-pilot. The "Transgas LNG Safety Handbook" serves as the basic instructional material.

Since May 1983, LNG transporters and operators of storage facilities have participated in an emergency response cooperative agreement -- "LNG Trucking Emergency Response Plan for New England," sponsored by the New England Gas Association. The plan, which has undergone several revisions, divides New England into 15 zones, each having a designated response company with the capability of responding to an LNG trucking emergency with qualified personnel and specialized equipment. The main objectives of the plan are to:

- Provide initial information on the characteristics of LNG;
- Provide a means of contacting personnel trained in the safe handling of LNG and in the proper techniques of handling a damaged LNG truck;
- Identify technical resources available to local authorities responding to the scene of an LNG truck emergency;
- Provide a framework for "responding companies" in the Voluntary Assistance Agreement, which defines the roles and obligations of participating New England shippers, LNG terminals, and LNG truck carriers; and
- Serve as the LNG Truck Emergency Preparedness Plan.

The organization of the plan incorporates the use of: a) LNG truck carriers; b) a zone response network; c) chemical transportation emergency center; and d) an emergency plan committee.

LNG Truck Accident History

While the history of LNG trucking has been free of major incidents, the possibility of an LNG truck accident over the duration of the project cannot be discounted. Unlike conventional gasoline or oil tank trailers, LNG trailers are of a double-shell construction -- an inner tank constructed of a cryogenic alloy to contain the LNG; an outer tank of carbon steel; and an evacuated annular space containing perlite insulation. Stiffening rings are incorporated in the outer shell to improve its structural strength and prevent its collapse. A typical 11,000-gallon tanker has a length of 42 feet, an inner tank diameter of 7 feet 4 inches, and an outer tank diameter of 8 feet. LNG trailer design must comply with the requirements of 49 CFR Part 173. Drivers must meet the training requirements in 49 CFR Part 172.

The LNG trucks have a relatively high center of gravity compared to other petroleum trucks, due to the low density of LNG and the large tank diameter. This feature increases the truck's susceptibility to

over turning accidents in some situations. However, the double-shell construction provides additional damage protection to minimize the potential for a major shell failure and product release.

In 1979, the DOT sponsored a study to quantitatively evaluate the risks associated with the then-current and future levels of LNG trucking from the Distrigas LNG terminal. The study was in part a response to an approval by the DOE in 1978 for a three-fold increase of LNG imports at Everett. The final report, "Assessment of Risks and Risk Control Options Associated with Liquefied Natural Gas Trucking Operations from the Distrigas Terminal, Everett, Massachusetts," was completed by Arthur D. Little, Inc. in June 1979.

The study included an evaluation of all known LNG truck accidents in the United States from 1970 through 1977, alternatives to LNG trucking, and risk control options. While the study found the risks associated with the then-current LNG trucking operations may be fairly low, it presented a number of options which could reduce risk levels even further. It was estimated that the accident rate per mile could be reduced by 60 percent if these recommendations were followed. In fact, the accident rate has dropped by 80 percent.

Table 4.12.6-2 summarizes LNG truck accidents from 1970 through 1977 and 1978 through 2002. The accident rate of the second period decreased by approximately 80 percent compared with the first period.

TABLE 4.12.6-2

LNG Truck Accident Summary

Years	Number of Accidents	Miles Traveled (millions)	Accidents Per Year	Accidents Per Million Miles
1970-1977	13	26	1.6	0.5
1978-2002	8	81 a/	0.3	0.1

a/ Estimated for 1995 through 2002 based on trucking levels.

Rollovers, which accounted for 76 percent (16) of the accidents over the 33-year period, are attributed to the relatively high center of gravity. Only four of the accidents resulted in a loss of product, because of the additional damage protection provided by the double-shell construction. Three were relatively minor leaks from fittings or valves damaged in the accident. In the only accident involving tank damage, 20 percent of the cargo was spilled. None of the releases resulted in an ignition of vapors and subsequent fire. If an LNG truck accident were to occur along the truck route, the potential hazard would depend on the severity of the accident and whether the cargo tank or associated valves sustained damage. This in turn would determine if the evacuation of nearby residences or businesses was necessary as well as what radius to evacuate. From the historical data, LNG truck accidents have resulted in only minor spills without an LNG fire. According to the 2004 Emergency Response Guide, for a large spill of either LNG or LPG, both widely transported throughout New England, the initial evacuation of ½ mile should be considered; while an evacuation of 1 mile should be considered for a truck involved in a fire.

Although the A.D. Little study was prepared in the late 1970s, it is a comprehensive analysis that accurately depicts the LNG trade some 25 years later for several reasons: 1) the LNG trucking levels have remained within the maximum predicted in the report; 2) the LNG truck routes are essentially unchanged other than minor variations to improve safety; 3) the annual mileage has remained within the limits of the study; and 4) the destinations are essentially unchanged (except that five satellite plants in Connecticut have been taken out of service). As a result, the conclusions on the safety of LNG truck transportation

remain valid. Further, the 33 years of operation in New England without a public fatality or the ignition of LNG vapors from an LNG truck spill supports the relative safety of this mode of transportation.

4.12.7 Terrorism and Security Issues

The security requirements for the onshore component of the proposed project are governed by 49 CFR 193, Subpart J - Security. This subpart includes requirements for conducting security inspections and patrols, liaison with local law enforcement officials, design and construction of protective enclosures, lighting, monitoring, alternative power sources, and warning signs. Requirements for maintaining safety of the marine terminal are in 33 CFR 127. Requirements for maintaining security of the marine terminal are in 33 CFR 105.

In the aftermath of the terrorist attacks that occurred on September 11, 2001, terrorism has become a very real issue for the facilities under the Commission's jurisdiction. The FERC, like other federal agencies, is faced with a dilemma in how much information can be offered to the public while still providing a significant level of protection to the facility. Consequently, the FERC has removed energy facility design plans and location information from its website to ensure that sensitive information filed under CEII is not readily available (RM02-4-000 and PL02-1-000 issued February 20, 2003).

Since September 11, 2001, the FERC has been involved with other federal agencies in developing a coordinated approach to protecting the energy facilities of the United States. The FERC continues to coordinate with these agencies, specifically with the Coast Guard to address this issue. The Coast Guard now requires arriving ships to provide them with a 96-hour advance notice of arrival that includes key information about the vessel and its crew which allows the Coast Guard to conduct a terrorism risk assessment and put in place appropriate mitigation before the ship reaches the ship channel. In addition, interstate natural gas companies are actively involved with several industry groups to chart how best to address security measures in the current environment. A Security Task Force has been created and is addressing ways to improve pipeline security practices, strengthen communications within the industry and the interface with government, and extend public outreach efforts.

In September 2002, the DOT's OPS issued non-public guidelines to LNG operators that direct them to develop new security procedures for onshore facilities. Operators were required to prepare a security plan within 6 months that responds to the five threat levels defined by the Office of Homeland Security. OPS conducts subsequent onsite reviews of the security procedures.

On October 22, 2003, the Coast Guard issued a series of six final rules, which promulgated the maritime security requirements of the Marine Transportation Security Act of 2002: Implementation of National Maritime Security Initiatives; Area Maritime Security; Vessel Security; Facility Security; Continental Shelf Facility Security; and the Automatic Identification System. The entire series of rulemakings establishes a new subchapter H in 33 CFR. In support of the rulemakings, the Coast Guard applied a risk-based decision making process to comprehensively evaluate the relative risks of various target and attack mode combinations and scenarios for those vessel types and port facilities that pose a risk of a security incident. This approach provides a more realistic estimation of risk than a simple "worst-case outcome" assessment. Risk management principles acknowledges that while risk generally cannot be eliminated, it can be reduced by adjusting operations to lower consequences, threats, or vulnerability, recognizing that it is easier to reduce vulnerabilities by adding security measures.

On December 29, 2003, all terminal owners or operators subject to 33 CFR 105 were required to submit a *Facility Security Assessment and Facility Security Plan* to the Coast Guard Captain of the Port for review and approval. The Facility Security Plans were required to be implemented no later than July

1, 2004 or for facilities constructed after July 1, 2004, 60 days prior to operations. Some of the principal owner or operator responsibilities include:

- Designating a FSO with a general knowledge of current security threats and patterns, risk assessment methodology, and the responsibility for implementing the Facility Security Plan and Assessment and performing an annual audit for the life of the project;

- Conducting a Facility Security Assessment to identify site vulnerabilities, possible security threats and consequences of an attack, and facility protective measures;

- Developing a Facility Security Plan based on the Facility Security Assessment, with procedures for responding to transportation security incidents, notification and coordination with local, state and federal authorities, prevent unauthorized access; measures and equipment to prevent or deter dangerous substances and devices, training and evacuation;

- Implementing scalable security measures to provide increasing levels of security at increasing MARSEC levels for facility access control, restricted areas, cargo handling, vessel stores and bunkers, and monitoring;

- Conducting security exercises at least once each calendar year and drills at least every 3 months; and

- Reporting of all breaches of security and security incidents.

Increased security awareness has occurred throughout the industry and the nation. President Bush established the Office of Homeland Security with the mission of coordinating the efforts of all executive departments and agencies to detect, prepare for, prevent, protect against, respond to, and recover from terrorist attacks within the United States. The Commission, in cooperation with other federal agencies and industry trade groups, has joined in the efforts to protect the energy infrastructure, including the more than 300,000 miles of interstate natural gas transmission pipeline and associated LNG facilities.

Safety and security are important considerations in any Commission action. The attacks of September 11, 2001 have changed the way pipeline operators as well as regulators must consider terrorism, both in approving new projects and in operating existing facilities. However, the likelihood of future acts of terrorism or sabotage occurring at the proposed LNG import terminal, or at any of the myriad natural gas pipeline or energy facilities throughout the United States is unpredictable given the disparate motives and abilities of terrorist groups. The continuing need to construct facilities to support the future natural gas pipeline infrastructure is not diminished from the threat of any such unpredictable acts.

4.12.8 Pipeline Facilities

The transportation of natural gas by pipeline involves some risk to the public in the event of an accident and subsequent release of gas. The greatest hazard is a fire or explosion following a major pipeline rupture.

Methane, the primary component of natural gas, is colorless, odorless, and tasteless. It is not toxic, but is classified as a simple asphyxiate, possessing a slight inhalation hazard. If breathed in high concentration, oxygen deficiency can result in serious injury or death.

Methane has an ignition temperature of 1,000 degrees Fahrenheit and is flammable at concentrations between 5.0 percent and 15.0 percent in air. Unconfined mixtures of methane in air are not explosive. However, a flammable concentration within an enclosed space in the presence of an ignition source can explode. It is buoyant at atmospheric temperatures and disperses rapidly in air.

