Another of these listed species, huckleberry, potentially exists in the pine barrens habitat within the BNL property. No impacts to this species are expected to occur to this species. The entire pipeline alignment along the BNL was surveyed and the listed huckleberry species was not identified. The remaining 21 listed plant species are those that generally occur in salt marsh and upland habitat adjacent to the Wading River. It is not anticipated that these species occur within the pipeline corridor because these habitats are located approximately 400 to 2,000 feet to the east of the proposed alignment, thus avoiding potential impacts to these species.

Iroquois has also reviewed the mapping that was attached to the October 22, 2001 species list indicating the locations of listed species in the ELI Project corridor. The only concentration of listed species indicated on this mapping were for plant occurrences associated with the Carmans River wetland. Because this feature will be crossed employing HDD technology, no impacts to these particular species is expected.

Tiger Salamander

The construction of the project is not anticipated to impact the tiger salamander, a state endangered species. The project corridor does not contain any breeding pools, including those identified by the NYSDEC (2001). Iroquois proposes to restore the construction right-of-way in accordance with the FERC Plan, which is expected minimize any potential impacts to this species' habitat.

Least Tern

The construction of the pipeline is not anticipated to adversely impact the Least Tern, a state threatened species. The Least Tern has a similar distribution, breeding season, and habitat requirements as the Piping Plover. Because Iroquois' proposed marine construction schedule is planned to occur outside of the April 1 to September 1 exclusion window, as required by the USFWS to protect the Piping Plover, this approach should also avoid direct impacts to the Least Tern. The restoration of the maritime beach habitat in accordance with FERC's Plan should protect against significant habitat modification or degradation for the Least Tern. Iroquois representatives will coordinate directly with the NYSDEC regarding the protection of this species.

Invertebrates

The construction of the ELI Project is expected to result in only short-term impacts to one state listed moth species. Although construction will result in the loss of suitable pine/oak habitat associated with this species along the William Floyd Parkway, and may result in the potential loss of some individuals, the impacts are expected to be minimal. Iroquois will work closely with the NYSDEC in order to minimize impacts and to mitigate for any potential impacts to this state protected moth species.

3.2.5 Wetlands

3.2.5.1 Pipeline

Table 3.2.5.1-1 summarizes the acreage of estuarine and freshwater (palustrine) wetlands located in the construction ROW and the permanent ROW. The ELI pipeline construction does not involve any loss of wetlands. Iroquois would construct the pipeline across wetlands in accordance with FERC's Plan and Procedures, which specifies the installation of erosion control barriers, use of equipment mats, dewatering procedures, and wetland restoration requirements, such as seeding and mulching. Implementing FERC's Plan and Procedures should maintain all applicable water quality standards. Table 1.9-1 in Resource Report 1 summarizes the permit approvals that Iroquois will seek to construct the pipeline in wetland areas.

The proposed project should have no long-term impacts on estuarine/state tidal wetlands. This wetland consists primarily of sands and is not vegetated. After the pipeline is installed, the trench would be backfilled and restored in accordance with FERC's Procedures. These impacts are expected to be short-term in nature, as studies have found that disturbed dredged habitats recolonize back to an ambient state within two years (Carey and Rhoads 1998, Rhoads and Germano 1986), and suspended sediment concentrations should also return to ambient levels shortly after construction is completed. The New York Tidal Wetland Regulations deem utility construction, where the ground surface will be restored, to be a generally compatible use of the Littoral Zone.

TABLE 3.2.5.1-1
JURISDICTIONAL WETLANDS AFFECTED BY THE EASTERN LONG ISLAND EXTENSION PROJECT

Milepost	Wetland	Construction ROW [a] (acres)	Operational ROW [a] (acres)	Proposed Crossing Method [b]
16.9 - 17.1	E2BBP/Littoral Zone	7.3 [c]	0.73 [c]	Open Cut
27.5 – 27.6	LIE-1	0	0	HDD
	Total:	7.3	0.73	

Notes:
[a] Acreage does not include areas to be horizontal directionally drill.
[b] Refer to Resource Report 1 for description of construction procedures in the Long Island Sound and wetlands.
[c] Impacts to tidal wetlands have also been included in impact calculation for navigable water of the Long Island Sound.

No short-term or long-term impacts should result from the construction of the pipeline at Wetland LIE-1. The proposed pipeline would be installed by HDD beneath this NYSDEC freshwater wetland and the 100-foot adjacent area, with no ground surface disturbance. A complete discussion of the HDD procedure is provided in Resource Report 1.

3.2.5.2 Aboveground Facilities

No wetlands were identified within 100 feet of any aboveground facility associated with the proposed ELI pipeline alignment.

3.2.6 Significant Habitats and Vegetation Communities

The project would involve the permanent conversion of forest habitat to open field habitat along existing maintained ROWs in the USFWS-designed Long Island Pine Barrens-Peconic River Complex and the CPBPC-regulated Central Pine Barrens. However, these proposed conditions should not threaten the management objectives of the Central Pine Barrens. The project does not cross any of the eight rare natural communities of the Central Pine Barrens, and the change of habitat cover type along the William Floyd

Parkway should not affect any of these rare communities, as they are not located near the project area. Also, no impacts to the Peconic River, either short-term or long-term, are anticipated.

