Report Submitted with the Application for Site-Specific Regulation of the Connecticut Portion of the Iroquois Natural Gas Transmission Pipeline

Volume 1

Iroquois

GAS TRANSMISSION SYSTEM

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SUMMARY

Introduction

The Iroquois Gas Transmission System (Iroquois) proposes to construct a pipeline with the capacity to transport 575.9 million cubic feet per day (MMMCFD) of natural gas. The initial volumes transported on Iroquois will be imported from Canada by the 21 companies which have contracted for Iroquois capacity.

The purpose of the project, which requires the construction of a pipeline and associated facilities through portions of upstate New York, Connecticut, Long Island Sound, and Long Island, is to transport these natural gas supplies to local distribution companies (LDCs) and power generators in six Northeast states (i.e., Connecticut, New York, Rhode Island, Massachusetts, New Hampshire, and New Jersey). Three Connecticut shippers on the Iroquois system -- Yankee Gas Services Company, Connecticut Natural Gas Corporation, and the Southern Connecticut Gas Company -- will receive 25% of the gas to be transported by Iroquois.

In February 1987, Iroquois applied to the Connecticut Siting Council for a declaratory ruling as to whether the Council had any jurisdiction over the Iroquois project; and, if so, what would be the appropriate time for Iroquois to submit an application to the Council. In the summer and fall of 1987, the Council advised that it had jurisdiction over issues residual to those matters to be decided by the Federal Energy Regulatory Commission (FERC). The scope of this report in support of Iroquois' application to the Siting Council is tailored to reflect the scope of the review which the Council may permissibly exercise. Since the questions of need, cost, system and routing alternatives, and the appropriate balance of public benefits and detriments presented by the project will be conclusively determined by the federal government, the report does not consider these matters except, to some extent, by way of background information.

Project Background

The Iroquois project was conceived in 1985 and has been under government review for almost four years. As an interstate natural gas transmission facility, the project falls under the jurisdiction of the FERC.

In May, 1986, Iroquois applied to the FERC for a certificate of public convenience and necessity authorizing the construction and operation of the proposed pipeline. A preliminary environmental report (ER) was filed in support of the application; a final, three-volume ER incorporating supplemental data and providing specifics regarding the project and alternatives was filed with the FERC in October 1986. In the fall of 1988, in accordance with a July 1988 FERC Order requesting additional data, Iroquois filed nine environmental "resource reports".

On November 14, 1989, FERC issued its Draft Environmental Impact Statement (DEIS) concerning the Iroquois project. (Included in the DEIS for the purposes of federal regulatory review were facilities proposed by Tennessee Gas Transmission Company to effect final delivery of certain volumes transported on Iroquois.) The public comment period on the DEIS spanned from November 14, 1989 to February 16, 1990. A Final DEIS is expected to be issued in late May to early June, and a FERC certificate is anticipated in late June to early July 1990. Since the authority granted to Iroquois' shippers to export gas from Canada will expire on October 31, 1991, the Iroquois pipeline must be in service by then.

Project Facilities

The proposed Iroquois project will consist of 369.4 miles of buried pipeline, as well as associated valves, sales meter stations, and internal electronic inspection vehicle launchers/receivers. The 369.4 miles of pipeline will include 343.1 miles of buried land pipeline (consisting of both 30-inch and 24-inch diameter pipe) and a 26.3-mile subsea crossing of Long Island Sound.

Approximately 17.2% of the project will be located in Connecticut. This includes 47.5 miles of land pipeline. In addition, 16 miles of the 26.3-mile marine crossing of Long Island Sound will be within waters under Connecticut jurisdiction.

The pipeline route will specifically be aligned across eight municipalities in Fairfield, Litchfield, and New Haven counties. These municipalities include:

- Sherman
- New Milford
- Brookfield
- Newtown

- Monroe
- Shelton
- Stratford
- Milford.

The land portion of the pipeline has been aligned parallel to existing rights-of-way to the extent practicable. In addition, Iroquois will narrow its construction right-of-way in 34 miles of the 47.5 miles of the route in Connecticut. The construction of the land portion of the pipeline thus will require the use of a 60-foot-wide right-of-way and the temporary use of an additional 15-to-40-foot width. Additional temporary working space may be required at road, railway, and water crossings and in areas of steep slopes.

Iroquois will require a 60-foot-wide permanent easement. This permanent right-of-way will be maintained in non-woody vegetation. Although mature woody growth and the development of structures will not be allowed within the easement for safety purposes, other land uses will be permitted (e.g., agricultural use, wetlands, lawn and ornamental vegetation).

The construction of the marine portion of the pipeline will entail the use of a landfall at Silver Sands State Park in Milford, and the use of a layvessel. The nearshore portion of the pipeline (i.e., the portion of the route from the 50-foot-isobath landward at Milford) will be lowered below the seabed, while the portions farther offshore will be laid on the bottom.

Schedule

The project is planned for construction in 1991. In order to finance and construct the pipeline prior to the expiration of the export permits on October 31, 1991, while observing all of the constraints which the DEIS indicates that FERC will impose, Iroquois must have all final regulatory approvals (including final Council action) in hand by September 1, 1990. Installation of the marine pipeline is planned to occur during the period of January through May in order to avoid conflicts with both aquatic resources in the Sound, as well as recreational activities. The land portion of the pipeline is expected to occur largely during the summer to fall, although some construction activities may be performed in the winter.

Environmental Evaluation

The construction and operation of the project will not result in long-term significant environmental impacts. Impacts will occur during the construction of the project. However, such effects will be limited to the right-of-way and most will be temporary, lasting only for the duration of the construction period in any one location.

During the construction of the project, approximately 472 acres of land will be disturbed. However, Iroquois will adhere to applicable regulations regarding, among others, soil erosion control and measures for minimizing impacts to wetlands and residential areas. In addition, following the completion of construction, the right-of-way will be recontoured and revegetated in accordance with federal requirements, as well as in accordance with stipulations agreed to during the Siting Council process. Iroquois also has agreed to develop and implement special mitigation plans to further reduce the impacts in selected environmentally sensitive areas (e.g., the Appalachian Trail crossing, crossings of land trusts and blue dot trails).

The operation and maintenance of the buried pipeline will result in minimal long-term impacts. Iroquois will not use herbicides to maintain the right-of-way. All right-of-way maintenance will be performed on a five-to-seven year frequency using mechanical methods. In wetlands with permanently saturated soils, Iroquois has agreed to allow the right-of-way to be maintained in natural wetland vegetation; in such areas, no routine maintenance operations will be performed other than required safety inspections.

Consultation and Coordination

In accordance with the Siting Council's pre-application review process, Iroquois filed technical reports and documents concerning the project with each of the affected municipalities. These materials were filed between December 8 and 15, 1989. Iroquois timed the initiation of the Siting Council review process to coincide with the FERC DEIS review process so that public comments could be combined to the extent practical. At the request of the municipalities, Iroquois also participated in various public meetings and hearings.

I. HISTORY AND SCOPE OF THIS PROCEEDING

In May, 1986, Iroquois Gas Transmission System, (Iroquois) applied to the Federal Energy Regulation Commission (FERC) pursuant to Section 7 of the Natural Gas Act for a certificate of public convenience and necessity for a natural gas transmission line to transport gas from Iroquois, Ontario on the U.S.-Canada border to South Commack, Long Island, New York, along a route through New York State and Connecticut.

In February of 1987, Iroquois applied to the Connecticut Siting Council (Council) for a declaratory ruling as to whether the Council had any jurisdiction over the Iroquois project; and, if so, what would be the appropriate time for Iroquois to submit an application to the Council. Upon advice from the Attorney General of Connecticut, the Council ruled in August 1987 that it had jurisdiction to regulate "the placement of the line within the FERC approved route;" and that this jurisdiction would be "restricted to matters of local concern which neither interfere with the federal regulatory scheme nor impose an undue burden on interstate commerce." (Attorney General's Opinion of January 28, 1987, Appendix A, p. 5). Since the scope of the regulation left open to the Council by FERC could not be definitively determined until FERC had issued a certificate of public convenience and necessity to Iroquois, the Council also advised Iroquois that the appropriate time to apply to the Council would be after FERC had issued such a certificate. (Letter of Colin Tait dated October 6, 1987 to Anthony M. Fitzgerald, Appendix A).

It has now become apparent that, were Iroquois to wait until FERC acts before filing an application to the Council, the Council may not have sufficient time to consider the application carefully. FERC issued its Draft Environmental Impact Statement (DEIS) for the Iroquois project on November 14, 1989. Iroquois expects the Final Environmental Impact Statement (FEIS) to be issued in late May or early June 1990 and expects to receive its certificate of public convenience and necessity from FERC in a late June to early July 1990 timeframe. Since the authority granted to Iroquois' shippers to export gas from Canada will expire on October 31, 1991, the Iroquois pipeline must be in service by then.

In order to finance and construct the pipeline in time for an October 31, 1991 in-service date while observing all of the constraints which the DEIS indicates that FERC will impose, Iroquois must have all final regulatory approvals (including final Council action) in hand by September 1, 1990. Accordingly, any review by the Council which did not begin until after FERC had issued its certificate could only be summary in nature, beginning no earlier than July, 1990 and terminating in August, 1990. Otherwise, the Council proceeding would delay Iroquois' in-service date, threaten the viability of the project, and thus impose an undue burden on interstate commerce.

The contents of the report in support of Iroquois' application have been tailored to reflect the scope of the review which the Council may permissibly exercise. Since the questions of need, cost, system and routing alternatives, and the appropriate balance of public benefits and detriments presented by the project will be conclusively determined by FERC, the report does not consider these matters except, to some extent, by way of background information. Rather, the report is calculated to provide the Council with information it will find useful in determining jurisdictional matters residual to FERC, and in regulating and supervising construction practices and mitigation measures in Connecticut (to the extent that such practices and measures are consistent with those recommended by FERC.)

II. PROJECT DESCRIPTION

II. 1 PROJECT OVERVIEW

Iroquois proposes to construct a pipeline with the capacity to transport 575.9 million cubic feet per day (MMCFD) of natural gas. The initial volumes transported on Iroquois will be imported from Canada by the 21 companies which have contracted for Iroquois capacity. The purpose of the project, which requires the construction of a pipeline and associated facilities through portions of upstate New York, Connecticut, Long Island Sound, and Long Island (see Figure II-1), is to transport these natural gas supplies to local distribution companies (LDCs), cogenerators and power generators in six Northeast states (i.e., Connecticut, New York, Rhode Island, Massachusetts, New Hampshire and New Jersey).