4.12.8.1 Safety Standards

The DOT is mandated to provide pipeline safety under Title 49, U.S.C. Chapter 601. The Pipeline and Hazardous Materials Safety Administration's (PHMSA) OPS administers the national regulatory program to ensure the safe transportation of natural gas and other hazardous materials by pipeline. It develops safety regulations and other approaches to risk management that ensure safety in the design, construction, testing, operation, maintenance, and emergency response of pipeline facilities. Many of the regulations are written as performance standards which set the level of safety to be attained and allow the pipeline operator to use various technologies to achieve safety. The PHMSA ensures that people and the environment are protected from the risk of pipeline incidents. This work is shared with state agency partners and others at the federal, state, and local level. Section 5(a) of the Natural Gas Pipeline Safety Act provides for a state agency to assume all aspects of the safety program for intrastate facilities by adopting and enforcing the federal standards, while section 5(b) permits a state agency that does not qualify under section 5(a) to perform certain inspection and monitoring functions. A state may also act as DOT's agent to inspect interstate facilities within its boundaries; however, the DOT is responsible for enforcement action. The majority of the states have either 5(a) certifications or 5(b) agreements, while nine states act as interstate agents.

The DOT pipeline standards are published in Parts 190-199 of Title 49 of the CFR. Part 192 of 49 CFR specifically addresses natural gas pipeline safety issues.

Under a Memorandum of Understanding on Natural Gas Transportation Facilities (Memorandum) dated January 15, 1993 between the DOT and the FERC, the DOT has the exclusive authority to promulgate federal safety standards used in the transportation of natural gas. Section 157.14(a)(9)(vi) of the FERC's regulations require that an applicant certify that it will design, install, inspect, test, construct, operate, replace, and maintain the facility for which a certificate is requested in accordance with federal safety standards and plans for maintenance and inspection, or shall certify that it has been granted a waiver of the requirements of the safety standards by the DOT in accordance with section 3(e) of the Natural Gas Pipeline Safety Act. The FERC accepts this certification and does not impose additional safety standards other than the DOT standards. If the Commission becomes aware of an existing or potential safety problem, there is a provision in the Memorandum to promptly alert DOT. The Memorandum also provides for referring complaints and inquiries made by state and local governments and the general public involving safety matters related to pipeline under the Commission's jurisdiction.

The FERC also participates as a member of the DOT's Technical Pipeline Safety Standards Committee which determines if proposed safety regulations are reasonable, feasible, and practicable.

The pipeline and aboveground facilities associated with the Weaver's Cove LNG Project must be designed, constructed, operated, and maintained in accordance with the DOT Minimum Federal Safety Standards in 49 CFR Part 192. The regulations are intended to ensure adequate protection for the public and to prevent natural gas facility accidents and failures. Part 192 specifies material selection and qualification, minimum design requirements, and protection from internal, external, and atmospheric corrosion.

Part 192 also defines area classifications, based on population density in the vicinity of the pipeline, and specifies more rigorous safety requirements for populated areas. The class location unit is

an area that extends 220 yards on either side of the centerline of any continuous 1 mile length of pipeline. The four area classifications are defined as follows:

Class 1	Location with 10 or fewer buildings intended for human occupancy.
Class 2	Location with more than 10 but less than 46 buildings intended for human occupancy.
Class 3	Location with 46 or more buildings intended for human occupancy or where the pipeline lies within 100 yards of any building, or small well-defined outside area occupied by 20 or more people on at least 5 days a week for 10 weeks in any 12-month period.
Class 4	Location where buildings with four or more stories aboveground are prevalent.

Class locations representing more populated areas require higher safety factors in pipeline design, testing, and operation. Pipelines constructed on land in Class 1 locations must be installed with a minimum depth of cover of 30 inches in normal soil and 18 inches in consolidated rock. All pipelines installed in navigable rivers, streams and harbors must have a minimum cover of 48 inches in soil or 24 inches in consolidated rock. Class 2, 3, and 4 locations, as well as drainage ditches of public roads and railroad crossings, require a minimum cover of 36 inches in normal soil and 24 inches in consolidated rock.

Class locations also specify the maximum distance to a sectionalizing block valve (e.g., 10.0 miles in Class 1, 7.5 miles in Class 2, 4.0 miles in Class 3, and 2.5 miles in Class 4). Pipe wall thickness and pipeline design pressures, hydrostatic test pressures, MAOP, inspection and testing of welds, and frequency of pipeline patrols and leak surveys must also conform to higher standards in more populated areas. Preliminary class locations for Weaver's Cove Energy's pipeline facilities have been developed based on the relationship of the pipeline centerline to other nearby structures and manmade features. The Northern Pipeline would be constructed in about 3.26 miles of Class 3 locations and about 0.33 mile of Class 1 locations. The Western Pipeline would be constructed in about 2.37 miles of Class 3 locations and about 0.15 mile of Class 1 locations. However, all of the pipeline would be constructed to Class 3 specifications. If a subsequent increase in population density adjacent to the right-of-way indicates a change in class location for the pipeline, Weaver’s Cove Energy would be required to reduce the MAOP or replace the segment with pipe of sufficient grade and wall thickness to comply with the DOT code of regulations for the new class location.

In 2002, Congress passed an act to strengthen the Nation's pipeline safety laws. The Pipeline Safety Improvement Act of 2002 (HR 3609) was passed by Congress on November 15, 2002, and signed into law by the President in December, 2002. No later than December 17, 2004, gas transmission operators must develop and follow a written integrity management program that contains all the elements described in §192.911 and addresses the risks on each covered transmission pipeline segment Specifically, the law establishes an integrity management program which applies to all high consequence areas (HCAs). The DOT (68 FR 69778, 69 FR 18228, and 69 FR 29903) defines HCAs as they relate to the different class zones, potential impact circles, or areas containing an identified site as defined in §192.903 of the DOT regulations.

OPS published a series of rules from August 6, 2002 to May 26, 2004 (69 Federal Register [FR] 29903), that defines HCAs where a gas pipeline accident could do considerable harm to people and their property and requires an integrity management program to minimize the potential for an accident. This

definition satisfies, in part, the Congressional mandate in 49 U.S.C. 60109 for OPS to prescribe standards that establish criteria for identifying each gas pipeline facility in a high-density population area.

The HCAs may be defined in one of two ways. In the first method an HCA includes:

- current class 3 and 4 locations;
- any area in Class 1 or 2 where the potential impact radius[25] is greater than 660 feet and there are 20 or more buildings intended for human occupancy within the potential impact circle;[26] or
- any area in Class 1 or 2 where the potential impact circle includes an identified site.[27]

In the second method an HCA includes any area within a potential impact circle which contains:

- 20 or more buildings intended for human occupancy; or
- an identified site.

Once a pipeline operator has determined the HCAs on its pipeline, it must apply the elements of its integrity management program to those segments of the pipeline within HCAs. The DOT regulations specify the requirements for the integrity management plan at § 192.911. The pipeline integrity management rule for HCAs requires inspection of the entire pipeline in HCAs every 7 years.

Part 192 prescribes the minimum standards for operating and maintaining pipeline facilities, including the requirement to establish a written plan governing these activities. Under section 192.615, each pipeline operator must also establish an emergency plan that includes procedures to minimize the hazards in a natural gas pipeline emergency. Key elements of the plan include procedures for:

- receiving, identifying, and classifying emergency events, gas leakage, fires, explosions, and natural disasters;
- establishing and maintaining communications with local fire, police, and public officials, and coordinating emergency response;
- emergency shutdown of system and safe restoration of service;
- making personnel, equipment, tools, and materials available at the scene of an emergency; and
- protecting people first and then property, and making them safe from actual or potential hazards.

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[25] The potential impact radius is calculated as the product of 0.69 and the square root of the MAOP of the pipeline in psi multiplied by the pipeline diameter in inches.

[26] The potential impact circle is a circle of radius equal to the potential impact radius.

[27] An identified site is an outside area or open structure that is occupied by 20 or more persons on at least 50 days in any 12-month period; a building that is occupied by 20 or more persons on at least 5 days a week for any 10 weeks in any 12-month period; or a facility that is occupied by persons who are confined, are of impaired mobility, or would be difficult to evacuate.

The proposed lateral pipelines, which are expected to be operated under an agreement to be negotiated between Mill River Pipeline and Algonquin, would be operated according to standards and procedures that have been approved by the DOT.

The pipeline would be patrolled and inspected on the ground on a periodic basis per DOT requirements or better. The frequency of these inspections would be affected by activity along the pipeline route such as construction or possible encroachment. These inspections would identify conditions indicative of pipeline leaks, evidence of pipeline damage or deterioration, damage to erosion controls, loss of cover, third party activities or conditions which may presently or in the future affect pipeline integrity, safety, or operation of the pipeline. The pipeline system would participate in the state "One Call" system.

Part 192 requires that each operator must establish and maintain liaison with appropriate fire, police, and public officials to learn the resources and responsibilities of each organization that may respond to a natural gas pipeline emergency, and to coordinate mutual assistance. The operator must also establish a continuing education program to enable customers, the public, government officials, and those engaged in excavation activities to recognize a gas pipeline emergency and report it to appropriate public officials. Weaver's Cove Energy would maintain liaisons with public authorities and local utilities and a current contact list would be included in the emergency response plan. Weaver's Cove Energy's liaison program would include: periodic fire fighting demonstrations emphasizing when and when not to extinguish a natural gas fire during an emergency and how to extinguish different types of natural gas fires; periodic visits with emergency response agencies (fire and police) to inform them of the nature and operation conditions of the pipeline facilities and to coordinate emergency response in the event of an accident; special informational meetings and training at the request of the municipality; periodic literature distribution to the emergency response agencies listing emergency telephone numbers for Weaver's Cove Energy and other pertinent data; and providing maps to police and fire departments showing the location of the pipeline within the boundaries of their communities.

4.12.8.2 Pipeline Accident Data

Since February 9, 1970, 49 CFR Part 191 has required all operators of transmission and gathering systems to notify the DOT of any reportable incident and to submit a report on form F7100.2 within 20 days. Reportable incidents are defined as any leaks that:

- caused a death or personal injury requiring hospitalization;
- required taking any segment of transmission line out of service;
- resulted in gas ignition;
- caused estimated damage to the property of the operator, or others, or both, of a total of $5,000 or more;
- required immediate repair on a transmission line;
- occurred while testing with gas or another medium; or
- in the judgment of the operator was significant, even though it did not meet the above criteria.

The DOT changed reporting requirements after June 1984 to reduce the amount of data collected. Since that date, operators must only report incidents that involve property damage of more than $50,000, injury, death, release of gas, or that are otherwise considered significant by the operator. Table 4.12.8-1 presents a summary of incident data for the 1970 to 1984 period, as well as more recent incident data for 1986 through 2003, recognizing the difference in reporting requirements. The 14.5-year period from 1970 through June 1984, which provides a larger universe of data and more basic report information than subsequent years, has been subject to detailed analysis, as discussed in the following sections.[28]

During the 14.5-year period, 5,862 service incidents were reported over the more than 300,000 total miles of natural gas transmission and gathering systems nationwide. Service incidents, defined as failures that occur during pipeline operation, have remained fairly constant over this period with no clear upward or downward trend in annual totals. In addition, 2,013 test failures were reported. Correction of test failures removed defects from the pipeline before operation.