The ELI Project is different than residential or commercial development projects, which may destroy vegetative communities, convert pervious surfaces to impervious ones, and generate pollution over the sole source aquifer (i.e. septic systems, parking lot runoff). The ELI Project does not involve these situations, as no new impervious surface cover is proposed in the Central Pine Barrens.. The proposed meter station has been sited outside of the Central Pine Barrens, and the associated parking lot is relatively small and would be used infrequently.

The proposed HDD of the Carmans River and its riparian wetland habitat should not harm the management objectives of the USFWS-designated Great South Bay Complex, and the NYDOS-designated Carmans River Significant Coastal Fish and Wildlife Habitat.

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IROQUOIS GAS TRANSMISSION SYSTEM, L.P.

EASTERN LONG ISLAND PROJECT: PIPELINE SECTION
RESOURCE REPORT 6

GEOLOGY

Presented to:

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SUMMARY OF FILING INFORMATION			
	INFORMATION	Included in ER	To be filed
•	Discuss the need for any locations where blasting may be necessary in order to construct the proposed facilities.	✓	
•	Identify the location (by milepost) of mineral resources and any planned or active surface mines crossed by the proposed facilities.	✓	
•	Identify any geological hazards to the proposed facilities	✓	
•	Identify any sensitive paleontological resource areas crossed by the proposed facilities	✓	

IROQUOIS GAS TRANSMISSION SYSTEM. L.P.

RESOURCE REPORT 6
GEOLOGICAL RESOURCES

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6.0 INTRODUCTION

This Resource Report describes geologic conditions and resources, and potential geologic hazards along the proposed Eastern Long Island (ELI) Extension Project in Long Island Sound and the Town of Brookhaven, New York. The information discussed in this report is applicable for both the proposed ELI pipeline and the aboveground facility locations, as these facility locations occur along the same project corridor. The assessment of potential geologic hazards in the project area are the opinions of ENSR environmental scientists, and are based on the review of available mapping and reports, and discussions with government agencies.

6.1 PHYSIOGRAPHY AND GEOLOGY

6.1.1 Long Island Sound

The ELI pipeline route in Long Island Sound is located within the Atlantic Coastal Plain physiographic province, which is characterized as a seaward-thickening wedge of Cretaceous-age and younger sediments consisting mainly of sand, gravel, clay, and silt, that in the offshore is called the Continental Shelf (Isachsen et al. 2000). The basement rock below the portion of the Long Island Sound crossed by the proposed ELI pipeline route is metamorphic rock (gneiss and schist) of Paleozoic age. This basement rock is seen at the surface in the shoreline area near Milford, Connecticut, however is assumed to be below the trench depth along the ELI pipeline route in Long Island Sound (Thales Geosolutions, Inc. 2001).

These basement rocks were eroded by Pleistocene glacial ice that repeatedly extended across the New York-New England area and was more than a mile thick in places. Long Island marks the southern extent of the local ice margin, along which terminal moraine deposits were laid down. During the last Ice Age (Wisconsin), the sea level was lower due to the great volume of ice covering the continents and there was a broad valley eastward between Long Island and the present Connecticut shoreline. The ice sheet filled this valley and scoured the Paleozoic and Cretaceous bedrock into a smoothed topographic low. Over this low-relief bedrock surface, the glaciers deposited till and drift that are mixtures of material ranging from clays to very large boulders.

When the glaciers began to retreat, the melt water was dammed behind the terminal moraine to form a lake covering the Long Island Sound basin area. This resulted in relatively thick (250-500 feet) layered glacial lake deposits within the Long Island Sound paleo-valley. When the morainal dam was overtopped at the eastern end (The Race) the resulting progressive erosion drained the lake. As glaciers continued to melt, the sea level rose, and the valleys that were cut into the Long Island Sound glacial deposits were flooded and became estuaries.

The marine deposits generally tend to become coarser near the islands, reefs and shorelines. This is a result of both stronger current flows at these margins due to wave and wind forces, constrictions, and due to the proximity to sources of coarser sediments, especially when they are formed of glacial drift. Along the pipeline route, this combined effect is typified at both shorelines where the effect of current, wave action and erosion of the foreshore results in coarse sediment deposits, principally sand. The Biological Assessment (Volume III) describes sediment textural distributions along the offshore pipeline alignment.

6.1.2 Brookhaven, New York

The ELI pipeline route on Long Island is located in the Embayed section of the Atlantic Coastal Plain physiographic province (Fenneman 1938). This coastal plain landscape along the pipeline route has been formed from two prominent till moraines and gently sloping outwash plains, which extend southward from these morainal hills. During the earlier part of the Wisconsin stage, the ice sheet moved to about the middle of Suffolk County and stopped, leaving before it the central ridge called the Ronkonkoma moraine, which runs the entire length of the county from the Nassau County line to Montauk Point. The glacier retreated from this point back to the north of Long Island and then readvanced. The last advance terminated along the north shore; and, again, a hilly terminal moraine was formed called the Harbor Hill moraine. After the two ice sheets reached their southern limits in the county, they began to melt carrying large volumes of sand and gravel farther south. This sand and gravel was deposited in a more or less flat plain, developing what is known as an outwash plain.