Of the 575.9 MMCFD currently contracted for transport through Iroquois, Iroquois' three Connecticut shippers--Yankee Gas Services Company (Yankee Gas), Connecticut Natural Gas Corporation (CNG), and the Southern Connecticut Gas Company (Southern)--will receive 80 MMCFD in 1991 and 144 MMCFF in 1992. This accounts for 25% of the gas to be transported by Iroquois. Table II-1 identifies the first year and full nominated transportation volumes of Iroquois' 21 shippers.

Natural gas is our least environmentally polluting fossil fuel, and pipelines are the least intrusive means of transporting it. The Iroquois project is specifically designed to serve existing and new gas markets in the Northeast by providing a link from the Canadian gas transmission

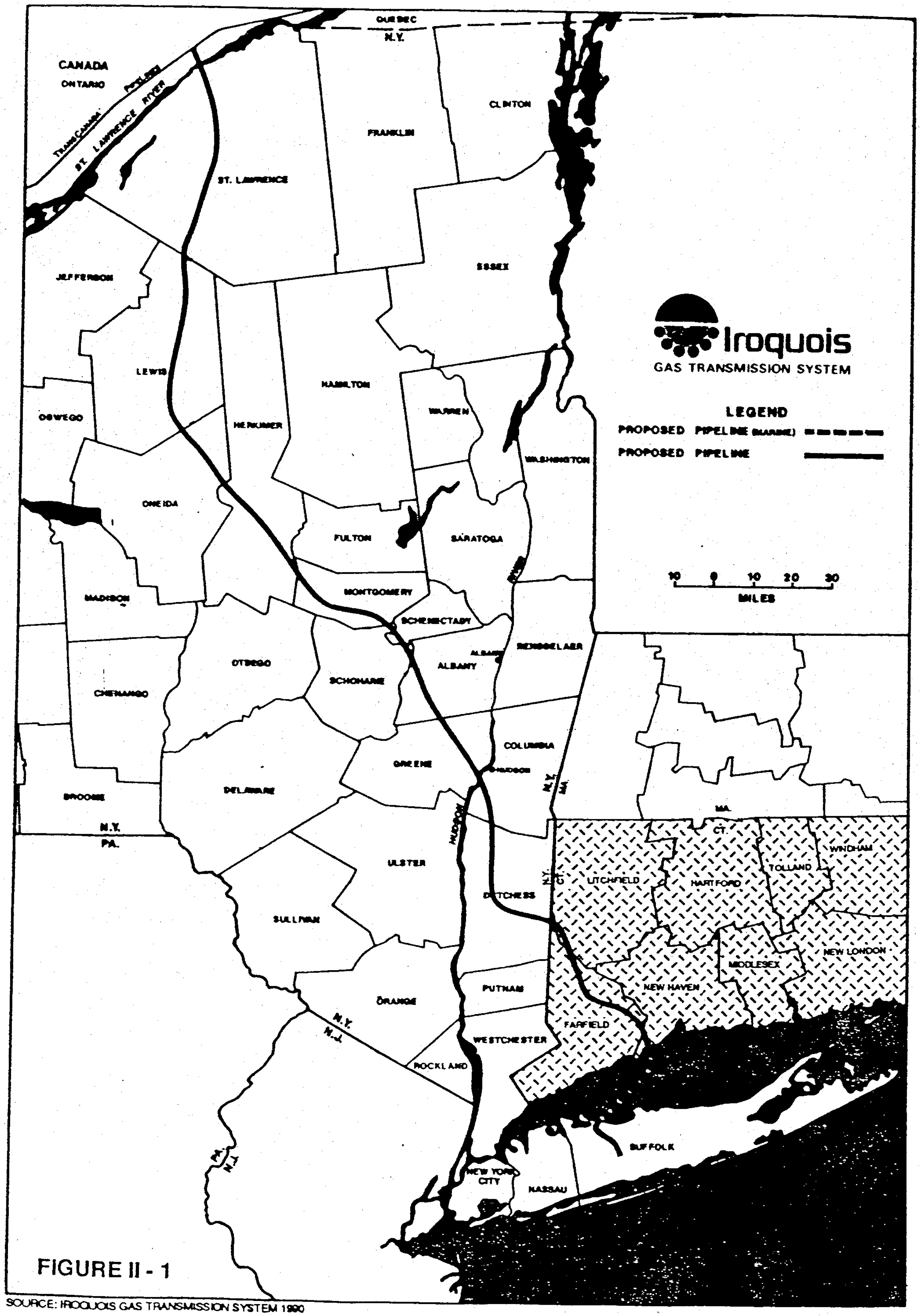

FIGURE II - 1

SOURCE: IROQUOIS GAS TRANSMISSION SYSTEM 1990

TABLE II-1
LIST OF SHIPPERS*

	Volume (MMcf/d) First Year	Second and Subsequent Years
The Brooklyn Union Gas Company	50.0	70.0
Yankee Gas Services Company	30.0	59.0
Connecticut Natural Gas Corporation	30.0	50.0
New Jersey Natural Gas Company	40.0	40.0
Long Island Lighting Company	35.0	35.0
Southern Connecticut Gas Company	20.0	35.0
Central Hudson Gas & Electric Corp.	15.0	20.0
Consolidated Edison Company of N.Y., Inc.	20.0	20.0
Boston Gas Company	52.1	52.1
New York State Electric & Gas Corp.	6.0	17.0
Granite State Gas Transmission, Inc.	35.0	35.0
Public Service Electric & Gas Company	10.0	10.0
Elizabethtown Gas Company	5.0	5.0
EnergyNorth Natural Gas, Inc.	4.0	4.0
Colonial Gas Company	2.0	2.0
Essex County Gas Company	2.0	2.0
Valley Gas Company	1.0	1.0
LDC Subtotal	357.1	457.1
New England Power Company	60.0	60.0
MASSPOWER, Inc.	25.0	25.0
JMC Selkirk Cogeneration	21.0	21.0
Pawtucket Power Associates	12.8	12.8
Power Generation Subtotal	118.8	118.8
Total: LDC and Power Generation	475.9	575.9

SOURCE: Iroquois Gas Transmission System 1990

* Shows the first year and full nominated transportation volumes of Iroquois' 21 shippers.

facilities of TransCanada PipeLines Limited to local distribution systems and power plants in the United States.

In recent years, the Northeast has experienced significant growth in historical gas markets in the residential, commercial, and industrial sectors. This growth is expected to continue.[1] In addition, new markets are emerging for natural gas in cogeneration applications, electric generating capacity using combined cycle technology, and as an alternative and interruptible fuel supply to imported residual fuel oil in existing power plants. Natural gas also represents a zero sulfur source of energy, which will assist efforts in the Northeast to meet sulfur emission standards as a means of reducing acid rain.

The Iroquois project will allow access to western Canada's large gas reserves by gas distribution companies and electric utilities in the densely populated Northeast market area where the gas is needed on a firm and long-term basis. The project will significantly improve gas service deliverability and reliability throughout the region.

The Iroquois project was conceived in 1985 and has been under government review for almost four years. In May, 1986, Iroquois applied to the FERC for a certificate of public convenience and necessity authorizing the construction and operation of the proposed pipeline. A

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1 Detailed market data has been filed with FERC by Iroquois and the Iroquois shippers. Detailed data has also been filed with the U.S. Department of Energy (DOE) and the National Energy Board of Canada (NEB). On January 11, 1990, DOE issued specific findings regarding need. DOE Office of Fossil Energy Opinion and Order No. 368. Findings with regard to need will also be made by FERC and the NEB.

preliminary Environmental Report (ER) was filed in support of the application. A final, three volume ER incorporating supplemental data and providing specific data concerning the proposed action and alternatives was prepared by Iroquois and filed with FERC in October, 1986.

In July, 1988, FERC issued an Order requesting additional data from applicants proposing to bring natural gas supplies to the Northeast. In response to that Order, in September and October 1988, Iroquois filed with the FERC nine environmental "resource reports" and supporting maps and aerial photographs.

On November 14, 1989, FERC issued its DEIS concerning the Iroquois project. Included in the DEIS for the purposes of the federal regulatory review were jurisdictional facilities proposed by Tennessee Gas Transmission Company to effect final delivery of certain volumes transported on Iroquois. The DEIS also evaluated certain non-jurisdictional facilities proposed by gas distribution companies to effect receipt of volumes transported on Iroquois.

The public comment period associated with the DEIS spanned from November 14, 1989 to February 16, 1990. As part of the public comment process for the DEIS, FERC held three days of public hearings, each of which included both afternoon and evening sessions. These hearings were held on January 8, 10, and 11, 1990 in Danbury, Connecticut; Albany, New York; and Amherst, Massachusetts. A Final Environmental Impact Statement is expected to be issued by the FERC in late May or early June 1990.

Concurrent with the FERC review process, Iroquois also applied to the New York State Public Service Commission (PSC) for a Certificate of Environmental Compatibility and Public Need pursuant to Article VII of the New York Public Service Law. PSC Opinion and Order No. 89-42 granting this certificate was issued on December 8, 1989.

II.2 PROJECT FACILITIES

The proposed Iroquois project will consist of 369.4 miles of pipeline, as well as associated valves, sales meter stations, and internal electronic inspection vehicle (pig) launchers/receivers. The 369.4 miles of pipeline will include 343.1 miles of buried land pipeline (consisting of both 30-inch and 24-inch diameter pipe) and a 26.3-mile subsea crossing of Long Island Sound between Milford, Connecticut and Northport, Long Island.

Approximately 17. 2% of the project will be located in Connecticut. Of the 343.1 miles of the land pipeline, 47.5 miles (13.8%) are proposed for location in Connecticut. In addition, approximately 16 miles (60.8%) of the 26.3-mile marine crossing of Long Island Sound will be within waters under Connecticut jurisdiction. The entire Connecticut portion of the project will consist of 24-inch-diameter pipe.