TABLE 4.12.8-1

Natural Gas Service Incidents by Cause

	Incidents per 1,000 miles of Pipeline (percentage)	
Cause	1970-1984	1986-2003
Outside force	0.70 (53.8)	0.10 (38.4)
Corrosion	0.22 (16.9)	0.06 (23.1)
Construction or material defect	0.27 (20.8)	0.04 (15.4)
Other	0.11 (8.5)	0.06 (23.1)
Total	1.30	0.26

Additional insight into the nature of service incidents may be found by examining the primary factors that caused the failures. Table 4.12.8-1 provides a percentage distribution of the causal factors as well as the annual frequency of each factor per 1,000 miles of pipeline in service.

The dominant incident cause is outside forces, constituting 53.8 percent of all service incidents. Outside forces incidents result from the encroachment of mechanical equipment such as bulldozers and backhoes; earth movements due to soil settlement, washouts, or geologic hazards; weather effects such as winds, storms, and thermal strains; and willful damage. Table 4.12.8-2 shows that human error in equipment usage was responsible for approximately 75 percent of outside forces incidents. Since April 1982, operators have been required to participate in "One Call" public utility programs in populated areas to minimize unauthorized excavation activities in the vicinity of pipelines. The "One Call" program is a service used by public utilities and some private sector companies (e.g., oil pipelines and cable television) to provide preconstruction information to contractors or other maintenance workers on the underground location of pipes, cables, and culverts. The 1986 through 2003 data show that the portion of incidents caused by outside forces has decreased to 38.4 percent.

TABLE 4.12.8-2

Outside Forces Incidents by Cause (1970-1984)

Cause	Percent
Equipment operated by outside party	67.1
Equipment operated by or for operator	7.3
Earth movement	13.3
Weather	10.8
Other	1.5

[28] Jones, D.J., G.S. Kramer, D.N. Gideon, and R.J. Eiber, 1986. "An Analysis of Reportable Incidents for Natural Gas Transportation and Gathering Lines 1970 Through June 1984." NG-18 Report No. 158, Pipeline Research Committee of the American Gas Association.

The pipelines included in the data set in table 4.12.8-1 vary widely in terms of age, pipe diameter, and level of corrosion control. Each variable influences the incident frequency that may be expected for a specific segment of pipeline.

The frequency of service incidents is strongly dependent on pipeline age. While pipelines installed since 1950 exhibit a fairly constant level of service incident frequency, pipelines installed before that time have a significantly higher rate, partially due to corrosion. Older pipelines have a higher frequency of corrosion incidents, since corrosion is a time-dependent process. Further, new pipe generally uses more advanced coatings and cathodic protection to reduce corrosion potential.

Older pipelines have a higher frequency of outside forces incidents partly because their location may be less well known and less well marked than newer lines. In addition, the older pipelines contain a disproportionate number of smaller diameter pipelines, which have a greater rate of outside forces incidents. Small diameter pipelines are more easily crushed or broken by mechanical equipment or earth movements.

Table 4.12.8-3 clearly demonstrates the effectiveness of corrosion control in reducing the incidence of failures caused by external corrosion. The use of both an external protective coating and a cathodic protection system, required on all pipelines installed after July 1971, significantly reduces the rate of failure compared to unprotected or partially protected pipe. The data shows that bare, cathodically protected pipe actually has a higher corrosion rate than unprotected pipe. This anomaly reflects the retrofitting of cathodic protection to actively corroding spots on pipes.

TABLE 4.12.8-3

External Corrosion by Level of Control (1970-1984)

Corrosion Control	Incidents per 1,000 miles per Year
None-bare pipe	0.42
Cathodic protection only	0.97
Coated only	0.40
Coated and cathodic protection	0.11

4.12.8.3 Impact on Public Safety

The service incident data summarized in table 4.12.8-1 include pipeline failures of all magnitudes with widely varying consequences. Approximately two-thirds of the incidents were classified as leaks, and the remaining third classified as ruptures, implying a more serious failure.

Table 4.12.8-4 presents the average annual fatalities that occurred on natural gas transmission and gathering lines from 1970 to 2003. Fatalities between 1970 and June 1984 have been separated into employees and nonemployees, to better identify a fatality rate experienced by the general public. Of the total 5.0 nationwide average, fatalities among the public averaged 2.6 per year over this period. The simplified reporting requirements in effect after June 1984 do not differentiate between employees and nonemployees. However, the data show that the total annual average for the period 1984 through 2003 decreased to 3.8 fatalities per year. Subtracting two major offshore incidents in 1989, which do not reflect the risk to the onshore public, yields a total annual rate of 2.9 fatalities per year for this period.

TABLE 4.12.8-4

Annual Average Fatalities - Natural Gas Transmission and Gathering Systems a/, b/

Year	Employees	Nonemployees	Total
1970-June 1984	2.4	2.6	5.0
1984-2003 c/	-	-	3.8
1984-2003 c/	-	-	2.9 d/

a/ 1970 through June 1984 - American Gas Association, 1986.
b/ DOT Hazardous Materials Information System.
c/ Employee/nonemployee breakdown not available after June 1984.
d/ Without 18 offshore fatalities occurring in 1989: 11 fatalities resulted from a fishing vessel striking an offshore pipeline and 7 fatalities resulted from explosion on an offshore production platform.

The nationwide totals of accidental fatalities from various manmade and natural hazards are listed in table 4.12.8-5 in order to provide a relative measure of the industry-wide safety of natural gas pipelines. Direct comparisons between accident categories should be made cautiously, however, because individual exposures to hazards are not uniform among all categories. Nevertheless, the average 2.6 public fatalities per year is relatively small considering the more than 300,000 miles of transmission and gathering lines in service nationwide. Furthermore, the fatality rate is approximately two orders of magnitude (100 times) lower than the fatalities from natural hazards such as lightning, tornados, floods, earthquakes, etc.

The available data show that natural gas pipelines continue to be a safe, reliable means of energy transportation. Based on approximately 302,000 miles in service, the rate of public fatalities for the nationwide mix of transmission and gathering lines in service is 0.01 per year per 1,000 miles of pipeline. Using this rate, the pipeline facilities associated with the Weaver's Cove LNG Project might result in a public fatality every 16,000 years. This would represent a slight increase in risk to the nearby public.

TABLE 4.12.8-5

Nationwide Accidental Deaths a/

Type of Accident	Fatalities
All accidents	90,523
Motor vehicles	43,649
Falls	14,985
Drowning	3,488
Poisoning	9,510
Fires and burns	3,791
Suffocation by ingested object	3,206
Tornado, flood, earthquake, etc. (1984 to 1993 average)	181
All liquid and gas pipelines (1978 to 1987 average) b/	27
Gas transmission and gathering lines Nonemployees only (1970 to 1984 average) c/	2.6

a/ All data, unless otherwise noted, reflects 1996 statistics from the U.S. Department of Commerce, Bureau of the Census, "Statistical Abstract of the United States 118th Edition."
b/ U.S. Department of Transportation, "Annual Report on Pipeline Safety - Calendar Year 1987."
c/ American Gas Association, 1986.

4.12.9 Additional Safety Issues Identified in Scoping

Remote Siting - We received a number of comments which referenced that congress passed legislation on the need to site LNG facilities in remote locations. The comments are referring to the Pipeline Safety Act of 1979 (PL96-129, November 30, 1979) which directed the Secretary of Transportation to issue minimum safety standards for determining the location, design, installation, construction, initial inspection and initial testing of any new LNG facility. Section 6(d) of the Pipeline Safety Act listed several factors to consider in prescribing the rules, including "(F) the need to encourage remote siting."

On January 30, 1980, DOT issued the final rule that established Federal Safety Standards for LNG Facilities. Part 193.2057 requires the establishment of thermal exclusion zones around the facility and Part 193.2059 requires flammable vapor dispersion exclusion zones in order to protect people who live or work near the facility. The DOT stated that the safety advantages of "remote siting" were essentially obtained by compliance with the exclusion zone provisions, but without incurring such potential drawbacks as poor positioning relative to exiting pipelines, gas markets, or navigational needs.

On September 8, 2004, the Mayor of Fall River, Massachusetts, filed a petition with the DOT requesting that the Secretary issue regulations prescribing minimum safety standards for the location of new LNG facilities, as required by the Pipeline Safety Act of 1979, that specifically address: the projected population and demographic characteristics of the location; the existing and proposed land use near the location; the physical aspects of the location; the public safety capabilities of the community; and the need to encourage remote siting. The petition includes proposed regulations stating that no LNG facility shall be located at a site where the existing or estimated future population within 1 mile of the facility exceeds 5,000 individuals, or 1,000 individuals under the age of 12 or over 65; or is within 1 mile of a school, day care center, nursing home, or hospital. The proposed regulations also address proximity to highways and commuter rail lines, bridge closures, adequacy of local emergency services, and that offshore sites be given preference over onshore sites in populated areas. A joint petition was also filed by the Rhode Island Attorney General and Massachusetts Attorney General on September 8, 2004.

Several smaller LNG tanks - One comment suggested that several smaller tanks could be used or the tank compartmentalized to increase safety. If two 600,000 barrel LNG storage tanks were to be used instead of the proposed single 1,250,000 barrel tank, each individual tank would have a slightly reduced footprint and somewhat shorter thermal radiation exclusion zones than the proposed tank. But collectively, two tanks would cover a much larger portion of the site and also shift the thermal exclusion zones further to the north where property lines taper to the northeast and residences are closer. It is not feasible to divide the internal storage tank.

Safety Design Comparison and Improvements - Commentors requested a discussion of alternative safety measures and design improvements over the past 50 years, as well as design alternatives for other projects. Section 4.12.3 presents a review of the six principal LNG storage tank and retention system designs. The four original LNG import terminals in the United States as well as the majority of LNG peakshaving facilities utilize the single containment tank design (figure H.1). The double containment design (figure H.3) is used for the 1,000,000 barrel LNG storage tank at the EcoElectrica import terminal in Guayanilla, Puerto Rico, which commenced operations in July 2000. Many of the new LNG import terminals propose to use the full containment design (figure H.4).

Tank design evolution has seen an increasing use of internal LNG pumps, a necessity for the H.3 and H.4 configurations, and a means of eliminating any penetrations to the primary inner container for other designs. The use of internal LNG pumps results in a smaller design spill and the corresponding potential to reduce the flammable vapor dispersion exclusion zones required under the DOT's Federal

Safety Standards at Part 193.2059. Similarly, the low impoundment surface area for the H.3 and H.4 configurations can reduce the thermal exclusion zones around the facility under Part 193.2057. Other improvements over the years have witnessed the change from analog instrumentation and controls systems, with manually operated valves and local equipment operation; to distributed control systems with computer interface and remotely actuated valves and equipment, providing greater flexibility in operational controls and in responding to potentially hazardous events.