The proposed pipeline alignment generally crosses the Harbor Hill moraine where the pipeline alignment comes ashore onto Long Island to Route 25A and crosses the Ronkonoma moraine by the William Floyd Parkway/Long Island Expressway interchange. These moraine deposits are typically composed of poorly sorted mixture of clays, silts, sands, and coarse fragments approximately 30 feet to 100 feet thick (Cadwell 1989). Contour information from USGS topographic maps shows that the ground surface of both moraines is regionally uneven. Elevations generally range from sea level to 180 feet and 60 to 140 feet where the pipeline alignment crosses the Harbor Hill moraine and the Ronkonoma moraine, respectively.

The other pipeline alignment sections are located in glacial outwash deposits. These deposits consist of stratified coarse to fine gravels with sand, with the percentage of finer textured materials increasing in distance from the moraines. These deposits are approximately five feet to 50 feet thick (Cadwell 1989). Contour information from USGS topographic maps shows that ground surface elevations where the alignment crosses glacial outwash areas generally range from 10 feet to 60 feet in elevation.

The bedrock geologic units underlying the project area on Long Island consist of the Cretaceous Monmouth Group, Matawan Group, and Magothy Formation (Fisher et al. 1970 and Busiolano et al. 1998). This assemblage of units is comprised of semiconsolidated coastal deposits of silty clay, sand, gravel, and glauconitic ~~(shallow marine)~~ sandy clay. ~~The Monmouth Group~~ consists of interbedded clays, sands, and silts deposited in a marine environment, and contains significant amounts of glauconite and lignite. The Magothy Formation is a fine to coarse sand with silt, lignite, and clay in the interstitial pore spaces, interbedded with lenses of clay and silt. A basal sequence in the Magothy Formation consists of coarse sand and gravel beds. Crystalline bedrock basement underlies these sedimentary strata, which are of Triassic or Jurassic age.

6.2 BLASTING

It is anticipated that bedrock will not be encountered during construction activities. Bedrock varies in depth under Suffolk County from approximately 400 to 2,200 feet below sea level (Soil Conservation Service 1987). Also, no rock outcrops were observed by ENSR during field surveys. It is, therefore, anticipated that blasting will not be required at the site. While not anticipated, variably cemented sands and gravels and bedrock depth variations can potentially occur.

In the event that bedrock is encountered, the technique used for bedrock removal would depend on the factors such as strength and hardness of the rock. Iroquois would attempt to use mechanical methods such as ripping or conventional excavation to remove the bedrock where possible. If required, bedrock blasting would be conducted in accordance with measures identified in Resource Report 1.

6.3 MINERAL RESOURCES

The proposed construction of the ELI Project should not affect the extraction of mineral resources. The New York State Department of Environmental Conservation – Division of Mineral Resources identifies ten active sand and gravel mines and one proposed sand and gravel mine in the Town of Brookhaven (Cooper 2001). None of these active or proposed mines is located within 0.25 miles of the project area. It is not likely that construction of the project would prohibit future mining operations because a majority of the project area is located on properties where mining is not a compatible land use.

6.4 GEOLOGIC HAZARDS

6.4.1 Karst Topography and Subsidence

The ELI Project should not be at risk from the solution of bedrock, which can result in the subsidence of the ground surface. Karst topography results from solution of carbonate bedrock by groundwater and is characterized by terrain with distinctive relief and drainage features including sinkholes and caves. The project area does not overlie near surface carbonate rock and no karst topography was identified in the project area during field surveys or by Davies et al. (1976).

6.4.2 Seismic Risk

The New York State Geological Survey (2001) states that earthquakes of up to magnitude 6.0-6.5 are possible anywhere in New York State, and earthquakes of up to magnitude 7.0-7.5 are possible in southeastern New York. No faults have been mapped along the pipeline route, however, detailed investigations have not been completed because of the great depth that the basement bedrock exists under Long Island (Fakundiny 2001). A fault in the basement bedrock may have caused an earthquake on August 10, 1884 that affected Long Island with a Modified Mercalli (MM) Intensity of V. The epicenter of this earthquake was in New York City.

The USGS (2001) has developed relatively new seismic hazard maps that depict earthquake hazard. These maps show contour values that represent earthquake ground motion in terms of peak acceleration, defined as a percent of gravity, that have a common given probability of being exceeded in a defined number of years. The map entitled "Peak Acceleration (percent of gravity) with 10 percent probability of Exceedance in 50 years" shows the percent of gravity in the project area as 4.0 out of a possible range of zero to 100 (USGS 1997). For comparison, this map shows the percent of gravity in parts of California as 100.

6.4.3 Soil Liquefaction

Soil liquefaction occurs when sudden shock is delivered to the sediment mass in a location where either water in interstitial spaces supports sediment grains as they settle, or where pore water is forced upward rapidly as a result of the shock, greatly separating the space between grains. In the event that an earthquake did occur in the vicinity of the ELI Project, unconsolidated, saturated, loose granular soils with silt and clay contents of less than 20 percent would be most prone to soil liquefaction. Gravel, coarse sands and silty sands are potentially liquefiable, but less susceptible.

The project area is expected to be at low risk for soil liquefaction. The surficial deposits in the project area are predominately sands and gravels of the coastal plain, and much of the project area does not experience saturation within five feet of the ground surface. Due to the small percentage of susceptible soils and low probability that a significant seismic event would occur in the project area, the potential for liquefaction should be low.