The land portion of the proposed pipeline will be buried throughout its length and has been aligned parallel to existing rights-of-way to the extent practicable. Iroquois will narrow its right-of-way in the majority of Connecticut (see Table II-2). The construction of the land portion of the proposed pipeline generally will require a 60-foot-wide right-of-way and the temporary use of an additional 15-to-40-foot width. Additional temporary working space may be required at road, railway, and water crossings and areas of steep slopes.

The permanent right-of-way will be maintained in non-woody vegetation; however, in agricultural areas, crop production and grazing (pasture) uses will be permitted; in residential areas, lawn and ornamental vegetation will be permitted; and in wetland areas, indigenous vegetation will be allowed to reestablish. Also in wooded

TABLE II-2

Areas in Connecticut Where Restricted Construction Right-of-Way (Less than 100 feet wide) Will Be Used

Municipality	Mileposts	Total Miles
Areas of 90-foot-wide Construction ROW		
. Newtown	315.15-316.25	1.10
Areas of 75-foot-wide Construction ROW		
. Sherman	286.50-286.80	0.30
	286.90-287.15	0.25
	287.30-287.60	0.30
. New Milford	288.95-289.50	0.55
	290.35-291.60	1.25
	292.15-293.10	0.95
	294.60-297.05	2.45
. New Milford/Brookfield	297.60-302.90	5.30
. Brookfield	303.05-304.10	1.05
	304.20-305.60	1.40
. Newtown	306.15-306.35	0.20
	309.00-309.45	0.45
	310.10-313.75	3.65
	314.45-315.15	0.70
	316.25-316.50	0.25
. Monroe	317.10-318.10	1.00
. Monroe/Shelton	319.30-323.85	4.55
. Shelton/Stratford	326.10-330.80	4.70
. Milford	331.15-331.95	0.80
	332.95-334.15	1.20
SUBTOTAL (75-FOOT-WIDE ROW)		31.30
Areas of less than 75-foot-wide Construction Right of Way		
. New Milford	297.05-297.60	0.55
. Brookfield	302.90-303.05	0.15
	304.10-304.20	0.10
. Newtown	306.35-306.45	0.10
. Milford	331.95-332.95	1.00
SUBTOTAL		1.90
Connecticut Total Reduced Right-of-Way		34.30
Total Miles in Connecticut		47.50

* All final decisions on right-of-way width will be made during field surveys. It is likely that the total area will increase rather than decrease. Additional work room also will be required for: full width top soil stripping; major roads and highway crossings; railroad crossings; and intermediate and large river crossings. All areas of restricted right-of-way would require 75 feet for construction, unless otherwise noted.

Source: Iroquois Gas Transmission System 1990.

areas, only 50 feet of the 60-foot permanent right-of-way will be maintained in a non-woody condition. In certain areas, such as congested (developed) locations or areas with special scenic value, consideration will be given to reducing the width of the permanent right-of-way for these short segments of the route.

The land pipeline will be high-quality steel, the wall thickness of which will vary in accordance with U.S. Department of Transportation (DOT) regulations. The steel pipe will be manufactured in compliance with DOT and American Petroleum Institute (API) specifications for High-Test Line Pipe.

The 26.3-mile submarine pipeline will consist of 0.576-inch thick, high-quality steel pipe, which will be concrete-coated for negative buoyancy and protection of the pipe. The thickness of the concrete will depend on pipeline stability requirements and will be a minimum of 2 inches thick. The nearshore portion of the pipeline (i.e., the portion of the submarine route from the 50-foot isobath landward at both Milford and Northport) will be lowered below the seabed, while the portions of the pipeline farther offshore will be laid on the bottom.

The entire pipeline system will be designed for a maximum allowable operating pressure of 1,440 pounds per square inch gauge (psig) in accordance with DOT specifications, although average operating pressures will vary from about 1,400 psig along the northern portion of the route in upstate New York to about 800 psig in Connecticut and approximately 500 psig across Long Island Sound and on Long Island. Since the proposed project will not include any compressor stations, the pressure will decrease linearly from north to south along the route.

The Iroquois project will require minimal aboveground structures. These include mainline valve assemblies, pig launcher/receivers (which, where required, will be sited at valve locations), interconnection points with other natural gas transmission pipeline systems, and sales meter stations. The locations of the above-ground facilities proposed for Connecticut are listed on Table II-3.

The spacing of mainline valves is a function of population density and varies from 8 to 20 miles, in accordance with DOT regulations. The visual impact of these structures will be minimal because of the small size of the facilities. For example, a typical mainline valve site will occupy a fenced area of only 18 feet by 40 feet. At locations of valve assemblies and pig launcher/receivers, the sites will be 120 feet by 210 feet and will have fenced enclosures of about 80 feet by 200 feet. Figures II-2 and II-3 illustrate the proposed valve configuration and visual appearance.

Sales meter station sites will be 200 feet by 100 feet and typically will include a small structure which will be designed to blend into its surroundings to the maximum extent possible. Each sales meter station is expected to have a fenced area of approximately 50 feet by 110 feet. Figures II-4 and II-5 illustrate a typical sales meter station.

TABLE II-3

PROPOSED ABOVEGROUND FACILITY SITES IN CONNECTICUT

Facility	Milepost	Location**
Mainline Valves*		
	293.10	D/S Private Rd. (New Milford)
	304.15	D/S Vail Rd. (Brookfield)
	317.20	U/S State Highway 111 (Monroe)
	333.70	Silver Sands State Park (Maintenance Area)

Company	Location	Milepost
Sales Meter Stations		
Yankee Gas Services Co.	New Milford	297.2
Yankee Gas Services Co.	Huntington	324.4
Southern Connecticut Gas Co.	Stratford	330.10
Interconnection Points		
Algonquin Gas Transmission Co.	Brookfield	305.50
Tennessee Gas Pipeline Co.	Stratford	328.50

* Note: Mainline valve locations, which are specified by DOT regulations, will change in response to incorporation of route variations.

** D/S - Downstream in terms of direction of gas flow.
U/S - Upstream in terms of direction of gas flow.

Source: Iroquois Gas Transmission System 1990.