Bridge Integrity - A number of concerns were raised on the potential impact of LNG vessels on the integrity of one or more of the four bridges that would be encountered by the vessel transit: the impact of damage to bridges on the area's economy; the impact on traffic in the event of a collision with a bridge abutment; financial capability to restore damage to bridge abutments and compensation for delayed shipments; and changes to the abutments or fender systems.

Incidents involving ships in transit alliding with structures, such as bridge piers outside a channel, invariably result from ships proceeding at high speeds, often moving with a strong current, without tug escort and experiencing steering failure, electrical failure or a combination of both. The LNG ships transiting the Mount Hope Bay and the Taunton River would have attached tug escorts, would not be moving at high speeds, would not be carried along by strong currents, and would have duplicate steering gear and electric generator systems operating. Vessel traffic simulations have been performed at the MSI facility (see section 4.12.5.1) to identify the envelope of marine conditions and tug assist required to safely guide the LNG vessels through the Brightman Street and Braga Bridges. The simulations and operational controls imposed by the pilots should make the potential for bridge damage to be remote.

In 1997-1998, the proposed design of the new Brightman Street Bridge allowed a 150-foot opening for ships in the navigation channel. Later discussion with the Coast Guard resulted in the final design, which provides 200 feet of clear navigation channel. The Coast Guard requested an increase in width primarily to allow more room for large barges with tugs secured along the side. The width was also increased to take into consideration the long life expectancy of bridges, making provisions for future larger ships, such as ones with double hulls. The extensive ship handling simulations carried out at MSI have confirmed the adequacy of this final design width for the passage of 145,000 m^3 LNG ships.

The new Brightman Street Bridge would also have a fender system lining the relatively narrow opening between the piers. This system is designed to be completely independent and stand alone from the bridge support structure. The protection structure for each of the two main piers would be comprised of a pair of earth-filled circular steel sheet pile cells and a pile-supported fender beam. One fender, approximately 274 feet long, would run along each side of the navigational channel, with the fender beam sitting about 13 feet from the bridge foundation pier and reaching approximately 17 feet above MLW. These beams would be comprised of cast-in-place concrete, 7 feet wide by 12 feet high, supported on a series of steel pipe piles. Weaver's Cove Energy would maintain a stock of spare fender panels in case any are damaged by an LNG vessel.

Engineers from Han-Padron Associates, LLP confirm that these fenders would have sufficient capacity to arrest or deflect a fully loaded 145,000 m^3 LNG ship transiting at up to 3 knots while turned 16.5 degrees toward the fender. It is important to note that 16.5 degrees off of a straight course represents a worst-case scenario, since the narrow channel limits would prevent an LNG ship from achieving any further deviation. The engineers also state that, during an allision with the fender, no part of an LNG ship would come within 5 feet of any part of the bridge structure. At the maximum deflection, the fender would still be 8 feet away from the bridge pier but the wide upper part of the ship could reach a few feet closer.

Mitigation to prevent an LNG ship from getting into this position would be provided by the employment of powerful tractor tugs; the training of the Northeast Marine Pilots, tug masters, and LNG ship captains simultaneously at MSI; and the provision of additional aids to navigation as identified during previously completed and future simulations. Limiting LNG ships to passage only during certain favorable environmental conditions would also be established and enforced. In addition, the draft of LNG ships is relatively constant, only about 3 to 5 feet less in the ballast condition than the loaded condition; therefore, windage effects are not significantly greater in the ballast condition.

In the unlikely event that a LNG vessel collided with any of the four bridges, the effect on vehicular bridge traffic would depend on the extent of the damage and the time required for repairs.

Liability - Although this topic is outside the scope of the EIS and is more properly addressed in legal forums, several laws may apply. Financial responsibility for the compensation of personal or property losses due to a marine incident may be subject to the Limitation of Vessel Owner's Liability Act, 46 U.S.C. 181 et seq. Under 49 U.S.C. 60111, the Secretary of Transportation can order the operator of a LNG facility to demonstrate and maintain financial responsibility in at least the amount the Secretary considers adequate. In general, an LLC (limited liability company) business structure only protects the owners from personal liability for business debts and claims but does not protect the assets of the business itself.

4.12.10 Conclusions on Safety Issues

Much of the recent safety debate has centered on the size of worst case scenarios; the distance to various thermal radiation heat levels for LNG fires; the range of potentially flammable vapors; and the population and infrastructure that are located within the various hazard areas. These are some of the components of a consequence analysis.

However, the evaluation of safety is more than an exercise in calculating the consequences of worst case scenarios. Rather, safety is a determination of the acceptability of risk which considers: (1) the probability of events; (2) the effect of mitigation; and (3) the consequences of events.

Accidental Causes - Based on the extensive operational experience of LNG shipping, the structural design of an LNG vessel, and the operational controls imposed by the Coast Guard and the local pilots, the likelihood of a cargo containment failure and subsequent LNG spill from a vessel casualty – collision, grounding, or allision – is highly unlikely. For similar reasons, an accident involving the onshore LNG import terminal or LNG trucking from the terminal is unlikely to affect the public. As a result, the risk to the public from accidental causes should be considered negligible.

Intentional Attacks - Unlike accidental causes, historical experience provides little guidance in estimating the probability of a terrorist attack on an LNG vessel or onshore storage facility. For a new LNG import terminal proposal, having a large volume of energy transported and stored near populated areas, the perceived threat of a terrorist attack may be considered as highly probable to the local population.

However, at the national level, potential terrorist targets are plentiful, many having national significance, while others with a large concentration of the public (major sporting events, skyscrapers, etc.) or critical infrastructure facilities. Currently, the United States has over 500 chemical facilities operating near large populations. U.S. waterways also transport over 100,000 annual shipments of hazardous marine cargo, including LPG, ammonia, and other volatile chemicals. Many of these substances pose a similar hazard to that of LNG.

Risk Management - While the risks associated with the transportation of any hazardous cargo can never be entirely eliminated, they can be managed. For potential targets where the threat is perceived to be high, resources can be directed to mitigate possible attack paths. Such efforts may deter potential attacks one target, but shift efforts to those that are less protected. As a result, the issue is how to best direct finite resources.

For the proposed project, it may be possible to apply risk management resources to manage realistic threats; however, an even greater level of resources may be required to manage the threats as perceived at the local level. The issue for the decision makers is whether the resources required to manage the risks are justified by the benefits, while recognizing that the risks cannot be entirely eliminated.

4.13 CUMULATIVE IMPACTS

Cumulative impact results when impacts associated with a proposed project are superimposed on, or added to, impacts associated with past, present, or reasonably foreseeable future projects within the area affected by the proposed project. Although the individual impacts of the separate projects may be minor, the effects from the projects taken together could be significant.

Existing environmental conditions in the project area have been influenced by human industry, activities, and development, which have permanently altered the natural ecosystems within the Narragansett Bay watershed. This is particularly true in and around the public ports within the bay including those at Providence, Quonset Point-Davisville, and Fall River.

Table 4.13-1 provides a list of other past, present, or reasonably foreseeable future projects or activities that have impacted or may cumulatively impact resources that would be affected by construction and operation of the Weaver's Cove LNG Project. The general locations of many of these projects/activities are shown on figure 4.13-1. These projects and activities include primarily those located in the vicinity of the proposed project. More distant projects are not assessed because these projects generally do not have regional effects and, therefore, do not contribute significantly to cumulative impacts in the proposed project area. Potential impacts associated with these projects that are most likely to be cumulatively significant are related to aquatic resources, upland or wetland vegetation, infrastructure and public services, vehicular traffic, ship traffic, land use, air quality/noise, and natural gas infrastructure. Cumulative impacts that could be most directly associated with the Weaver's Cove LNG Project are discussed below.

Aquatic Resources and Water Quality

The Mount Hope Bay and the Taunton River aquatic ecosystem is made up of a variety of habitats including open water, salt marshes, seagrass beds, cobble bottoms, oyster beds, soft bottoms, tidal flats, beaches, and rocky shores. The fish community within the area is estuarine with coastal migrant fishes that include striped bass, bluefish, tautog, winter flounder, summer flounder/fluke, scup, and weakfish. Additionally, this system provides habitats to various benthic organisms (both epifauna and infauna) including clams, quahogs, crabs, lobsters, snails, shrimps, sponges, barnacles, amphipods, and polychaete worms. These aquatic resources have been stressed due to overfishing, habitat alternation, and pollution (EPA, 2002a).

Overfishing is believed to have contributed to the declines that have been observed in many of the fish stocks in Mount Hope Bay. Currently, there are strict commercial and recreational fishing limits to help restore fish stocks. These restrictions have closed Mount Hope Bay to commercial trawlers and closed recreational fishing for winter flounder in the bay for 10 months of the year.

Dredging of ship channels and berths as well as coastal developments (e.g., piers, marinas, waterfront structures) have altered habitats within Mount Hope Bay. For example, eelgrass beds that once occurred extensively throughout the region have been nearly eliminated from Mount Hope Bay. Additionally, water temperatures in Narragansett and Mount Hope Bays have increased markedly over the past 40 years. Likely causes include global warming and the discharge of waste heat into the bay from local power plants. This warming has resulted in a loss of the usual winter-spring diatom bloom, with potential impacts on higher trophic levels because of changes in prey availability. Warmer water in winter may also increase predation rates by shrimp on larval winter flounder, contributing to recent population declines (Keller and Klein-MacPhee, 2000).