6.4.4 Landslides

The project area should not be at a significant risk from landslides. Godt (1997) identifies a majority of the project area as having a low landslide incidence, where landslides occur in less than 1.5 percent of the area involved. Godt (1997) does identify the north shore of Long Island as having a moderate landslide incidence, where landslides have been known to occur in 1.5 percent to 15 percent of this area. Landslides that have been recorded along the north shore are primarily rotational earth slumps, likely due to the failure of slopes comprised of unconsolidated beach sediments. The project does not involve work activities in steeply sloping areas, which could potentially become destabilized and cause a landslide.

6.5 PALEONTOGICAL RESOURCES

The ELI Project is not expected to impact paleontogical resources. The construction of the project area should only generally involve trenching in surficial deposits laid down about 12,000 years ago and are unlikely to contain significant paleontological resources. The sedimentary basement bedrock underlying the project area, which formed during the Triassic and Jurassic periods of the Mesozoic era, may possess paleontogical resources. However, they occur at a depth of approximately 400 to 2,200 feet below the ground surface and would not be impacted by proposed construction activities.

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IROQUOIS GAS TRANSMISSION SYSTEM, L.P.

EASTERN LONG ISLAND EXTENSION PROJECT: PIPELINE SECTION
RESOURCE REPORT 10

ALTERNATIVES

Prepared for:

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SUMMARY FILING INFORMATION		
INFORMATION	Included in ER	To be filed
• Address the consequences of not constructing the project.	✓	
• For large projects, address the effect of energy conservation or energy alternatives to the project.	✓	
• Identify system alternatives considered during the identification of the project and provide the rationale for rejecting each alternative.	✓	
• Identify major and minor route alternatives considered to avoid impact of sensitive environmental areas (*e.g.*, wetlands, parks, or residences) and provide sufficient comparative data to justify the selection of proposed route.	✓	
• Identify alternative sites considered for the location of major new aboveground facilities and provide sufficient comparative data to justify the selection of the proposed site.	✓	

IROQUOIS GAS TRANSMISSION SYSTEM

RESOURCE REPORT 10
ALTERNATIVES

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LIST OF FIGURES

10.0 INTRODUCTION

This resource report describes the alternatives considered as a part of the process of identifying the preferred actions of the pipeline segment for the proposed Eastern Long Island (ELI) Extension Project. The preferred route for the ELI Project is the result of a comprehensive evaluation process involving, but not limited to, the consideration of environmental, economic, engineering, and landowner benefits and costs at each stage of the project. The iterative process ranged from a broad analysis of major energy development options to the specific selection of pipeline route alternatives. As a result, Iroquois believes the preferred route represents the most environmentally acceptable, technologically feasible, and economically viable option for meeting the stated project objective.

Four basic sets of options were considered that would fulfill the objective to provide competitive, reliable service in the long-term delivery of energy to expanding markets in New York. The no-action alternative was also considered. These sets of alternatives include:

"No-Action" Alternative. A new pipeline system is not constructed. New supplies of economically viable natural gas are not supplied to New York markets.

Energy Conservation. Energy conservation alternatives include the potential for improvements in energy efficiency in the residential, commercial, and industrial sectors, beyond the energy efficiency potential already incorporated in current gas demand forecasts.

Energy Alternatives. Energy alternatives include natural gas and other conventional or non-conventional energy sources, such as orimulsion, coal, oil, electricity (from coal, oil, and out-of-state purchases), propane, LNG, synthetic fuels, nuclear fuels, solar resources, wind resources, or geothermal resources.

Existing Transportation System Alternatives. System options involve the transportation of the equivalent amount of incremental natural gas by the expansion of existing pipeline systems or by other new pipeline systems.

Alternatives to the Preferred Route. These alternatives each comprise different routes for transporting the same amount of gas from the supply to the delivery points. The alternatives analysis involved major system route alternatives, minor route alternatives, and route variations.

Resource Report 10 is organized into three major sections. Section 10.1 discusses the "no-action" alternative. Section 10.2 provides a description of system alternatives. Section 10.3 discusses major route alternatives and alternatives for aboveground facilities.

10.1 "NO-ACTION" ALTERNATIVE

The no-action alternative would result in not building the proposed ELI Project. Such a result would have adverse consequences for the electric generating market in New York. Although the "no-action" alternative would also avoid the environmental impacts identified in this Environmental Report (ER), electric generators and Local Distribution Companies (LDCs) would likely pursue new transportation alternatives to move their natural gas supplies resulting in less, equal, or more environmental impacts, depending on route alternatives. Use of energy sources other than natural gas most likely would result in more impacts (see Section 10.1.2 below). Therefore, the "no-action" alternative is not considered acceptable because it would not accomplish the stated project objective of providing the incremental volumes of natural gas transportation service to markets in New York in an efficient, safe, and cost effective manner.

10.1.1 Energy Conservation

The use of the energy conservation option for serving the demands of Iroquois' customers includes:

Potential for improvements in energy conservation in the residential, commercial, and industrial sectors, beyond the energy efficiency potential already in current gas demand;
System optimization is also an option and includes: Potential for increasing the efficiency of use of the natural gas transmission system using load management techniques at both end-use customer and utility level; and identification of bottlenecks in gas transmission systems that decrease the effective capacity of the system to provide natural gas services. This would likely have significant impacts and not yield sufficient results to satisfy demand.