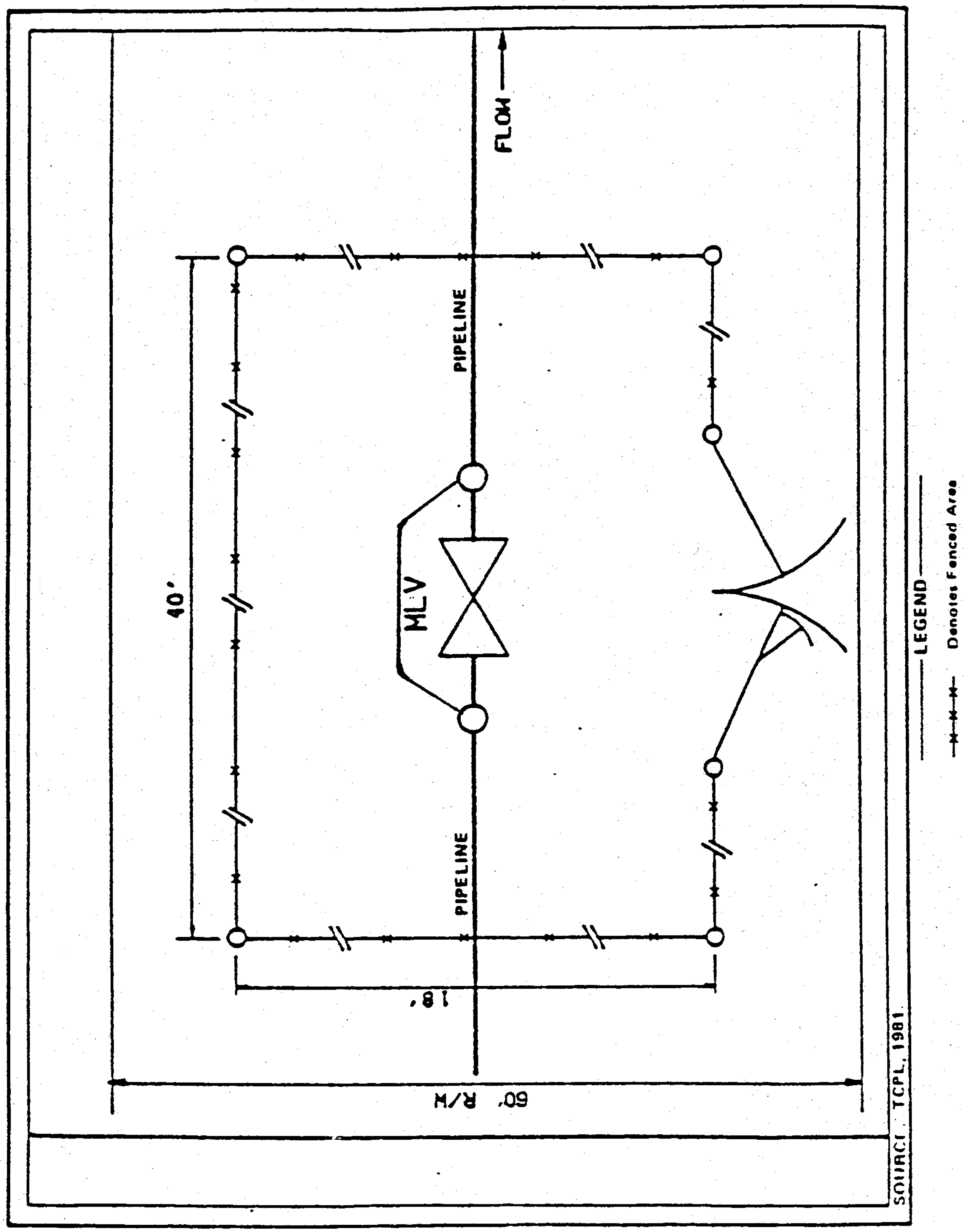
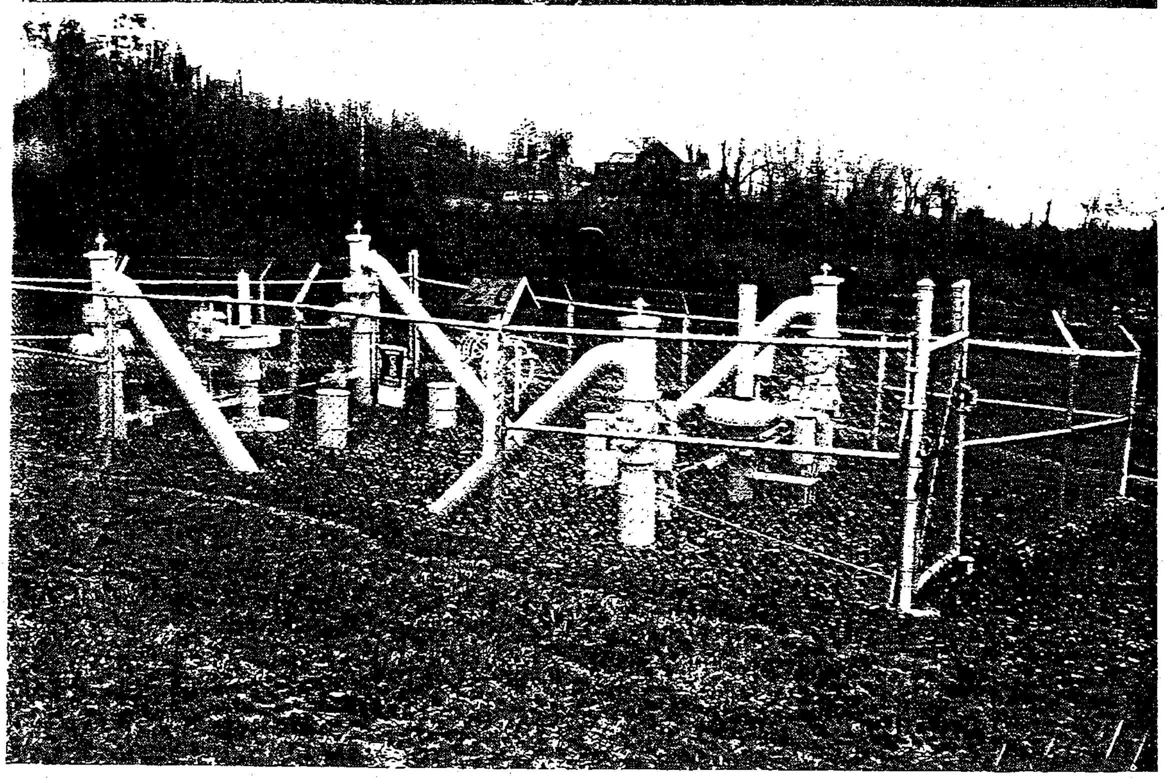
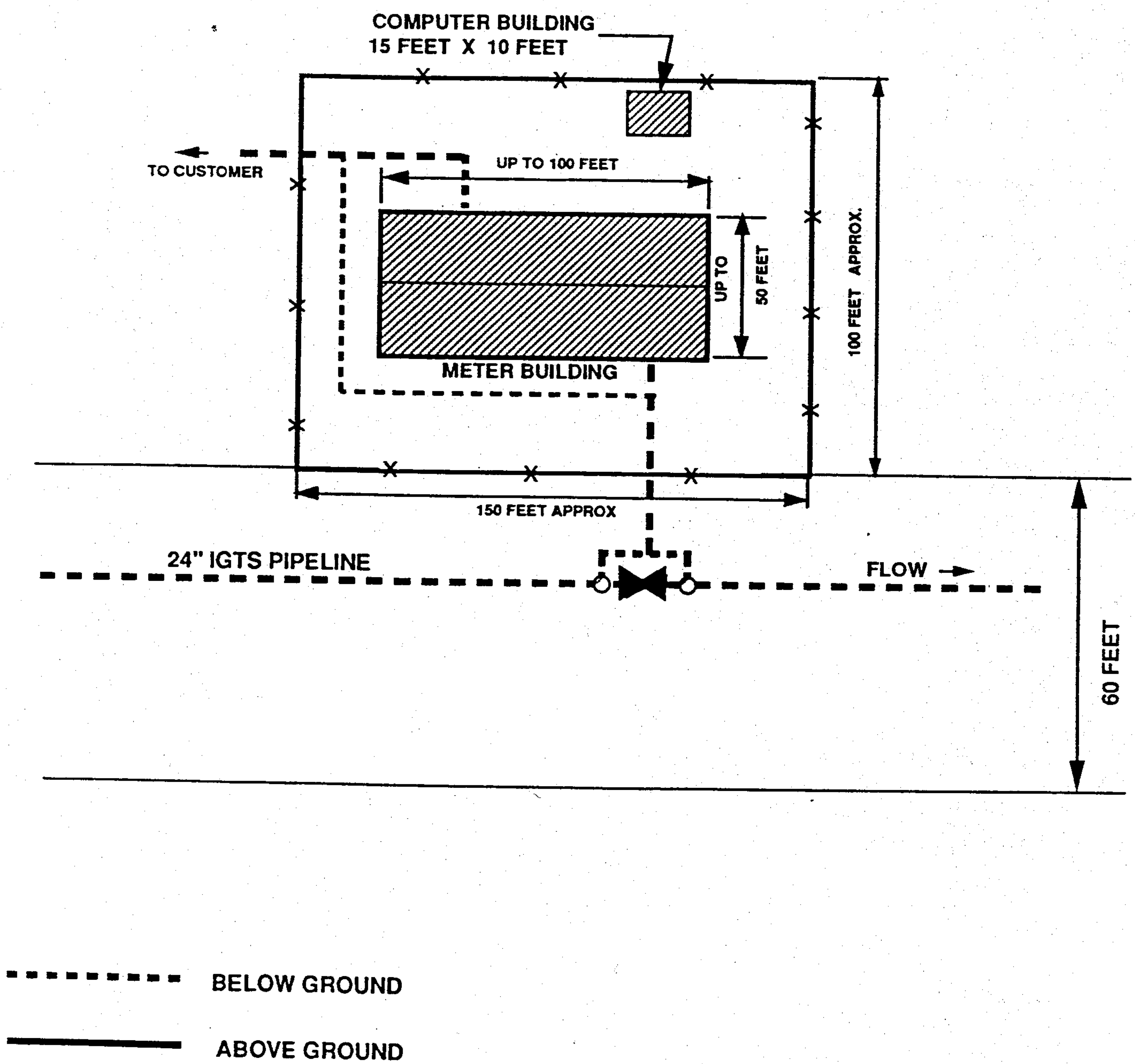


Figure 1—31 TYPICAL MAINLINE VALVE ASSEMBLY SITE

FIGURE II - 2

Figure II-3
Photographs of Typical Valve Sites





TYPICAL SALES METER STATION

FIGURE II - 4

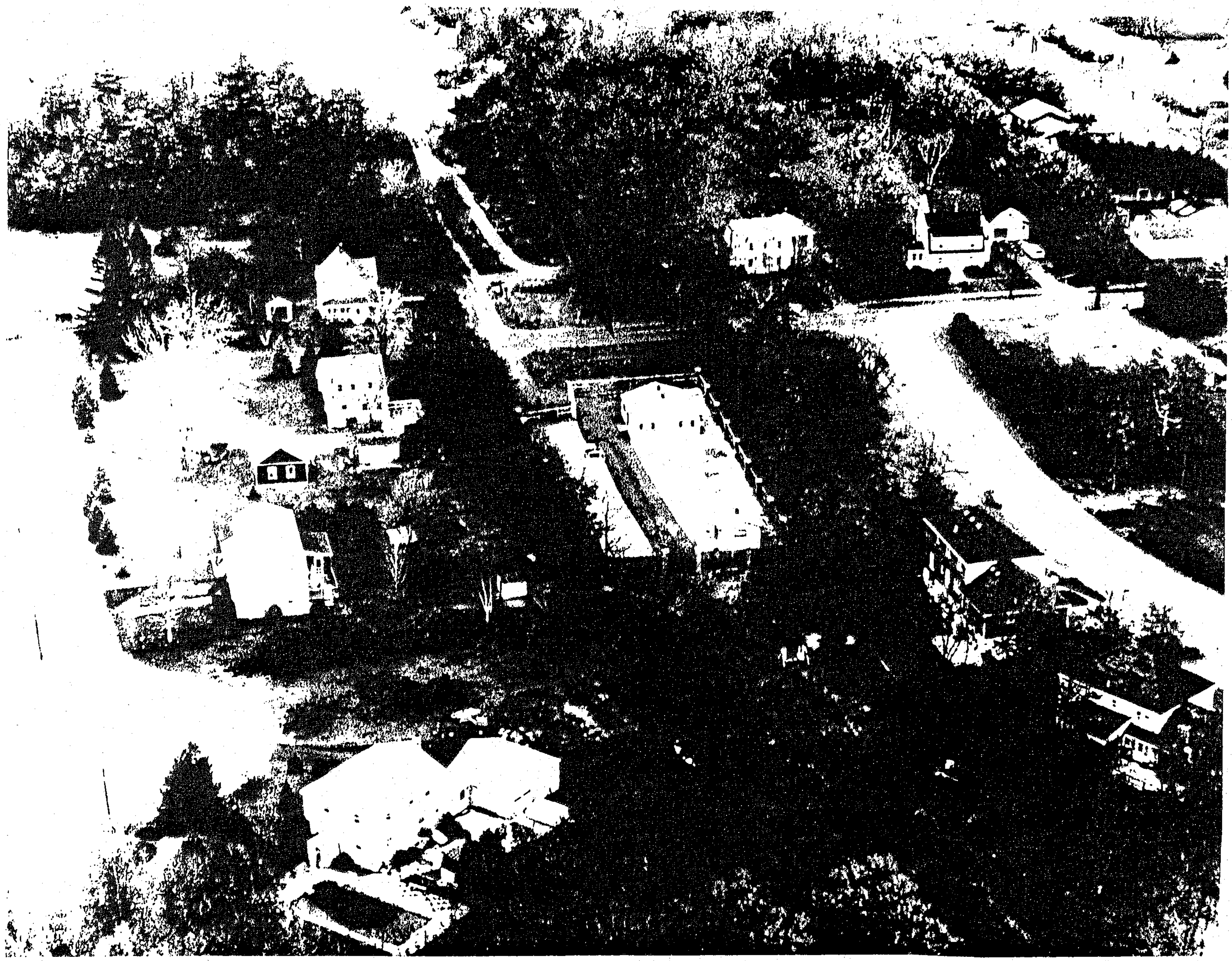


Figure II-5
Photograph of Typical Sales Meter Station Site

II.3 ROUTE SELECTION PROCESS

The preferred route of the Iroquois pipeline is the result of a comprehensive evaluation process that has spanned more than four years and is still ongoing. This process has involved the consideration of environmental, economic, and engineering benefits and costs at each stage in the evolution of the project, ranging from the broad analysis of major energy development options to the specific selection of right-of-way alternatives. At the crux of this pipeline routing process is the use of an iterative approach whereby the pipeline alignment was refined as increasingly more detailed data were compiled and analyzed.