TABLE 4.13-1

Past, Present, and Future Projects That Could Cumulatively Impact Resources of Concern Near the Weaver's Cove LNG Project

		Primary Environmental Impact							
Activity/Project	Description	Aquatic Resources/ Water Quality	Vegetation	Public Services	Vehicular Traffic	Ship Traffic	Land Use	Air Quality/Noise	Gas Infrastructure
Past and Present Activities/Projects									
Residential/Commercial Developments	Various developments in Fall River, Swansea, and Somerset.	✓	✓	✓	✓	✓	✓	✓	
Commercial/Recreational Fishing	Historically, commercial and recreational fishing and shellfishing did occur in Mount Hope Bay and the Taunton River. Because of the current status of fish populations and poor water quality, commercial fishing and shellfishing have been essentially eliminated and recreational fishing and shellfishing for many species have been severely curtailed in these areas. However, both commercial and recreational fishing and shellfishing continue in some areas of Narragansett Bay	✓				✓			
Recreational Boating	Recreational boating, including motor boating and sail boating, is widespread throughout Narragansett Bay and also occurs to a lesser extent on the Taunton River. Current estimates indicate that there are as many as 60,000 registered boaters in Rhode Island and the number is increasing. These activities generally occur during the 6 warmer months of the year but are particularly concentrated during June, July, and August.	✓		✓	✓	✓	✓		
Regional Stormwater and Sewer Systems	Currently, the 19 Combined Sewer Overflow (CSO) Outfalls of the Fall River system discharge approximately 1.3 billion gallons of rainwater and sewage to the Mount Hope Bay each year.	✓							

TABLE 4.13-1 (cont'd)

Past, Present, and Future Projects That Could Cumulatively Impact Resources of Concern Near the Weaver's Cove LNG Project

		Primary Environmental Impact							
Activity/Project	Description	Aquatic Resources/ Water Quality	Vegetation	Public Services	Vehicular Traffic	Ship Traffic	Land Use	Air Quality/Noise	Gas Infrastructure
Brayton Point Power Plant	Fossil fuel burning, electricity generating plant located on the Lee and Taunton Rivers in Somerset.	✓	✓			✓	✓	✓	
Borden and Remington Corporation	Chemical distribution facility in Fall River. Docking facilities along the Taunton River - bulk storage of chemicals.	✓	✓			✓	✓	✓	
Montaup Power Plant	Fossil fuel burning, electricity generating plant located in Somerset.	✓	✓			✓	✓	✓	
Braga Bridge Rehabilitation	Work includes repairs to the bridge structure and concrete deck, and resurfacing the pavement. Currently scheduled to be completed in 2005 or 2006.			✓	✓				
Fall River State Pier	Upgrading and expansion of the existing Fall River State Pier.	✓		✓	✓	✓	✓	✓	
Aquaria Project	Desalination plant on the Taunton River in Dighton, Massachusetts. Project includes construction of 16-mile-long water pipeline. Scheduled to be in-service in 2005.	✓	✓	✓			✓		
Fall River CSO Abatement Project	Construction of a three-mile long, 20-foot diameter CSO tunnel to eliminate storm-related discharges. Located in the city's south end.	✓		✓	✓				
Brightman Street Bridge Replacement (Route 6)	Construction of a new, higher bridge and reposition Route 6 in Somerset and demolition of the old bridge. Scheduled to be completed in 2010.	✓		✓	✓	✓			
Resurfacing Route 138	Includes South Main Street, Broadway Extension, North Davol and South Davol Streets.			✓	✓				
Shaw's Boat Yard, Inc.	Retain unauthorized structures and install and maintain new structures in the Taunton River at Dighton, MA.	✓				✓			

TABLE 4.13-1 (cont'd)

Past, Present, and Future Projects That Could Cumulatively Impact Resources of Concern Near the Weaver's Cove LNG Project

		Primary Environmental Impact							
Activity/Project	Description	Aquatic Resources/ Water Quality	Vegetation	Public Services	Vehicular Traffic	Ship Traffic	Land Use	Air Quality/Noise	Gas Infrastructure
Bay State Gas Company	Excavate coal gasification-related materials from areas of the Taunton River, dispose of them and restore the sites. Located within the Weir Village section of Taunton, MA.	✓				✓			
Future Activity/Project									
Route 79 Relocation and Harbor Enhancement	Bring Route 79 down to grade and combine it with Davol Street to create a pedestrian-friendly boulevard as part of Fall River's waterfront plan.			✓	✓		✓		
Boardwalk in Somerset along the Taunton (recreation)	Construct a commercial boatyard for various marine related activities.	✓		✓		✓	✓		
Reconstruct North Main Street in Fall River	Construction will include North Main Street from the intersection of Herman Street going north to Freetown. Expected to begin in 2004.			✓	✓				
Quequechan Bike Path/Boardwalk	Extend the Heritage State Park boardwalk along the city's waterfront to Bicentennial Park and provide a link to Britland Park. It will traverse along Watuppa Pond, and the Quequechan and Taunton Rivers.			✓	✓		✓		
Commuter Rail	Extend existing Stoughton Line service from Boston to New Bedford and Fall River. Includes construction of track, bridges, grade crossings, intersection improvements, eight new commuter rail stations and two train layover facilities. Project currently on hold.	✓	✓	✓	✓		✓	✓	
City Pier Cleanup	City of Fall River is applying for EPA Brownfields Cleanup Grant for 4.2-acre parcel located on Davol Street.	✓					✓	✓	

TABLE 4.13-1 (cont'd)

Past, Present, and Future Projects That Could Cumulatively Impact Resources of Concern Near the Weaver's Cove LNG Project

		Primary Environmental Impact							
Activity/Project	Description	Aquatic Resources/ Water Quality	Vegetation	Public Services	Vehicular Traffic	Ship Traffic	Land Use	Air Quality/Noise	Gas Infrastructure
Hotel and Conference Facility	150- to 200-room hotel located along the waterfront at the city pier site.	✓		✓	✓		✓	✓	
KeySpan LNG Facility Upgrade Project	Modification of existing LNG peakshaving facility in Providence to allow for marine imports of LNG. Sendout pipeline providing natural gas to Algonquin's G-system.	✓	✓			✓	✓	✓	✓
Somerset LNG Project	Construction of a new LNG import terminal at Brayton Point in Somerset, MA. Sendout pipeline providing natural gas to Algonquin's G-system.	✓	✓	✓	✓	✓	✓	✓	✓
Marina Expansions	Proposals for the addition of approximately 2,056 boat slips within Narragansett Bay,most of which are associated with the Weaver Cove Marina in Portsmouth.	✓		✓	✓	✓	✓		

Insert Figure

4.13-1 Select Past, Present, or Future Activities/Projects Located Along the Taunton River

Current environmental conditions in Mount Hope Bay and the Taunton River do no meet designated water quality standards established in Massachusetts or Rhode Island (see section 4.3.2). These waterbodies have and are being degraded by both point and non-point sources of pollution. Non-point sources of pollution that affect water quality include stormwater runoff and wastewater discharge from residential, commercial, and industrial areas. Although the pretreatment of industrial wastewater is reducing the presence of industrial toxic pollutants from point sources, traces of metals and organic compounds are still found in area sediments (see section 4.2.2). Regardless of the source, the introduction of pollutants results in a variety of ecosystem impacts. The presences of some pollutants create potential human health risks primarily through the consumption of contaminated seafood. Nitrogen introduced into the Taunton River or Mount Hope Bay has resulted in excessive plant growth (algal blooms). When the algae die, they are decomposed by bacteria that consume dissolved oxygen, effectively suffocating fish and other organisms. Similarly, bacterial nitrification of ammonia discharged by wastewater treatment facilities can deplete waters of dissolved oxygen, making many areas uninhabitable (Caton, 2002). Fall River is presently working on a combined sewer outflow abatement program to improve water quality in Mount Hope Bay.

A specific source that has been singled out by regulators as contributing significantly to the degradation of the Mount Hope Bay ecosystem is the existing Brayton Point Power Plant. The power plant uses water from the bay to condense the steam used to produce electricity. The heated water is then discharged back into Mount Hope Bay at a temperature of up to 95º F. Studies indicate that these discharges have resulted in a distinct thermal plume within Mount Hope Bay. Although contested by the power plant operator, this thermal plume and the impingement/entrainment of aquatic organisms during operation of the water intake system have been cited by regulators as major factors in the decline of fish stocks (particularly winter flounder) in the bay. A recent draft permit issued by the EPA for the Brayton Point Power Plant seeks to substantially reduce the facility's impact on aquatic resources of Mount Hope Bay through applying stronger controls on the withdrawal of water from the bay and the discharge of heated water to the bay (i.e., reduction of the total annual heat discharge to the bay by 96 percent and the reduction of water withdrawn from the bay by 94 percent).

In the foreseeable future, there will likely be a number of projects or activities that result in additional stresses on the aquatic resources of the Taunton River and Mount Hope Bay. Non-point sources of pollution are predicted to continue to contribute significantly to water quality degradation (DEM, 2000). As listed in table 4.13-1, there are several waterfront projects in the region that could also degrade aquatic habitat in the project area.

Construction of the Weaver's Cove LNG Project would adversely affect surface water quality and biological resources associated with Mount Hope Bay and the Taunton River (see sections 4.3.2 and 4.6.2). Specific project activities such as dredging, dredge disposal, pipeline installation, and upland clearing/grading could result in a variety of impacts related to aquatic resources that include:

- increased water turbidity and resuspension of sediments;
- surface runoff/erosion;
- loss of wetland or upland vegetation;
- disturbance to benthic substrates (e.g., quahog habitats); and
- potential spills of hazardous substances.

Potential construction impacts on aquatic resources would be minimized by Weaver's Cove Energy's compliance with our recommendations, the FERC's Plan and Procedures, its onshore and offshore SPCC Plans, and adherence to the mitigative measures discussed in section 4.6.2. Nevertheless, the Weaver's Cove LNG Project could contribute to cumulative impacts on water quality and aquatic organisms when considered in relation to past, present, and reasonably foreseeable impacts on the Mount

Hope Bay and the Taunton River. Impacts from dredging could be compounded if other significant dredging projects were conducted concurrently (e.g., Somerset LNG Project).

The entrainment and impingement of fish (eggs, larvae, juveniles, and/or adults) during construction and operation of the Weaver's Cove LNG Project could also contribute to the cumulative impact on biological resources in Mount Hope Bay and the Taunton River. As discussed in section 4.6.2, the Weaver's Cove LNG Project could involve a one time appropriation of between 32 and 33 million gallons of water from the Taunton River to hydrostatically test the LNG tank and sendout pipelines. Furthermore, each ship unloading LNG at the terminal would take on between 11 and 14 million gallons of ballast water from the river. Given the facility could accommodate between 50 and 70 ships per year, the withdrawal of water for LNG ship ballast from the Taunton River could be between 550 and 980 million gallons per year during operation of the terminal. These withdrawals would be in addition to other existing or planned facilities in the area that currently withdraw or may withdraw much larger volumes of water such as the Brayton Point Power Plant near the mouth of the Taunton River and the Manchester Street Station on the Providence River.

The cumulative impacts of these withdrawals are difficult to quantify given that the numbers of aquatic organisms entrained or impinged during water intake is a function of the intake structure's location, design, capacity and approach velocity, and the abundance of organisms of various species in the general vicinity at the time of the withdrawal. Historically, the estimated average annual loss of fish eggs and larvae due to water withdrawals of up to 1 billion gallons per day (or 365 billion gallons per year) at the Brayton Point Power Plant were about 251 million winter flounder, 11.8 billion bay anchovy, 375 million windowpane flounder, and 3.5 billion tautog (EPA, 2002a). At the Manchester Street Station, where water withdrawals have been up to 258 million gallons per day (or 94 billion gallons of water per year), the average annual loss of fish eggs and larvae due to water withdrawals is estimated to be about 891 million eggs and larvae. Additionally, although estimates are not available, the number of eggs and larvae lost through ballasting of other ships that offload cargo within the Narragansett Bay watershed would also be a relatively large amount. For comparison, assuming 70 LNG ships per year and 14 million gallons of ballast water required per ship, operation of the proposed LNG terminal could result in the annual loss of eggs and larvae totaling about 1.3 million winter flounder, 5.8 million bay anchovy, 150,400 windowpane flounder, and 6.9 million tautog. Although the number of eggs and larvae potentially lost as the result of LNG ship ballasting would be much less than the numbers lost as the result of power plant operations, the cumulative impacts of these losses could further stress the fish populations in Mount Hope Bay and Narragansett Bay.