Energy conservation programs that serve to save a significant amount of natural gas on such a large scale as this program are difficult to quantify and often take a number of years to implement and yield significant returns and may never compensate for continued energy demand. Energy conservation has been encouraged in the residential, commercial and industrial sectors with some success. The use of natural gas is itself an indicator of this trend toward conservation of non-renewable resources. Air quality legislation has been implemented, which enhances fuel conservation in numerous sectors of energy users and in many cases encourages the use of natural gas over other more environmentally taxing fuels. Increases in population and commercial and industrial uses of natural gas have spurred demand for natural gas.

In summary, natural gas demand in New York is continuing to grow despite programs, which are designed to encourage fuel conservation. Fuel conservation should continue to be an ongoing alternative. However, conservation cannot alone meet the growing demand for natural gas in such a large market sector.

10.1.2 Energy Alternatives

The use of alternative energy sources is an option for serving the demands of Iroquois' downstream markets. Potential alternative energy sources include coal, oil, nuclear energy, and electricity, as well as more innovative sources such as solar, wind and geothermal energy. Energy conservation to avert the need for increased gas volumes was also considered. All of these options were discounted for various environmental, economic, or engineering reasons, as discussed below.

Coal, although an available energy option, is not as clean-burning as natural gas, and its use may have implications related to acid rain policies unless costly air pollution controls are applied to coal-burning power plants.

Because much of the oil consumed in the United States is purchased from overseas sources, the use of additional oil supplies to meet future energy demands in the expanding New York markets could further increase the country's reliance on overseas crude petroleum and petroleum products. This may increase the risks related to economic and national security in the event of an emergency or a supply curtailment. Given the current instability of some oil-producing regions, particularly the Middle East, this option would not guarantee reliable, deliverable energy supplies and, thus, is not a preferred option. In addition, the increased use of oil increases the level of environmental impact associated with processing, transporting, and burning this type of fuel. For example, an increase in the movement of oil tankers to transport the fuel causes an increased risk of oil spills and the associated significant environmental impacts. Trace sulfur in this fuel also typically results in sulfur dioxide emissions, as well as emissions of nitrogen oxides (NO_x) and particulates, during burning. These emissions cause air quality degradation. Moreover, if new or expanded refineries were required to process the crude oil, various additional environmental problems may result (e.g., air pollution, visual intrusion, and noise).

Nuclear energy development is an environmentally viable option, especially in terms of limiting air emissions of criteria pollutants. However, this option has drawbacks because of the negative public perception concerning the safety risks that this poses. As a result, an unfriendly regulatory climate exists in which the probability of a new nuclear facility coming on line to serve the incremental energy demands is extremely low. Moreover, the use of nuclear fuel would result in long-term environmental impacts stemming from the disposal of radioactive waste products.

Solar, wind, geothermal, and other such innovative alternative energy sources are not considered economically acceptable fuel for use in residential, commercial, and industrial markets. Compared to using other fuels that are feasible for use in downstream markets, the use of natural gas clearly benefits the environment. Specifically, compared to other fossil fuels, the use of natural gas:

- Results in significantly lower emissions of sulfur oxides (which are a primary cause of acid deposition);
- Generates lower emissions of total airborne particulates, hydrocarbons, carbon monoxide, and NO_x; and,
- Eliminates residual wastes and the subsequent land requirements for the disposal of such waste.

Given adequate pipeline transmission capacity and a competitive gas supply market, natural gas is a cost effective and reliable long-term energy option to meet the demands of the utility, residential, commercial, and industrial sectors in New York.

In summary, natural gas was determined to be the most environmentally clean source of energy of the practical and available energy options. As a clean-burning fuel, natural gas would minimize the emission of particulates and other air pollutants that contribute to acid rain and cause concern over the greenhouse effect.

10.2 SYSTEM ALTERNATIVES

Subsequent to the determination that natural gas is the preferred energy alternative (see Section 10.1 above), system alternatives for transporting the required incremental supplies of natural gas through existing or new natural gas pipeline systems to markets in New York were examined.

10.2.1 Existing and Proposed System Alternatives

Existing systems in the project area would require substantial looping, as well as new pipeline and compression facilities to deliver the volumes of natural gas Iroquois would deliver to the markets at the pressure levels identified in this application. Expansion or looping of existing systems would also be constrained by new deliveries that are planned in New York. That is, if the existing facility were not located near the new deliveries, new pipeline facilities would be required to deliver natural gas to the customers to be served by Iroquois.

Iroquois examined the feasibility of several existing and proposed systems to deliver the proposed volumes of natural gas to the New York markets. None of these existing or proposed systems could provide the system benefit that the Iroquois System provides.

Proposed Project

Iroquois is aware that another pipeline system has been announced proposing to transport incremental volumes of natural gas into Long Island, New York. Specifically, this project is identified as the Islander East Pipeline Project (Docket No. CP01-384-000).