Applying such an iterative approach, the Iroquois routing process began with the general examination of regional scale mapping and regional helicopter overflights, and, in a step-by-step fashion, has incorporated increasingly more detailed and route-specific information as provided by the public (e.g., in FERC scoping meetings, FERC/COE comment hearings, public statement hearings, scoping comments, public meetings in Connecticut (1986, 1989, 1990), and testimony during the New York State Article VII hearings); by representatives of federal, state, and local agencies; and by the results of on-ground field reconnaissance and right-of-way specific environmental field studies.

As the project review process proceeds, right-of-way surveys and inspections are performed, and all affected landowners are individually consulted, the iterative process will continue and minor route modifications will be made. Such minor route refinements may be made to accommodate consideration of factors such as local environmental features (e.g., a wetland incorrectly depicted on a map or a newly discovered archaeological site) or various landowner concerns (e.g., avoidance of springs or wells used for drinking purposes, minimization of impacts to tile-drained agricultural fields, reduction in potential conflicts with planned residential development and existing residences, including private wells or septic fields). This approach reflects Iroquois' intent to be flexible in the routing process -- within the bounds of the alignment certified by the FERC and the conditions attached to the FERC certificate -- in order to ensure that adverse environmental impacts are minimized and that landowner concerns are fully addressed.

The following briefly summarizes Iroquois' application of the iterative approach to the pipeline routing process. This approach was presented in Iroquois' 1986 Environmental Report (ER), Section 2.4, as well as in Iroquois Resource Report No. 10, Alternatives (September 1988).

II.3.1 Initial Routing Considerations

The selection and evaluation of alternative alignments for the Iroquois pipeline route required the evaluation of numerous environmental, engineering, and economic factors which take into consideration the basic objective of the project -- to provide new incremental natural gas supplies to the Northeast. The overall evaluation process involved a phased approach, beginning with the consideration of the project objectives and the constraints imposed by these objectives. Thus, the initial routing of the Iroquois was predicated upon three principal constraints:

- The location of the export point for the gas.
- The location of market areas and delivery points.

- The availability of space for a right-of-way through, and landfall in, the backshore coastal areas of New York and Connecticut. (A marine pipeline crossing of Long Island Sound is required in order to provide gas to Long Island at the east end of the facilities system jointly-owned by the three utilities serving the metropolitan New York area.[2] A landfall for the construction of the marine pipeline on each side of the Sound requires space for on-land construction staging, as well as a nearshore marine environment in which construction could occur without long-term, significant impacts to sensitive coastal resources. (For the purposes of Iroquois' analyses, a landfall refers to a coastal zone area, including terrestrial and nearshore marine areas.))

With these constraints in mind, Iroquois initially plotted a "direct line" route between the export and the delivery points. The route was then modified based on the review of aerial photography and U.S. Geological Survey (USGS) maps in order to avoid those areas in which pipeline construction would not be feasible from an engineering, economic, or environmental standpoint. At the same time, various alignment options were identified in the vicinity of this general route; these included the use of other existing rights-of-way, alternative marine pipeline alignments, and alternative landfalls.

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2 The fact that Iroquois "backfeeds" the New York Facilities System is considered one of Iroquois' major benefits, because it substantially increases the capacity and reliability of service to downstate New York and creates significant future opportunities for delivery of domestic natural gas to Connecticut and the rest of New England by exchange and displacement.

Some of these original alternatives developed into the preferred Iroquois alignment as additional market areas and delivery points evolved and as more specific environmental data became available. In a similar fashion, some of the alternatives considered initially were dismissed due to environmental constraints identified during the review process or due to economic considerations.

Further evaluations of the remaining alignment alternatives were conducted using detailed topographic and bathymetric maps, on-ground reconnaissance surveys, and aerial overflights. In addition, data were obtained from published and unpublished references, as well as interviews with state, federal, and regional environmental regulatory and planning agencies. Other major factors considered in the selection and evaluation of alignment alternatives included the location of suitable pipeline landfalls along both the north and south shorelines of Long Island Sound; engineering and environmental constraints associated with construction and operation of the marine pipeline; and engineering and environmental constraints associated with construction and operation of the land pipeline.

Pipeline Landfalls.

The selection of the pipeline landfalls involved the consideration of a number of factors, including:

- The physical characteristics of the shoreline and nearshore marine environments which can influence pipeline construction, seabed restoration, and long-term maintenance;

- The existing land uses along the shoreline and inland coastal areas adjacent to potential landfalls; and
- Environmental constraints at the potential landfall sites, such as the presence of sensitive coastal resources and habitats.

The physical characteristics of the shoreline influence the technical feasibility of installing a pipeline at a proposed landfall both from the standpoint of minimizing the difficulties of construction and minimizing the hazards to the pipeline during operation. Physical characteristics considered in the location of potential landfalls included:

- Slope of shoreline and nearshore areas;
- Shoreline erosion potential;
- Depth to and nature of the bedrock;
- Characteristics of shoreline sediments;
- Nearshore currents;
- Tidal amplitude; and
- Shoreline access.

In addition, coastal ecological characteristics were key factors in the consideration of landfall sites. Coastal areas contain many habitats which are sensitive to disturbance and which can be difficult to restore. The specific factors that were given careful consideration in identifying alternative landfalls for the project included:

- Habitats for rare or endangered species;
- Important fish spawning or nursery areas;

- Commercially important or productive shellfish beds; and
- Areas such as tidal wetlands, sand bluffs, or dunes, which would be difficult to restore after construction because of the nature of the sediments, vegetation, or aesthetic values.

The existing land uses along the coast and on inland areas adjacent to the landfall were also factors used to identify potential pipeline landfall sites. Of principal concern was the selection of areas with sufficient space for pipeline routing or staging activities during construction; with existing land uses that would not conflict with the pipeline; and with existing rights-of-way or other open areas which would provide access to inland areas. This was especially important since the coastal areas which the Iroquois project traverses to reach the identified delivery points are highly urbanized. The few open areas that do exist at the shoreline and in the coastal area consist mostly of scattered parcels designated for recreational use, nature preserves, or wildlife refuges. Moreover, such lands are interspersed with highly developed areas within which a continuous right-of-way through the coastal area could not be constructed without the removal of numerous houses and other structures.

As a result, the number of potential landfall sites along the coastal areas was limited. Each conceivable route to the coast was examined as part of the evaluation process that incorporated the physical and ecological factors described above.

Marine (Long Island Sound) Pipeline.

The identification and evaluation of marine pipeline routes involved consideration of a number of physical and ecological factors. In addition, route selection was constrained by the general location of feasible landfall sites and the location of the land portion of the pipeline route.

The offshore pipeline route was selected primarily to avoid the following types of features:

- o Areas of rough or irregular bathymetry (i.e., steep slopes);
- o Areas which are excessively shallow or deep;
- o Areas with unfavorable sediments, such as highly erodible or non-cohesive sediments, or sediments with a large number of boulders;
- o Areas with shallow sediments or exposed bedrock which would require extensive seabed preparation (e.g., blasting or stone dumping);
- o Areas with strong bottom currents;
- o Areas with known obstacles such as wrecks, cables, ledges, or designated/active anchorages; and
- o Areas which have been or are being used for ocean disposal.

In addition to the avoidance of the above-listed physical features, pipeline routes were selected that minimized disturbance to important shellfish beds, spawning or nursery areas for important fishery resources, and areas used extensively for commercial fishery operations. Specific considerations included the types of commercial shell- and finfishing activities in Long Island Sound; the schedule of construction required to avoid interference with fishery operations; and the duration of potential impacts -- i.e., short-term or long-term. Examples of the latter include interfering with use of certain types of commercial fishing gear over the pipeline or disturbance to shellfish areas which could require a number of years to become reestablished. Other ecological resources of concern considered in the selection of alternative marine pipeline routes were areas that support unusual concentrations of non-marine species of wildlife such as wintering waterfowl or seabirds, or marine species, including high-quality oyster beds, lobster habitat, or threatened or endangered species.

Land Pipeline.

In general, the factors which were of primary importance in identifying and evaluating alternative alignments for the land pipeline included physical features which would require special pipeline construction from an engineering standpoint, or which would preclude construction from a regulatory standpoint, as well as environmental features with which pipeline construction and operation would be incompatible (i.e., impacts which would be major and could not be mitigated). Thus, the primary environmental factors considered in the identification of alternative routes for the land portion of the pipeline included:

- Topographic conditions;
- Geology;
- Soils;

- Wetlands and water resources;
- Threatened or endangered species;
- Known cultural resources (i.e., recorded archaeological sites and structures of designated historic significance); and
- Existing and proposed land uses and policies (including settlement density, land use patterns, designated public recreational areas, availability of existing rights-of-way that could be paralleled).

All of these factors were considered fully in the evaluation process to the maximum extent practical.

II.3.2. Alternatives Evaluated

Iroquois initially identified, evaluated, and compared alternative routes on a regional scale using general environmental databases and techniques such as the review of USGS topographic maps and relatively large scale aerial photography; the general examination of the project region from helicopters; and initial consultations with federal and state agencies. These data were used to identify potential alignments on a regional scale, based on factors such as:

- Avoidance of regionally important environmental features or land uses (e.g., the Adirondack and Catskill state parks in New York; densely populated areas within the Connecticut coastal zone);

- Avoidance of steep, rugged topography to the extent practical;
- Alignment adjacent to existing utility or transportation corridors; and
- Consideration of policies, issues, or concerns raised by representatives of federal and state agencies.