Even though existing permits require the Brayton Point Power Plant to reduce the quantity of water withdrawn to 56 million gallons per day, both the volume and aquatic impact of the power plant water withdrawals will likely still far exceed the volumes and potential aquatic impacts of water withdrawals associated with other existing or planned facilities on Mount Hope Bay and the Taunton River. Additionally, effective mitigation for the smaller volume withdrawals may be easy to implement. For example, the impacts from proposed withdrawals of 5 to 10 million gallons of water per day at the new desalination facility in Dighton (Aquaria Project) would be minimized by covering the intake structures with exclusionary mesh and withdrawing water at relatively low velocities.

During operation of the proposed LNG terminal, prop wash from LNG ships and tugs could temporarily increase suspended sediments and turbidity in the navigation channel and turning basin. Many past, current, and planned activities in the Taunton River and Mount Hope Bay involve ships that temporarily disturb bottom sediments, including ship traffic to the existing Montaup and Brayton Point Power Plants as well as any future traffic to the proposed KeySpan and Somerset LNG terminals. However, as with LNG ships delivering cargo to the proposed LNG terminal, sediments suspended by other ships would be expected to resettle shortly after ship passage. Additionally, even with the existing

and proposed facilities operating simultaneously, disturbance associated with prop wash would not be expected to occur at intervals that would prevent resettling after each ship. Some of the suspended sediments could settle out in adjacent shallow water areas, harbors, and marinas, which could ultimately result in increased sedimentation in these areas.

In conclusion, while construction and operation of the Weaver's Cove LNG Project could contribute cumulatively to impacts on aquatic resources and water quality in the Taunton River, Mount Hope Bay, and Narragansett Bay, we believe these impacts would be relatively short-term and/or minor in comparison to those from non-point sources of pollution or from operation of facilities such as the Brayton Point Power Plant and Manchester Street Station. Additionally, implementation of Weaver's Cove Energy's proposed mitigation measures and our recommendations in section 4.6.2 would reduce impacts of the proposed project such that, even when considered in light of past or present activities in the general project area, aquatic resources would not be adversely affected by project activities.

Vegetation and Wildlife

When projects are constructed at or near the same time, the combined construction activities would have a cumulative impact on vegetation and wildlife living in the immediate area. Right-of-way clearing and grading and other construction activities associated with the Weaver's Cove LNG Project along with other construction projects would result in the removal of vegetation, alteration of wildlife habitat, displacement of wildlife, and could have other secondary effects such as increased population stress, predation, and establishment of invasive plant species. The filling of salt marsh at the proposed terminal site and the removal of forest vegetation along the pipeline rights-of-way would have long-term impacts on vegetation and wildlife. These impacts would be greatest where other projects are constructed within the same time frame and areas as the proposed facilities (e.g., residential development in forested areas along the Western Pipeline route). Additional vegetation clearing along existing rights-of-way (electric transmission, pipeline, or railroad) can have the additive effect of creating a cleared corridor of significant widths. Given the developed nature of the landscape, the collocation of the proposed pipeline with existing utility rights-of-way allows for the consolidation of similar land uses. The collocation of the proposed pipelines with existing utility rights-of-way also reduces the total width by allowing overlap of construction workspace for the pipeline with the existing rights-of-way (see section 4.8.1.2). The collocation of the proposed pipelines with existing rights-of-way would be expected to minimize cumulative impacts on vegetation and wildlife.

As discussed above, it is possible that the development of both the Somerset LNG and Weaver's Cove Energy LNG projects could require an expansion of the existing Algonquin pipeline system. Although the specific nature of the improvements required by Algonquin to accommodate both projects is unknown, it is possible that additional pipeline looping may be necessary. The construction of additional pipeline could require widening of existing pipeline rights-of-way, resulting in both vegetation and wildlife impacts.

Infrastructure and Public Services

The cumulative impact of the Weaver's Cove LNG Project and other projects on infrastructure and public services would depend on the number of projects under construction at one time and the specific services required for each project. The small incremental demands of several projects occurring at the same time could become difficult for police, fire, and emergency service personnel to address. This problem would be temporary, and occur only for the length of construction. The operation of the proposed LNG terminal and associated facilities is not expected to have a major impact on public services since it would not result in the construction of new public roads, extensive new sewer or water systems, or significant changes in local population levels. There is however a concern that an incident at the LNG

terminal could exceed the current response capacity of the Fall River fire and police departments. Weaver's Cove Energy would coordinate with local fire departments to develop an emergency response plan to be used in the event of an incident at the LNG terminal. In addition, Weaver's Cove Energy would have its own fire-fighting equipment at the facility. See section 4.12 for additional discussion of fire and public safety impacts and Weaver's Cove Energy's liaison program with the area emergency response departments. The details of this plan and specifics regarding the role of the police and fire departments in the event of an incident are not available at this time.

We received comments on the draft EIS that state and local communities would have to bear some of the costs of ensuring the security of the LNG terminal and the LNG ships while in transit and unloading at the terminal. If more than one LNG import terminal is constructed and operated within the Narragansett Bay area, particularly if the facilities are in close proximity and each requires the services of one or more towns, the combined security costs of multiple projects could have a cumulative impact on some communities. There are currently two proposed LNG terminals (Weaver's Cove LNG Project and KeySpan LNG Facility Upgrade Project) and possibly a third planned LNG terminal (Somerset LNG Project) that would require LNG ships to transit Narragansett Bay. The operation of the proposed LNG terminals are not anticipated to have major impacts on public services because they would not result in the construction of new public roads, new sewer or water systems, or significant changes in local population levels. However, there has been public concern about the training of the local police, fire, and emergency responders and their capability to handle an incident at an LNG terminal or along the shipping route. Both Weaver's Cove Energy and KeySpan LNG would have their own fire-fighting equipment at the LNG facilities, and LNG ships would be required to have fire detection and protection systems. In addition, the tugs escorting the LNG ships would have fire-fighting equipment and trained personnel. Although the details regarding the specific demands and roles of the police and fire departments in the event of an LNG incident are not available at this time, we believe the efforts described above would minimize the cumulative effects of this project on existing public services. See sections 4.9.3, and 4.12.5 of this EIS for additional discussion of fire and public safety impacts and Weaver's Cove Energy's coordination with the area emergency response departments.

We also received comments expressing concern that local communities might be overburdened by the additional costs of ensuring the security of the LNG terminal and the LNG ships while in transit and unloading at the terminal. If more than one LNG terminal is constructed and operated within the Narragansett Bay area, particularly if the facilities are in close proximity and each requires the services of one or more towns, the combined security costs of multiple projects could have additional cumulative impact on some communities. The specific costs associated with security for the two proposed LNG terminals are not known at this time. As discussed below and in section 4.12.5, the Coast Guard has developed an initial Vessel Transit Security Plan for both the KeySpan LNG Facility Upgrade Project and the Weaver's Cove LNG Project that will become the basis for appropriate security measures.

The security measures anticipated to be implemented each time an LNG ship calls at Fall River or Providence would require Coast Guard as well as state and local agency support. Specific costs associated with Coast Guard support for the Weaver's Cove LNG Project or KeySpan LNG Facility Upgrade Project have yet to be specified. However, the specific costs associated with overtime and detail work by state and local agency personnel, including the local police, State Police, and other agencies, has been estimated to be in the range of $40,000 to $50,000 per LNG shipment.

Once these plans are finalized and the resources required to implement them have been identified, Weaver's Cove Energy and KeySpan LNG would be able to more specifically discuss the funding of such resources. In recent filings with the FERC, Weaver's Cove Energy has suggested that it be held to the same standard as the Distrigas LNG facility, which Weaver's Cove Energy says underwrites the entire cost of police and fire department details provided by the City of Everett, as required to provide security

during the unloading of LNG ships at the terminal. KeySpan LNG has stated that it would reimburse state and local agencies for the incremental costs associated with LNG ship security on a per-transit basis. We have recommended that both Weaver's Cove Energy and KeySpan LNG provide comprehensive plans identifying the mechanisms for funding all project-specific security/emergency management costs that would be imposed on state and local agencies. We believe that the cost sharing suggested by Weaver's Cove Energy and our recommendation would minimize the potential for cumulative impacts associated with security costs if multiple LNG terminals are constructed in the Narragansett Bay area. It should also be noted that the Weaver's Cove Energy and KeySpan LNG terminals would be located in different states and cities, and while LNG ships traveling to the two terminals would share the same ship channel in the vicinity of Newport, Jamestown, Middletown, and Portsmouth, the remainder of the ship routes do not overlap, which would tend to mitigate cumulative costs on a single state or community.

Vehicular Traffic

As discussed in section 4.9.4, the truck traffic that can be expected during operation at the LNG terminal would vary depending on the market demand of the LNG and the availability of trucks for transporting the LNG. Approximately 50 LNG truck trips and 70 employee vehicle trips are estimated per day during average operating conditions, which would be lower than the estimated historic traffic volumes at the site and represent only a small increase in the existing road traffic. Weaver's Cove Energy expects that the LNG trucks would use the New Street site entrance at the North Main Street/Route 79 entrance intersection. Employees and visitors would use an entrance located about 0.4 mile north on North Main Street, which would reduce the amount of traffic at the truck entrance intersection. The anticipated traffic volume resulting from operation of the LNG terminal, even when considered in terms of projected future traffic volumes and in relation to reasonably foreseeable future projects, would not significantly increase the existing traffic volumes on local area roadways (MDM Transportation Consultants, Inc., 2003). Construction of a higher bridge at Brightman Street should alleviate some local traffic congestion by reducing the frequency the bridge would be closed to vehicular traffic.

Traffic congestion along the proposed pipeline routes is not expected to be a major problem. However, there is potential for cumulative traffic impacts if other projects such as road improvements are scheduled to take place at the same time and in the same area as the proposed LNG and pipeline facilities. Currently, we are not aware of any planned road improvement projects that would cumulatively add to construction traffic associated with the proposed project. Moreover, several factors would minimize the potential for cumulative traffic impacts, including the large area over which the proposed project is spread and the tendency for construction workers to frequently share rides and travel to and from work during off-peak hours. Additional measures proposed by Weaver's Cove Energy to minimize traffic impacts include scheduling to avoid commuter traffic and ensuring the availability of necessary traffic safety personnel. As such, potential cumulative impacts on traffic are expected to be temporary and short term.