The proposed Islander East Project will consist of the retest and upgrade of approximately 27.4 miles of existing pipeline in Connecticut, a new 10,300 nominal horsepower compressor, construction of approximately 45 miles of new 24-inch pipeline from Connecticut to Long Island, and construction of various aboveground facilities including meter stations and mainline valves. The construction of these facilities by Islander East will be to initially provide 275,000 dekatherms per day of natural gas to energy markets in Connecticut, Long Island, and New York City. Because the project is the subject of a recently filed application, additional information is contained in the above referenced docket.

The proposed ELI project is superior to Duke's Islander East project for the following reasons:

Environmentally Superior – Iroquois' ELI Project does not require any looping of pipe in Connecticut; Iroquois proposes to "hot tap" its existing Long Island Sound Crossing in a location that will result in minimal impact (far less than that which Duke is proposing in Islander East) to existing oyster leases along the Connecticut coastline. Overall, Iroquois proposes to install 17 miles of marine pipeline versus 22 miles of marine pipeline that Islander East contemplates.

Minimizes Connecticut Public Opposition – The only new mainline facility that Iroquois is proposing to install in Connecticut as part of the ELI Project is a new compressor station in Milford, Connecticut. Iroquois currently owns this industrially-zoned piece of property on which Iroquois currently owns and operates metering facilities. Additionally, Iroquois is proposing to make some minor modifications to facilities that will be located in Brookfield, Connecticut. From a marine perspective, Iroquois is making every effort to avoid Connecticut oyster leases by "hot tapping" on the edge of an existing lease bed, whereas Islander East is required to construct pipeline directly through active oyster leases.

Reliability – Iroquois' ELI Project will be integrated into Iroquois' existing mainline, thereby benefiting from the redundancy of compression if an unplanned outage occurs. Islander East lacks redundancy of compression due to the fact that the project will be solely dependent on compression being installed in Chesire, Connecticut.

Lower Threshold Volume – Although forecasts for growth on Long Island are extremely bullish, it remains to be seen what effect the downturn in the economy will have on residential conversions to natural gas. Additionally, with the various Long Island Sound Crossing projects that are being proposed to increase electric transmission capabilities into this region, it remains to be seen how much new generation will indeed be constructed on eastern Long Island. As such, Iroquois' ELI Project (175,000 Dt/d) versus Islander East (275,000 Dt/d) offers measured growth into this region and eliminates the concern of an overbuild scenario. Yet, Iroquois' proposed 20-inch crossing of the Long Island Sound offers tremendous growth opportunity through compression expansions if the Long Island market does indeed achieve the growth that is being forecasted.

Higher Pressure – Iroquois' ELI Project will have a design delivery pressure into the facilities of KeySpan on Long Island on a year round basis well in excess of 800 psig versus Islander East's proposed design delivery pressure of approximately 350 psig.

Lower Rate – Iroquois' ELI Project filed Recourse Rate of approximately $0.25/Dt is nearly $0.07/Dt less expensive than Islander East's filed Recourse Rate of $0.32/Dt.

Transportation Optionality – Shippers on Iroquois' ELI Project will have secondary physical access to the New York City marketplace as opposed to having to rely on displacement access which is the only means available to shippers on Islander East.

10.3 ROUTE ALTERNATIVES

10.3.1 Major Route Alternatives

The overall route selection process for Iroquois commenced with the identification of key constraints or control points. These consisted of proposed supply points from their existing mainline and a delivery point on Long Island. Based on these very high-level control points, two major route concepts are applicable. The first route concept involves an offshore segment from the receipt points (Iroquois' existing pipeline), across the Long Island Sound, to a landfall on Long Island, corresponding to proposed market points further inland. The second concept would involve an all-onshore route across southern Connecticut and northern Long Island. The analysis of the two concepts is mainly a comparison between an offshore segment and an onshore segment.

Iroquois selected the offshore segment because this option offered the most direct and least intrusive route from a reliable network of supply points to the identified market area. The offshore route offers reduced length, minimal landowners, minimal safety risk, and minimal environmental impact as compared to an onshore route through densely populated areas in both southern Connecticut and northern Long Island. An overland route would involve extensive disturbance and impacts to landowners in areas, which would not directly benefit from the incremental supply of natural gas. Accordingly, any overland route would undoubtedly bring opposition from nearby residents who would feel that they must live with development that is perceived to have no local benefits.

It is felt that an option utilizing an offshore segment offers the most environmentally responsible and economically feasible alternative to servicing demands for natural gas in New York. Because of the amount of pipeline that would have to be constructed onshore and the impacts of these facilities to environmental resources, residences, and general impacts to urban areas from construction onshore options through Connecticut and Long Island were not considered viable alternatives and were eliminated from further analysis.

10.3.2 Offshore Selection Methodology

The alternative analysis of the offshore portion of the Iroquois System began by identifying the supply points and the major environmental and engineering constraints for construction and operation of the proposed pipeline. Primary engineering considerations included:

- locating the route within water depths that were deep enough to facilitate construction and minimize dredging, yet shallow enough to minimize costs and problems associated with deeper water installation;
  locate the pipeline within sediment deposits to accommodate the necessary cover and avoid rock for constructability;
- minimize crossings of existing obstructions and offshore pipelines;
- avoiding hazards such as steep bathymetric slopes and topographical relief;
- minimize potential impacts to shipping and navigation;
- avoid known constraints such as the disposal mounds;
- utilize available construction techniques;
- horizontal directional drilling limitations for major crossing; and,
- minimize crossing seabottom features such as sand waves, rock outcrops and scarps.