These initial routing options were subsequently refined and alternative routes identified based on the performance of more detailed aerial and on-ground reconnaissance; the review of specific environmental reports and maps compiled from federal, state, and local agencies (e.g., wetlands maps, soil surveys, land use plans, water resource studies); the results of extensive consultations with agency officials; and map and photographic interpretation. In addition to the route alternatives proposed by Iroquois, various alternatives were suggested by federal, state, and local government officials and the public. These route options also were evaluated. As a result, portions of the Iroquois route were reexamined and, in some cases, route adjustments were made in accordance with these suggestions.

The routes that were initially identified in this fashion were included in Iroquois' 1986 ER. Two basic categories of alternatives were described:

- Alternatives considered but eliminated from detailed analysis. These options include those that were initially evaluated but found to involve some overriding factor (environmental, engineering, and/or economic) that would absolutely preclude feasible construction of the pipeline.

- Alternatives considered seriously and in detail, including the preferred action. These options include all of the identified right-of-way alternatives that were seriously considered, and along which the pipeline could be constructed and operated in an environmentally sound manner. Each option was presented in the 1986 ER at the same level of detail as the preferred action in order to facilitate comparison, in accordance with FERC and CEQ regulations.

Under these two categories, alignment options were presented for all of the major components of the Iroquois project -- that is, alternative land pipeline routes, alternative marine routes, and alternative landfall sites. At least 25 route variations were considered; of these, 11 routes were considered potentially feasible and presented in detail in the 1986 ER.

Subsequent to the submission of the 1986 ER, Iroquois continued to refine its proposed route, working with federal, state, and local agencies and consulting with the public. As a result of such efforts, Iroquois has defined a third category of alignment alternatives--route variations to certain portions of the right-of-way. The route variations that have been identified were all proposed in specific response to the completion of more detailed environmental and routing studies of the originally proposed route or alternatives; the identification of environmental features not previously defined; the results of landowner discussions with Iroquois representatives; or the requests of agencies to avoid or minimize potential impacts to locally-sensitive land uses or habitats, including wetlands.

Based on these new information sources, more than 120 route variations to the original proposed and alternative routes were identified by Iroquois, government agencies, or the public. Approximately half of these were proposed in order to avoid wetlands since additional wetlands were identified as more route-specific data were developed. For each of the proposed variations, route-specific environmental evaluations were completed that compared the environmental features along both the reroute and the portion of the original route that it would replace. In a majority of cases, these evaluations verified that the reroutes offered environmental, economic, or engineering benefits compared to the portions of the original routes that each would replace.

In addition to the reroutes proposed by Iroquois, as part of the New York State Article VII review of Iroquois' application or as a result of consultations with local agencies or affected landowners in Connecticut, various reroutes were proposed by interested parties. Iroquois reviewed these proposed routes in a similar manner to its own reroutes. Several of these route modifications were incorporated into the preferred route that is now being considered by the FERC, while all of the others have been identified as alternatives that also have been included in the FERC DEIS.

II.3.3 Ongoing Studies

Iroquois currently is in the process of performing right-of-way surveys of its proposed route. As part of such surveys, Iroquois consults with each affected landowner, identifying the proposed location of the right-of-way on his or her property. Iroquois provides each landowner with an alignment map (a depiction of the proposed route on an aerial photograph of the property) and discusses with the landowner any potential concerns (e.g., relating to water supply wells, agricultural use, wetlands, future property development).

After obtaining landowner permission to survey, Iroquois flags the proposed alignment across each property. Biologists and cultural resource specialists then perform surveys along this flagged alignment, delineating wetlands and performing vegetation and wildlife investigations (including surveys for raptor nests in all forested areas), and conducting field investigations for archaeological resources, respectively.

The results of these environmental surveys and landowner consultations may, in selected areas, trigger minor modifications in the alignment of the pipeline route. Such modifications -- which may be required to avoid micro-scale features like private springs used for drinking water, newly discovered archaeological sites, or wetlands delineated in the field -- are a recognized part of the pipeline routing process and are made to ensure that both impacts to environmental features and conflicts with landowners' use of their property are minimized. This iterative approach continues -- to the benefit of the environment and the affected public -- throughout the agency decision-making process and up until easement acquisition.

The FERC explicitly recognizes the iterative process by noting in the DEIS that the route adjustment process can be expected to continue (see DEIS page ES-4, and note that the FERC -- in the Final EIS -- will evaluate alternate routes submitted as part of comments on the DEIS) and by providing a mechanism for the submission of such minor alignment modifications to the Commission (see Section 7.3, page 7-7).

II.4. CONNECTICUT PORTION OF THE IROQUOIS ROUTE

The proposed Iroquois pipeline will cross southwestern Connecticut, affecting eight municipalities within three Connecticut counties. The affected municipalities and the pipeline facilities to be located within each are listed in Table II-4.

Table II-4
LIST OF PIPELINE FACILITIES, BY MUNICIPALITY

MUNICIPALITY	MILES OF PIPELINE*	OTHER FACILITIES
Sherman	1.8	
New Milford	10.9	SMS, valve
Brookfield	6.8	IP, valve
Newtown	11.1	valve
Monroe	3.0	valve
Shelton	7.5	SMS
Stratford	3.3	SMS, IP
Milford	3.2	Valve

* Note: totals not exact due to rounding and route variations.

: SMS = sales meter station
: IP = interconnection point

Source: Iroquois Gas Transmission System 1990.

II.5 ALTERNATIVE ROUTES IN CONNECTICUT UNDER CONSIDERATION BY FERC

In the DEIS, FERC identified and evaluated various alternative routes for the pipeline in Connecticut. The DEIS also included FERC recommendations regarding these alignments (see DEIS Sections 3 and 6, parts of which are included herein as Appendix B). As a result of the public comment process on the DEIS, additional alignment alternatives have been suggested. Evaluations of these alignments will be included in the Final EIS (FEIS) prepared by FERC.

Table II-5 lists both the alignment alternatives considered in the DEIS and the additional alignment alternatives (of which Iroquois is aware) that will be considered in the FEIS. These alignments are also depicted on the maps included in Volume 2. In addition, information concerning these alignment alternatives that was provided in the DEIS or included in Iroquois' comments to the FERC or to the Corps of Engineers is included in Appendix B.

TABLE II-5
LIST OF ALIGNMENT ALTERNATIVES IN CONNECTICUT UNDER CONSIDERATION BY FERC

MUNICIPALITY	ALIGNMENT ALTERNATIVE	PROPONENT
Sherman		
	Wimisink Variation	FERC/Iroquois
	Sherman I	HVA
	Sherman 2	HVA
	Variations 1, 2A, 2B, 3	Dutton
New Milford		
	Stilson Hill Road Variation	Iroquois
	New Milford 1, 2, 3 (a,b,c)	HVA/Town
	Kimberly-Clark Variation	Iroquois
	Still River Variation	FERC/iroquois
Brookfield		
	Brookfield Wetland	FERC/Iroquois
	Route 133 Wetland	FERC
	Brookfield Nos 1, 2, 3	Iroquois
	Bound Swamp Wetland	FERC/Iroquois
	Route 7/Conrail Variation	Brookfield
	Brookfield Variation (RR)	Buchta
Newtown		
	Lands End Wetland	FERC/Iroquois
	Algonquin Variation	FERC/Iroquois
	Old Farm Hill Subdivision	Iroquois
	Pootatuck River	FERC/Iroquois
	Newtown Subdivisions	Iroquois
	Forest View Subdivision	Iroquois
	Paugussett State Forest	Newtown residents
Monroe		
	Monroe Subdivision	Iroquois
Monroe/Shelton		
	Conrail Variation	STOP, HVA Monroe, Shelton
Shelton		
	Blakeman Variation	FERC/Iroquois
	Stratford Alternate No. 1	HVA, Stratford Shelton, et. al.
	Constitution Blvd.	Wells

Table II-5 (con't)

Stratford		
	Carroll Variation Alternate Nos. 1 and 2 James Farm Road	Iroquois Stratford et. al. Ballaro
Milford		
	Milford Variation Milford Landfall Variation	FERC/Iroquois Milford Harbor Commission
Miscellaneous		
	In-stream Housatonic River Candlewood Lake	Various Brookfield

Source: Compiled by Iroquois Gas Transmission System 1990; see Appendix B.

NOTES: Identfication of FERC as "proponent" denotes FERC recommendation of variation in DEIS.

II.6 PROBABLE SCOPE OF FURTHER ROUTING ALIGNMENTS TO BE PERMITTED BY FERC

Iroquois anticipates that FERC will designate a route depicted on detailed alignment maps and aerial photography at a scale of 1" = 500'. (DEIS, Volume I, Section 7-3, p. 7-7). The Iroquois route as approved by FERC will thus be determined to a greater degree of specificity than the Council requires for certificate proceedings. (Section I (O) of the Council's "Application Guide" for fuel transmission lines requires mapping to a scale no smaller than 1"= 2,000'). On the other hand, the FERC designated route may be determined with less specificity than the Council requires for a D&M plan. (Section 16-50j-61 of the Council's regulations requires maps at a scale of 1"= 200'). Accordingly, the Council will in general have the opportunity to identify more specific alignments within the FERC designated route, as part of its D&M plan process, so long as the more sopecific alignments are consistent with the routing standards set forth in the FERC certificate.

Iroquois also anticipates that FERC will permit the Council to "impose mitigation measures within the context of" its permitting process, which may be "additional to" FERC's required mitigation measures. (DEIS, Volume 1, p. ES-4) Such detailed mitigation measures are also typically developed as part of the Council's D&M Plan process. (See, e.g. Sec. 16-50j-76 of the Council's Regulations).

FERC also will permit "minimal field realignments per landowners' needs and requirements" without prior FERC clearance (DEIS Vol I, Sec. 7-3, p. 7-7, para. 2) (FERC apparently includes in this category only realignments which affect a single landowner (DEIS, Volume I, p. ES-4)).

Such realignments could also be considered by the Council as part of its D&M Plan process.

Finally, FERC has indicated that it will consider further modifications to the route shown on the 1" = 500' scale mapping it has considered to date which "may be recommended by state regulatory authorities." (DEIS, Volume I, Section 7.3, pp. 7-7, 7-11). Iroquois understands that FERC will not consider any such "further route modifications" after it issues its certificate, which Iroquois anticipates will be no later late June or early July 1990. Consequently, the Council, should it wish to submit any such recommendation to FERC, would have to do so substantially prior to that date, in order to assure that the recommendation would be considered.