Cumulative traffic impacts could also result if more than one LNG terminal is constructed in the Narragansett Bay area and bridges are closed during the passage of LNG ships. Specifically, cumulative road traffic impacts could also result if more than one LNG terminal is constructed in the Narragansett Bay area and the Pell (Newport) Bridge is closed during the passage of LNG ships. The Pell Bridge is located above the East Passage and is the only bridge that crosses the LNG ship route for the two proposed LNG terminals (i.e., Weaver's Cove Energy, KeySpan LNG) and the planned LNG terminal (i.e., Somerset LNG). The Pell Bridge is currently closed a few times a year to allow the passage of LPG ships. If both the and Weaver's Cove Energy and KeySpan LNG terminals are approved, up to 260 LNG ships (counting inbound and outbound trips) could pass under the bridge each year. If the Somerset LNG Project proposal moves forward and is approved, the number of LNG ship passages could be as high as 380. As discussed in section 4.12.5, it was determined during the Coast Guard's recent security workshops for the Weaver's Cove LNG Project that it would not be necessary to close the bridge for

every LNG ship transit associated with this project unless warranted by particular security concerns. Therefore, under normal circumstances, the Weaver's Cove LNG Project would not contribute to cumulative impacts associated with closures of the Pell (Newport) Bridge.

The estimated average daily traffic traveling both directions on the Pell Bridge is 27,700 vehicles (RIDOT, 2003). As discussed in section 4.9.4, Weaver's Cove Energy completed a traffic analysis to identify the potential impacts on traffic if the Pell (Newport) Bridge is closed during passage of LNG ships (MDM Transportation Consultants, Inc., 2004). The study used an automated traffic recorder to quantify the regional traffic using these bridges. In addition, these traffic counts were used to estimate potential average delays and maximum queuing (back-up) distances at the bridges based on how long each bridge might be closed to traffic. The study indicates that at the Pell (Newport) Bridge, the maximum anticipated average traffic delays due to a bridge closure during peak season use would range from about 4.2 minutes on the eastbound lanes during weekday mornings (with traffic backing up about 0.34 mile) to about 4.9 minutes on the westbound lanes during weekday evenings (with traffic backing up onto the Route 114/138 on-ramp for about 0.52 mile). The actual frequency of bridge closures cannot be determined and would depend on specific conditions at the time of the LNG ship passages. If, as an example, we assume the Pell Bridge would be closed for 10 percent of LNG ship transits, then delays of 5 minutes would be experienced up to 26 times a year if both the KeySpan LNG Facility Upgrade and Weaver's Cove LNG Projects were operating and up to 38 times a year if the Somerset LNG Project were also operating. Overall, the effect on traffic associated with bridge closures is not expected to significantly increase cumulative traffic impacts particularly since bridge closures would be temporary and are anticipated to be limited to periods of high national security alert. We do not anticipate these closures would necessarily affect emergency vehicle access, however, since the Pell Bridge is a state highway (Route 138) and the State Police typically exercises its authority to allow emergency vehicles to cross during bridge closures (Bianchi, 2004; Swansberg, 2004).

Ship Traffic

Traffic in the Taunton River currently averages one vessel every 2 to 3 days and also appears to be declining. As discussed in section 4.9.4, there were about 112 ocean-going vessel movements into the Fall River/Somerset area from Narragansett Bay in 2002. The Weaver's Cove LNG Project would result in one additional vessel entering the federal navigation channel in the Taunton River every 5 to 7 days (an additional 50 to 70 ships per year). Dredging the federal navigational channel and the wider opening of the new Brightman Street Bridge could provide greater access to deeper draft and broader beam ships that move up the Taunton River as well as reduce some of the current sources of shipping delays. For example, some deep-draft ships may be able to move more freely within the federal navigation channel without waiting for appropriate tidal conditions. As such, it is possible that the project could indirectly result in slightly fewer vessel transits to the Brayton Point or Montaup Power Plants by making it possible for fewer vessel trips to deliver the same amount of coal that was previously delivered (via larger or fully loaded ships).

However, even taking into consideration the shipping activity associated with the Weaver's Cove LNG Project, the federal navigation channel in the Taunton River would remain under utilized. Existing and anticipated future traffic and traffic associated with the Weaver's Cove LNG Project would not result in traffic congestion upstream of the Brightman Street Bridge since no large commercial ships can proceed up the Taunton River beyond the LNG terminal site due to insufficient water depths. Any LNG ships accessing a potential LNG facility at Brayton Point (Somerset LNG Project) would require additional coordination of ship movements in the northern portion of Mount Hope Bay. At this time, we anticipate that the total utilization of the federal navigation channel, (excluding tows and tugs) would be approximately 170 to 250 commercial ships per year if the Weaver's Cove LNG Project becomes operational.

It is conceivable that the dredging of the federal navigation channel could increase the number of large vessel movements in the Taunton River to levels higher than current projections. However, because we are not aware of specific proposals by other industrial or commercial operators, we do not view these activities as reasonably foreseeable and have not included additional ship traffic impacts in our analysis.

On April 30, 2004, KeySpan filed an application with the FERC seeking authorization to modify its existing Providence LNG storage and vaporization facility to allow import of LNG by ships (see section 3.2.1). If approved, about one LNG ship would unload its cargo at this facility every week beginning in late 2005. LNG ships accessing the KeySpan LNG facility would transit up Narragansett Bay and follow the East Passage to the entrance of the federal navigation channel near Sandy Point on Prudence Island. Ships would then turn into Upper Narragansett Bay and follow the navigation channel to the Port of Providence. The portion of the ship route along the East Passage would be the same for LNG ships moving to or from either Providence or Fall River. LNG ships accessing the KeySpan LNG and Weaver's Cove Energy facilities could cumulatively contribute to ship traffic delays in Narragansett Bay

If both the Weaver's Cove Energy and KeySpan LNG terminals are constructed and operated, as many as 100 to 130 LNG ships could potentially transit in and out of Narragansett Bay every year. To evaluate current conditions and the potential impact of LNG ships on existing commercial ship traffic, KeySpan LNG assessed five case scenarios using the Monte Carlo methodology (MNI, 2004). Vessel types included in the study were passenger or dry cargo ship, tanker, dry cargo barge, and tanker barge. Tugs were not counted as separate entities because it was assumed that they travel as an integrated entity with the barges. Recreational boats were not included in the simulation; however, it can be assumed that the impacts on recreational boaters would be less than on deep draft vessels since recreational boats have shallower drafts and are less restricted on where they can travel in the bay and river. Three of the five scenarios KeySpan LNG assessed assumed that both the Weaver's Cove and KeySpan LNG terminals would be operational. These three scenarios include:

- Case 3 - Future conditions assuming there are two LNG terminals (the KeySpan LNG and Weaver's Cove Energy LNG facilities), and 52 and 60 LNG ships per year call at each facility, respectively;

- Case 4 - The same as Case 3 but assumes a hypothetical 70 LNG ships per year call at the KeySpan LNG facility; and

- Case 5: The same as Case 4 but assumes future traffic conditions of non-LNG ships increases 50 percent.

If the proposed LNG ship traffic associated with the both the KeySpan LNG Facility Upgrade and Weaver's Cove LNG Projects are analyzed (Case 3), the anticipated LNG ship traffic on Narragansett Bay and within the navigation channel would approximately double in volume compared with the traffic of just one facility. Under these conditions, about 6 percent of the non-recreational vessels operating in Narragansett Bay would experience delays each year, which is double the number of ships that currently experience delays. In another scenario, if KeySpan LNG's ship traffic is modeled to account for a hypothetical increase to 70 LNG ships per year and these ships are added to Weaver's Cove Energy's proposed LNG ship traffic (Case 4), an average of 7 percent of the annual ship traffic in the bay would experience some delay. Lastly, for a worst-case scenario, if this increased KeySpan LNG traffic is added to Weaver's Cove Energy's proposed LNG ship traffic and then also added to a 50 percent hypothetical increase in non-LNG ship traffic (Case 5), an average of 8 percent of the annual ship traffic in the bay would experience some delay each year. Based on these analyses, it appears that the Coast Guard-required security zones during LNG ship transit and unloading would widen the area restricted to ships

and increase the number of ships that are delayed either entering or leaving the port. We note that the 50 percent increase is based on an assumption rather than on projections by port facilities currently receiving non-LNG ships in Narragansett Bay. However, in its comments on this draft EIS, the Coast Guard noted that Rhode Island voters recently approved a $48 million bond to improve the Quonset Point/Davisville port complex, including improved vessel berths and new railroad lines directly from the waterfront to the interior. It is expected that this will generate new business at Quonset/Davisville, including more vessel traffic, especially car carriers.

The cumulative impact on ferry traffic would generally be small because most of the ferry routes only cross the LNG ship routes and conflicts could be managed by schedule coordination. The cumulative impact of multiple LNG terminals on the Providence to Newport ferry could be more significant, however, because the ferry and LNG ships would travel along the same route for several miles. KeySpan LNG identified this potential conflict in its analysis of ship traffic and suggested that the impact could be reduced if the Coast Guard allows the ferry to operate outside of the channel and overtake or pass the LNG ships in transit at specific locations.

Commercial fishing boats might also be cumulatively impacted by the security zones imposed by the Coast Guard as LNG ships transit the federal navigation channel, particularly if the width of the security zone encompasses the entire width of the waterway. However, the security zone would be a moving zone around the ship, so these impacts would be temporary and of short duration at any given point along the shipping route. In addition, depending on their individual drafts, commercial fishing boats might be able to go around the LNG ships at points in the river that are sufficiently wide for them to be outside of the security zone. To mitigate the impacts of security zones, the Coast Guard would routinely provide Notice to Mariners prior to the arrival and departure of LNG ships as the Coast Guard currently does for LPG vessels and for other activities such as the Tall Ship parades. The notification system includes broadcasts on radio frequencies used by mariners and loudspeaker announcements made from Coast Guard, police, or other agency boats that precede the ship.

Operation of the LNG terminal could also have a cumulative impact on recreational boating and fishing during the weekly transit of the LNG ships if multiple LNG terminals are approved and constructed within the Narragansett Bay area. In most areas, the waterways that would be traveled by the LNG ships are sufficiently wide to allow recreational craft, which generally are not confined to the federal channel, to navigate around the LNG ships without significant delay. To estimate what kind of cumulative delays might result from passing LNG ships in areas where the waterway is narrower, we identified the locations where the ship channel would be used by LNG ships en route to different terminals and where the moving security zone has the greatest potential to encompass the entire width of the waterway. We specifically looked for areas where there is less than 3,000 feet of open water on both sides of the LNG ship route (the anticipated width of the safety and security zone on either side of the ship). These areas include the East Passage between Newport and Jamestown, which would be transited at a speed of about 10 knots (this area would be transited by all LNG ships regardless of terminal locations); and the entrance of Mount Hope Bay near Bristol Point, which would be transited at a speed of about 5 knots (this area would be transited by LNG ships en route to either the proposed LNG terminal site or Somerset LNG Project site). For an LNG ship in transit at 10 knots, recreational craft attempting to travel in the opposite direction at one of the narrow locations may be delayed up to 16 minutes for the LNG ship to pass before proceeding on its way, and up to 32 minutes at the entrance to Mount Hope Bay.