The environmental considerations reviewed by Iroquois included:

- ecologically sensitive areas;
- provide for co-location opportunities;
- habitat of commercial shellfish;
- habitat of commercial fishing;
- historic properties and archeological sites;
- parks, recreational lands, wildlife refuges, natural areas and preserves; and,
- aesthetically important or otherwise significant geological formations.

The primary constraints for the offshore pipeline route, locating the beginning and ending points of the route, was determined by the location of the shoreline crossing points in Milford, Connecticut and Shoreham, New York, which is addressed elsewhere within this resource report. Then, fine-tuning of the shortest, most direct route was determined as described below. Figure 10.3.2-1 presents the offshore route alternatives for the proposed ELI pipeline project.

The overall proposed ELI route was selected based upon generalized engineering criteria, environmental considerations, and the geographical location of the supply and delivery points. Initial desktop studies coupled with an evaluation of the aforementioned considerations resulted in the selection of the preferred route, which is generally a direct path from Milford, Connecticut to Shoreham, New York.

Iroquois' existing mainline proceeds offshore in Milford heading east around Charles Island then turns southwesterly toward Northport, Long Island. Iroquois considered numerous starting locations for the proposed pipeline in Connecticut including both onshore and offshore beginning points, which will be further discussed in this section. Iroquois concluded that the most advantageous location would be an offshore tie-in to its existing mainline in order to minimize impacts to shellfish bed leases.

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Iroquois selected the preferred tie-in location for several reasons. The primary advantages to this location are the benefits provided by the existing sediments at this location. From previous studies and information from mainline construction, the existing mainline is buried approximately 10 feet below the seabed within sediments generally comprised of sand. This depth of burial provides a level of protection and a medium of stable material for the installation of new pipeline tie-in facilities associated with the ELI project. In addition, this depth of burial would provide sufficient cover over the pipeline and associated facilities to allow Iroquois to place a domed cover over the tie-in location to protect the facilities and allow the dome cover to be completely buried below the surface. Furthermore, only one shellfish bed lease would be crossed by the ELI project and would only occur at the tie-in location (see Resource Report 8, Section 8.5.1.1 and Table 8.5.1.1-2).

This location also maximizes the operation of the pipeline by locating the new pipeline as close to shore as possible. The optimum location from an operational standpoint would be to bring the new pipeline back to shore in Connecticut at a mainline valve location. This would avoid pressure drops in the system and minimize the bottleneck that would occur in the system by locating the tie-in offshore. The further offshore the tie-in, the higher the pressure drop in the system.

Finally, Iroquois routed the proposed pipeline in sedimentary environments that are more conducive to the installation of the pipeline. As shown in Figure 3.1.1.1-2 from Section 3.1.1.1 of the Biological Assessment included with this filing, there are four categories of bottom sedimentary environments identified in the study area. The optimum location for a pipeline would be fine-grained depositional areas where the pipeline could be installed in soft sediments that would allow the pipeline to be installed below the seabed. Other areas of either erosional, bedload transport, or sediment reworking would not only not provide suitable sediments for cover over the pipe for protection, but would also create an environment following construction that may remove material from the pipe resulting in operational issues after the pipeline is installed. Sedimentary deposits in which to install the pipeline and to avoid rock outcrops primarily determined the routing across Long Island Sound. During the field surveys, the route was refined through the Long Island Sound so that sufficient sedimentary deposits would provide the necessary cover. For these reasons and those stated above, Iroquois believes that the proposed offshore tie-in location and routing provides optimum benefit from an operations standpoint and is environmentally preferable to any alternative.

10.3.3 Onshore Selection Methodology

Once onshore on Long Island, Iroquois assigned a high priority to routing the pipeline adjacent to existing rights-of-way (ROWs) in accordance with the FERC routing criteria. This approach resulted in the identification of a base route that follows, to the extent practical, a combination of road and powerline ROWs in New York (Figure 10.3.3-1). The environmental factors considered included minimizing the length of pipeline, impacts to residences, wetlands, waterbodies, critical habitats, and other sensitive environmental areas, while maximizing co-location opportunities, to every extent practical.

During the development of the proposed route, Iroquois identified and evaluated several route alternatives. A description and comparison of each alternative to the corresponding segment of the proposed route and an explanation of why Iroquois considers the proposed route preferable to the alternative is provided in the sections that follow.

10.3.4 Connecticut Route Alternatives

10.3.4.1 Looping Alternative

Iroquois evaluated the possibility of constructing the ELI project rather than a as tie-in offshore, bringing the pipeline back to a mainline valve location onshore in Milford, Connecticut alongside Iroquois' existing mainline pipeline (Figure 10.3.2-1). This alternative would require the construction of approximately 1.5 miles of additional offshore pipeline and approximately 1 mile of additional onshore pipeline. Similar to the original mainline construction, Iroquois would propose to open cut the shore approach in Milford, Connecticut, install sheet piling to reduce the ROW width for construction, and backfill the trench with the excavated dredged material.