III. CONSTRUCTION DETAILS

III.1. RIGHT-OF-WAY TO BE ACQUIRED IN EASEMENT OR FEE

The construction and operation of the Iroquois project will involve the acquisition of both easements for the pipeline right-of-way and properties in fee for the sites of sales meter stations and valves. Based on the 47.5 miles of the pipeline right-of-way in Connecticut and assuming the use of an average 75-foot-wide area for construction of about 34.3 miles of this total, then 472 acres of land will be required. After the completion of construction, 127 acres will revert to the landowner, while 345 acres will be retained in a permanent easement by Iroquois (based on the use of a 60-foot-wide permanent easement).

In addition, Iroquois proposes three sales meter stations, two interconnection points and four valve sites in Connecticut. Since each sales meter station and interconnection point will require an area of approximately 1 acre, a total of five acres will be acquired in fee. Similarly, 0.07 acres of land will be acquired in fee on the right-of-way for the valve sites (based on the use of an 18' x 40' area for each site).

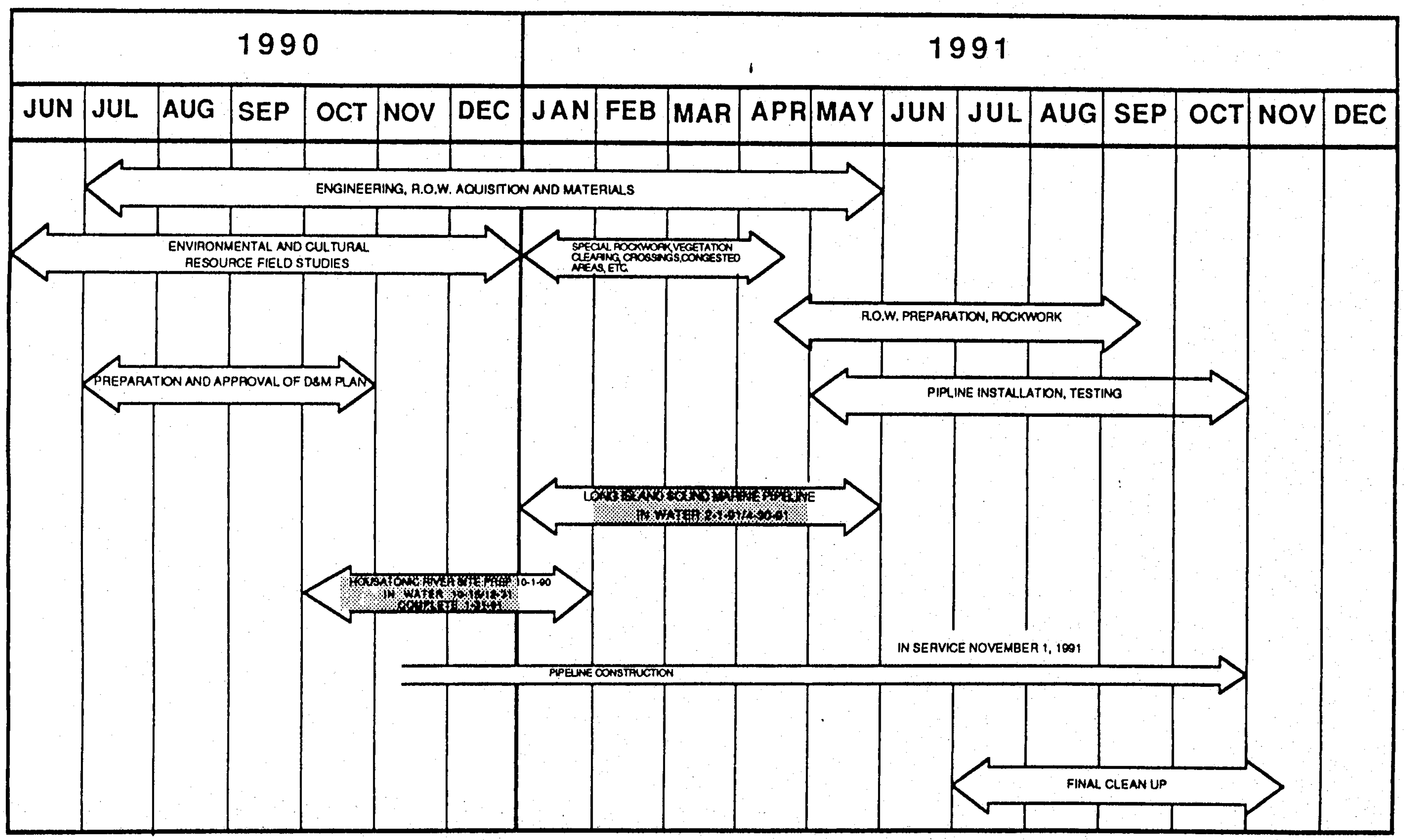
III.2. CONSTRUCTION SCHEDULE

Iroquois proposes an in-service date of November 1991. The land portion of the pipeline will be largely constructed during the spring-winter-fall (i.e., May through October) of 1991. The activities related to right-of-way preparation that may be performed during the winter (i.e., January through March) include clearing trees, grade and ditch blasting in areas of extensive surface rock, installation of the pipeline in certain congested areas, or major road crossings. Similarly, in certain areas, some activities (e.g., those related to final clean-up and restoration) may occur between October and mid-December or in the spring of 1992.

Winter crossings of some streams or roads also may be performed to avoid conflicts with fisheries resources, recreational boating, or in the case of roads, high summer traffic volumes. Figure III-1 shows the recommended in-water construction period for streams and rivers and the marine pipeline.

The marine pipeline is planned for construction in the winter of 1991 (generally during the period January through May) to avoid conflicts with shellfish and fisheries resources, as well as with water-oriented recreational activities (e.g., boating, swimming, sunbathing, fishing).

Marine pipeline installation is planned to be completed by June 1 because of state prohibitions on dredging activities in Long Island Sound; dredging is prohibited from June 1 to September 30 in Connecticut, and from June 30 through September 30 in New York. Extensive preplanning will ensure rapid mobilization and the efficient installation of the pipeline. Scheduling the construction period during the winter months will reduce the



SOURCE: IROQUOIS GAS TRANSMISSION SYSTEM 1990

NOTE: FINAL CLEAN UP WILL BE RESUMED IN SPRING OF 1992 IF NECESSARY

KEY:

PROPOSED CONSTRUCTION SCHEDULE - CONNECTICUT PORTION OF IROQUOIS PIPELINE

FIGURE III- 1

extent of impacts, since most biological communities are at their lowest level of activity during the winter.

III. 3. CONSTRUCTION METHODS

The proposed Iroquois facilities will be designed, constructed, and subsequently tested, operated and maintained to conform with or to exceed the latest editions of the following regulatory requirements: 49 CFR Part 192, "Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards"; 18 CFR Part 2.69, "Guidelines To Be Followed by Natural Gas Pipeline Companies in the Planning, Clearing, and Maintenance of Rights-of-Way and the Construction of Above-ground Facilities"; and other applicable federal regulations.

Iroquois presented detailed construction procedures in its three Volume ER filed with FERC in October 1986. Further detailed information about construction methods was provided in Iroquois' Resource Report No. 1, General Project Description, which was submitted to FERC in September 1988. The FERC DEIS also summarizes Iroquois' proposed construction procedures (see DEIS sections 2.2.1, 2.2.2) and recommends additional measures to be followed (see DEIS Section 7.3). The ensuing discussion of construction details summarizes the aforementioned information.

The construction procedures are discussed in general for the land and marine portions of the project. In addition, specific information is presented on the methods for crossing highway, railroad, and utility rights-of-way; agricultural lands; streams and major rivers; wetlands and rugged topography. Techniques for the construction of aboveground facilities (i.e. valves, sales meter stations) also are presented.

III.3.1 Typical Land Pipeline Construction Procedures

Five mainline construction spreads; one smaller spread (for the segment on Long Island); and three special river crossing spreads will be used to build the land portion of the project (see Table III-1). The 47.5-mile Connecticut portion of the land pipeline will be assigned to one mainline spread; in addition, special crews will be used to install the pipe in the City of Milford. A separate spread will be assigned to install the crossing of the Housatonic River.

Each spread will consist of discrete crews that will perform the full range of construction activities, from clearing and grading to restoration (see Figure III-2). Construction personnel will be hired from the New York-Connecticut area to the maximum extent possible.

Pipeline construction at any one location will typically involve six to 12 weeks between initial land disturbance and final right-of-way recontouring and restoration. Individual construction crews and activities can be expected to advance in most of Connecticut at an average rate of approximately 3000 feet per work day.

Mainline pipeline construction typically involves nine major sequential operations:

- Clearing and grading;
- Trenching;
- Stringing;
- Pipe installation (e.g., bending, welding, weld coating, lowering-in, and tie-ins);
- Backfilling;
- Clean-up (including temporary erosion controls);
- Hydrostatic testing;
- Commissioning activities; and

TABLE III-1

SUMMARY OF LAND PIPELINE
CONSTRUCTION SPREAD INFORMATION

SPREAD NO.			LOCATION		LENGTH (MILES)
Mainline Spreads					
Spread 1					
Start :	MP	0.0	St. Lawrence River		73.3
End :	MP	73.3	Indian River Road		
Spread 2					
Start :	MP	73.3	Indian River Road		80.7
End :	MP	154.0	Mohawk River		
Spread 3					
Start :	MP	154.0	Mohawk River		73.4*
End :	MP	227.4	South of NY Thruway (I-87)		
Spead 4					
Start :	MP	227.4	South of NY Thruway		59.2
End :	MP	286.6	NY/CT Border		
Spread 5					
Start :	MP	286.6	NY/CT Border		47.6
End :	MP	334.2	Long Island Soud		
Smaller Spread					
1			Long Island		8.7
Special Crossings					
St. Lawrence River			U.S.-Canadian Border		1.2
Hudson River			Greene-Columbia Counties, NY		1.0
Housatonic River*			Town of Stratford and City of Milford, CT		0.3

*Includes 38.3 miles of 30-inch diameter pipeline and 35.1 miles of 24-inch diameter pipeline. Spread also includes Mohawk River crossing and New York State Thruway crossing.