The extent of the impact on recreational boaters would depend on the number of boats in the project area during the days of the year that LNG ships would call on the LNG terminals. These impacts would be greatest during the peak recreational boating season between about May and September. As noted above, the Coast Guard would most likely use a program of announcements to give advance notice of each security zone.

Land Use

There are a variety of reasonably foreseeable residential, commercial, industrial, and transportation projects in the vicinity of the proposed LNG terminal and the pipeline routes (see table 4.13-1). Various agencies and organizations have made efforts to account for the cumulative impact of multiple development projects on land use by developing local and regional plans. These plans and the project's relationship to reasonably foreseeable projects are discussed in detail in sections 4.8.2 and 4.8.3. Although the Weaver's Cove LNG Project would affect existing land uses in the area, the project would be consistent with current land use plans and zoning ordinances. Consequently, the immediate cumulative land use effects of the project have already been considered. As discussed previously, it is conceivable that the development of multiple LNG projects in the region could result in a cumulative impact on the existing Algonquin pipeline system. Depending on the specific nature of an expansion by Algonquin, existing pipeline rights-of-way could be widened to accommodate additional pipeline (e.g., looping).

Air Quality/Noise

Construction of the proposed project and some of the reasonably foreseeable projects and activities listed in table 4.3-1 would involve the use of heavy equipment that produce noise, air contaminants, and dust. Operation of the proposed LNG facility would also contribute cumulatively to air emissions and noise in the project area.

Over the long term, the proposed LNG terminal and pipeline facilities would not exceed any of the applicable ambient air quality standards. Although the LNG terminal would emit NO_2, CO, SO_2, PM_{10}/$PM_{2.5}$, VOC, and Pb, the proposed terminal would not be a major source of air emissions under the PSD regulations for any of these pollutants (see section 4.11.1). The NO_x and VOCs emissions from the Weaver's Cove LNG Project would contribute to regional ozone concentrations (the entire Commonwealth of Massachusetts is classified as a serious non-attainment area for ozone). However, these emissions would be small in comparison to the total NO_x and VOCs emitted by existing sources in the area (e.g., Brayton Point or Montaup Power Plants, vehicle emissions). Because the operational emissions associated with the project would be less than 50 tpy of NO_x and VOC, the LNG terminal would not be subject to NSR (see section 4.11.1). Also, because the entire area is classified as serious non-attainment for the 1-hour ozone standard, projects that would generate large quantities of air emissions are required to offset their emission increase with emission reductions in the air basin. Therefore, Weaver's Cove Energy and other project proponents such as Somerset LNG and KeySpan LNG would either generate small amounts of air emissions or, if the air emission would be major, be required to provide offsets. In either case, the total increase in air emissions within the air basin would not be significant in comparison to other existing air emission sources.

Natural gas is a relatively clean and efficient form of energy compared to other fossil fuels because it is efficiently transported to end users and consists predominantly of simple hydrocarbons (methane and ethane). By burning natural gas rather than other fossil fuels such as coal or fuel oil, it could be possible to reduce the emissions of regulated pollutants (e.g., NO_x, SO_2, and PM_{10}) or unregulated greenhouse gases (e.g., CO_2). As such, it is possible that the Weaver's Cove LNG Project could cumulatively improve air quality in the region by providing a competitively priced source of natural gas that could replace the more polluting forms of energy that are currently being used.

Additional noise produced during construction of the Weaver's Cove LNG Project and other projects could create short-term annoyances to nearby residences. These noise impacts would be localized and would attenuate quickly as the distance from the noise source increases. Therefore, cumulative noise impacts associated with construction would be unlikely unless one or more of the

projects occur at the same time and in the same location. The operational noise from the Weaver's Cove LNG Project would not be significant. The other proposed LNG projects would be located at a distance from the proposed site and would have no effect on noise levels in the project area.

As discussed previously, it is conceivable that the development of multiple LNG projects in the region could result in a cumulative impact on the existing Algonquin pipeline system. Depending on the specific nature of an expansion by Algonquin, additional compression could be added to the existing pipeline system that would include additional air quality or noise impacts.

Natural Gas Infrastructure

We received a comment suggesting that we analyze the cumulative effects of the Weaver's Cove LNG Project in relationship to other planned energy infrastructure projects in the region. Currently, we are aware of two other companies that are considering construction of LNG import terminals in the Narragansett Bay area - Somerset LNG and KeySpan LNG. Whether or not these projects get built will depend on economics as well as regulatory approvals. Ultimately, the economic feasibility of these projects depends on the demand for LNG (and by extension natural gas). Based on a recent FERC study (FERC, 2003), it appears that by 2009 there will be demand during peak periods of use in New England for an additional 500 MMcfd of natural gas above what the current infrastructure is able to provide. More recently, the Power Planning Committee (2005) indicated that the anticipated additional demand for natural gas by 2009 will be between 420 MMcfd and 590 MMcfd. Given that there are several other LNG terminal projects proposed or under preliminary consideration in the New England region (see section 3.2), it appears unlikely that the market would support the construction of all of the projects proposed in the Narragansett Bay area. The need for additional modifications or improvements to the existing interstate pipeline system if two LNG import terminals are constructed depends on which facilities would be constructed. Based on information provided by Algonquin, it appears that Algonquin's system has capacity to accommodate the volumes from any single project without additional compression or looping provided $45 to $50 million of existing infrastructure improvements are made. These improvements could include either uprating or relaying some existing pipeline and other modifications. However, to accommodate the natural gas from multiple LNG import terminals, Algonquin would need to implement more significant expansions that could include increased compression and/or the installation of additional pipe.

FERC staff requested specific information from Algonquin regarding the additional facilities that would be needed to transport the volumes of natural gas proposed by Weaver's Cove Energy and KeySpan LNG. Recognizing that the specific facilities would depend on the actual delivery points and noting that KeySpan LNG has yet to request specific transportation service or identified delivery points. Algonquin provided information about the additional infrastructure that would be required assuming deliveries from both terminals would be made to Mendon, Massachusetts and Lambertville, New Jersey, the two natural gas delivery points identified by Weaver's Cove Energy.

The analysis reveals that substantial improvements would be required to accommodate the needed capacity to transport the vaporized LNG from the proposed Weaver's Cove and KeySpan LNG facilities operating at full sendout capacity, to deliveries at Mendon and Lambertville. Assuming sendout capacity of 400 MMcfd for Weaver's Cove Energy and 500 MMcfd for KeySpan LNG[29], Algonquin would need to:

[29] 500 MMcfd is more than the KeySpan LNG terminal is currently proposed for but is equal to the design capacity of the KeySpan LNG sendout pipeline.

- uprate the entire G System including the G-12 and G-20 Laterals to operate at a maximum of 811 psig; re-lay approximately 2.6 miles of 16-inch pipeline with 30-inch pipeline from the North Attleboro meter station to the South Attleboro meter station and approximately 0.9 miles of pipeline from the G-5 tap to the South Attleboro meter station; construct approximately 8.1 miles of pipeline between the G-1 tap and the Cumberland meter station; and construct approximately 5.2 miles of pipeline between the Cumberland meter station and the North Attleboro meter station;

- uprate the MAOP of the G-22 Lateral (Brayton Point Lateral) from the G-1 tap to MP 8.5 to 970 psig; install over-protection at MP 8.5 to protect the remaining 2.3 miles of the G-22 Lateral; and install over-protection at MP 0.0 to protect the G-1 System;

- reverse flow on its 30-inch-diameter pipeline by installing and modifying certain station piping and appurtenant station equipments at the Chaplin, Southeast, and Hanover Compressor Stations such that flow of natural gas within the 30-inch-diameter pipeline can be reversed, allowing the additional supply to backflow thorough to the western portion of the Algonquin system;

- review all meter stations along the pipelines that are to be uprated for additional changes due to the higher operating pressures; review internal piping and heater capacities for ability to accommodate increased inlet pressures. If the existing piping cannot accommodate the new pressures, install additional over-pressure protection. Review other meter stations for the effects of increased operating pressures due to the new operating conditions presented by the KeySpan LNG Facility Upgrade Project and the Weaver's Cove LNG Project; and

- install approximately 15 chromatographs throughout the system to accurately track the changes in heating value of the gas being delivered through the Algonquin system downstream of the BGLS Lateral and the proposed sendout pipelines for the Weaver's Cove LNG Project.

Additionally, because deliveries to Mendon are projected to be at a pressure of approximately 560 psig and Tennessee operates at a higher pressure, Algonquin would not be able to make the prescribed deliveries at Mendon without installing additional facilities. Moreover, because deliveries to the interconnect with Texas Eastern at Lambertville are projected to be at a pressure of approximately 575 psig and Texas Eastern operates at a higher pressure, Algonquin would not be able to make the prescribed deliveries at Lambertville without installing additional facilities. Algonquin's preliminary estimate of the cost of these facilities is approximately $140 million, which is based on Algonquin's preliminary review of the project and is subject to material adjustments as the result of site variations, additional work, permitting requirements, and other factors.

It is possible that the construction of the Weaver's Cove Energy, Somerset LNG, and/or KeySpan LNG import terminals also could indirectly or cumulatively result in other potential environmental impacts (both positive and negative) outside of the Narragansett Bay area. The proposals to build new LNG import facilities in the region is in response to current and future demand for natural gas. By providing new sources of competitively priced natural gas and LNG, these projects would help alleviate negative impacts on the economy and regional air quality that could potentially result from more limited access to these sources of energy (see sections 1.3 and 3.1). In addition to potential expansions of Algonquin's system as discussed above, construction of one or more LNG import terminals could result in other changes to the pipeline infrastructure in New England. In a recent study of natural gas infrastructure in the region, the FERC stated that the expansion of LNG deliveries to the area between

New York City and Boston would free up capacity on the Algonquin and Tennessee pipelines, thereby providing additional access to natural gas stored in New York and Pennsylvania (FERC, 2003). It seems likely, however, that accessing these storage areas would require some expansions or modifications of the Algonquin and Tennessee pipelines. Nevertheless, the construction of the Weaver's Cove Energy, Somerset LNG, and/or KeySpan LNG import terminals would reduce the overall need for new pipeline capacity in the region (FERC, 2003). This reduction in need for pipeline capacity would result in corresponding reductions in environmental impacts typically associated with pipeline expansions (e.g., temporary or permanent impacts on water quality, wetlands, vegetation, land use, air quality, etc.).