The major advantage of the Looping Alternative would be to allow Iroquois maximum operating potential (MAOP) by eliminating pressure drops along their pipeline system and further allowing Iroquois to install a second crossing of Long Island Sound for reliability purposes. This alternative would also provide an upland area for installing all the necessary connections and simplify the construction process including installing pigging facilities for inspection purposes.

In other respects, this alternative would have a greater impact on environmental resources. This alternative would require installing approximately 2.5 miles of additional pipe through freshwater and coastal wetlands resulting in additional impacts to shellfish bed leases. Although Iroquois believes that this alternative is operationally superior to the preferred route, it was eliminated from further consideration because of the greater impacts to shellfish bed leases.

10.3.4.2 Charles Island Alternative

Iroquois identified the Charles Island Alternative in an attempt to obtain the advantages of the Looping Alternative while minimizing impacts to shellfish bed leases. The concept of this alternative would also involve a pipeline that would originate onshore in Milford to provide optimum operation of the pipeline system. This alternative would involve two Horizontal Directional Drills (HDDs); one from shore to a point west of Charles Island; the second from west of Charles Island to a location southeast of Charles Island (Figure 10.3.2-1). The precise location of the entry and exit locations of the two horizontal directional drills was not determined nor was the design of the construction process that would be required. This alternative was quickly discounted as a viable option based on the difficulty of successfully completing two long complex drills that would be required for this alternative.

10.3.4.3 Proposed Route

Iroquois' proposed route consists of an alignment from Milford, Connecticut to Shoreham, Long Island. The proposed 20-inch diameter pipeline would span approximately 29.1 miles, totaling 17.1 miles in Long Island Sound and 12.0 miles on Long Island. The location of over 58 percent of the pipeline in Long Island Sound has substantially reduced the quantity and significance of the land-based environmental impacts and has reduced the number of affected landowners when compared to a route that is all land-based. Because a large portion of Iroquois' route is offshore, the route is much less intrusive than a route located entirely onshore to access the proposed power generation market area. In addition, Iroquois' preferred alternative involves tapping its existing mainline approximately four miles off the Connecticut shore, instead of onshore in Milford, Connecticut to avoid crossing sensitive shellfish bed leases located on the nearshore.

The proposed onshore portion was selected to maximize the use of existing utility and transportation corridors, thereby minimizing potential impacts to landowners and sensitive lands (Figure 10.3.3-1). In all, approximately 90 percent of the onshore alignment is co-located with existing corridors, in particular, the William Floyd Parkway and the Long Island Expressway. Other routing options to the west or east of the preferred route would have been in proximity to densely populated areas, and/or involved greater impacts to sensitive lands, including the Central Pine Barrens. A discussion of the potential impacts associated with these alternatives is provided in the following sections. The selection of the proposed route of the pipeline took into account engineering constraints both onshore and offshore as well as avoiding sensitive environmental features within Long Island Sound and on Long Island. Based on the offshore and onshore selection methodologies, and for reasons stated in the following sections, Iroquois believes the proposed route is preferable to the identified alternatives.

10.3.4.4 Subsea Tap Alternatives

Iroquois identified two offshore alternatives to the proposed route in an attempt to minimize the crossing of shellfish beds on the Connecticut side of Long Island Sound (Figure 10.3.2-1). The Option 1 alternative would tie-in to Iroquois' existing mainline further offshore in Long Island Sound and proceed southeasterly to Shoreham, New York. The Option 2 alternative would begin further west in Long Island Sound at an existing subsea tee on Iroquois' mainline, which was installed during mainline construction to service future potential markets in the Bridgeport, Connecticut area. Option 2 would then travel eastward parallel to Iroquois' existing mainline for approximately 2.5 miles and join with Option 1 and proceed to Shoreham. Both alternatives end when they rejoin the proposed route offshore of Shoreham (Figure 10.3.2-1).

The primary advantage of these alternatives and the reasons they were identified is that they avoid shellfish bed leases. The proposed route, conversely, will cross one shellfish bed lease owned by Fairhaven Clam and Lobster Company, LLC (lease #580). Although this needs to be confirmed with the owner, Iroquois believes that the current owner does not use this area for oyster propagation, but rather is leased for the temporary placement of clams and it is not known if the owner is presently harvesting or commercially using the lease bed. Regardless, the impacts on the leased bed are expected to be short term and temporary. The fact that additional leased beds have been obtained since the original mainline was constructed would seem to provide evidence that construction impacts were temporary and that the area was restored and recovered following construction and currently provides the habitat suitable for shellfishing.

These alternatives are environmentally and operationally inferior as compared to the proposed route and therefore were eliminated from further consideration. The pipeline and tie-in for either alternative would be constructed in over 70 feet of water as compared to 30 to 40 feet for the proposed tie-in. Information from local lobstermen during the planning stages of the project revealed that the area of the subsea tee and the tie-in location for Option 1 is a nursery area for lobsters and contains a high percentage of females lobsters. These local lobstermen have indicated that the deeper waters in the center of Long Island Sound provide prime lobster habitat. Both tie-in locations are located north of Stratford Shoal and are located within erosion, non-depositional, or sediment sorting sedimentary environments, which indicates that the area is less stable than the proposed tie-in location. Furthermore, because the tie-ins for both alternatives are further west on the existing mainline in Long Island Sound, the system that would be constructed would be inferior to the proposed route due to the pressure implications noted above in Section 10.3.2.

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