Source: Iroquois Gas Transmission System 1990.

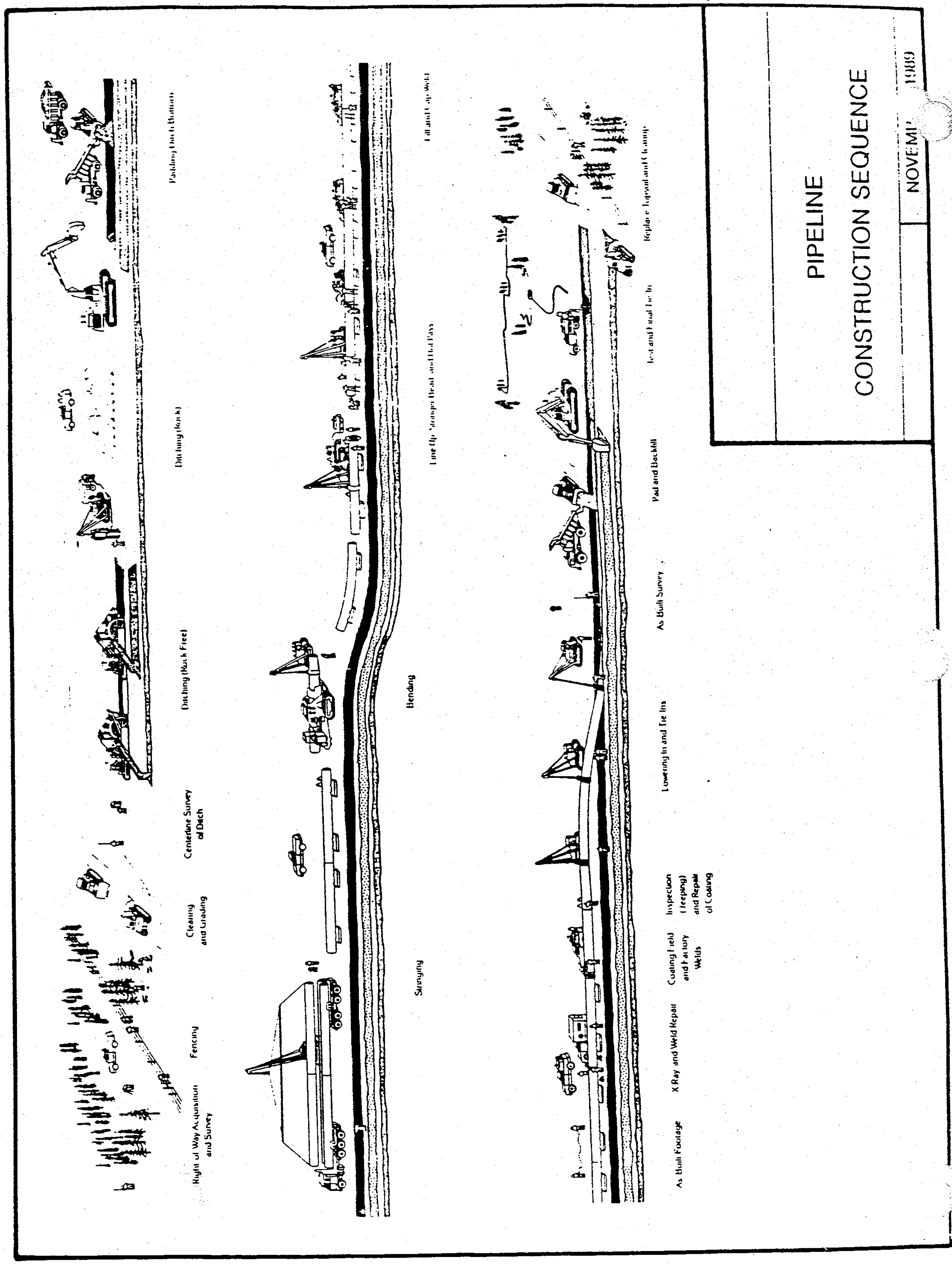

Right of Way Acquisition and Survey
Fencing
Clearing and Grading
Centerline Survey of Ditch
Ditching (Rock Free)
Ditching (Rock)
Stringing
Bending
As Built Footage
X Ray and Weld Repair
Coating Field and Factory Welds
Inspection (Jeeping) and Repair of Coating
Lowering In and Tie Ins
As Built Survey
Pad and Backfill
PIPELINE
CONSTRUCTION SEQUENCE

FIGURE III- 2

- Final clean-up and restoration.

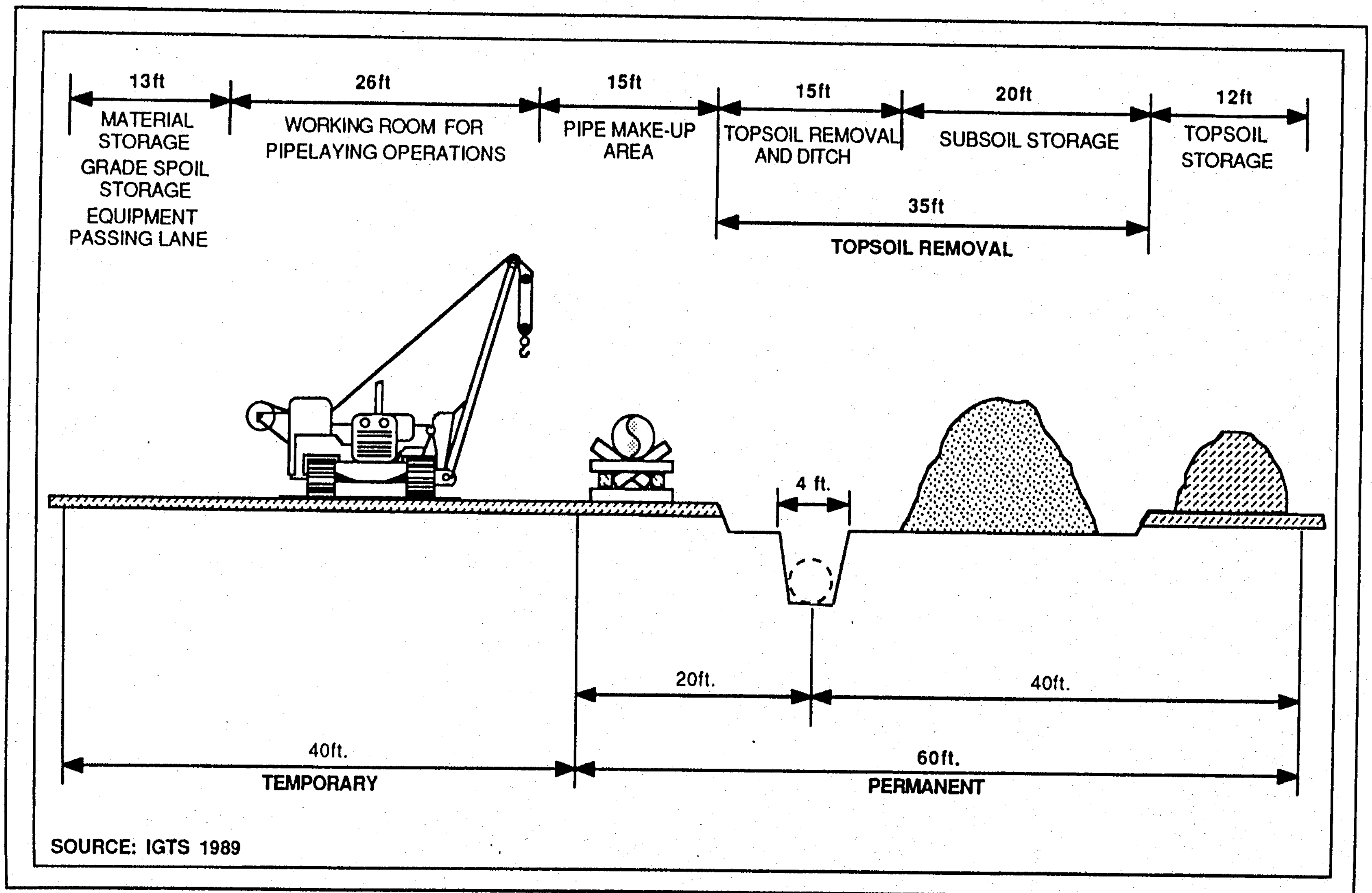
This section briefly discusses each of these activities.

Clearing and Grading

This operation normally involves the removal of obstacles (e.g., felling of trees and removal of large rocks, brush, and logs) from the right-of-way and temporary construction work space, as well as the partial leveling and smoothing of abrupt changes in ground contours within this area. The 60-foot-wide right-of-way and 15 to 40-foot-wide temporary work space will be required to provide sufficient space for construction activities and for the temporary storage of material (e.g., topsoil, subsoil) excavated from the trench. Figure III-3 illustrates why the 75-to-100-foot-wide construction area is needed. Excavated material will generally be stored along one side of the construction area. The remaining portion of the right-of-way will be used to provide access for construction equipment, to permit the passage of equipment and vehicles, to store supplies, and to install the pipeline.

In locations such as water crossings, steep slopes and other areas, additional temporary construction work room wider than 40 feet may be required. Such locations will be identified prior to construction. Locations where clearing could be less than 100 feet in width -- which includes a majority of the route in Connecticut -- also have been identified (See Table II-2).

When cutting existing fences or breaching existing stone walls, Iroquois will initially brace the areas on either side of the proposed cut to insure that no damage occurs to the remainder of the fence or wall. Temporary gates will be furnished if necessary to contain livestock or to prohibit public access across the right-of-way. Fences or stone walls of



NOT TO SCALE

RIGHT-OF-WAY CONSTRUCTION PROFILE

FIGURE III - 3

historical importance will be identified as part of the cultural resource survey of the proposed route or during easement negotiations with individual landowners. In such cases, special techniques may be used to clear the right-of-way, including the careful dismantling of the fence/wall and the conservation of all materials so that the fence/wall can be completely restored after the completion of construction.

Where the alignment passes through environmentally sensitive property, procedures will be followed to minimize property damage. For example, the clearing operation will incorporate construction procedures to prevent undue disturbance of the soil mantle and to prevent the loss of topsoil due to erosion. Data about site-specific erosion and sedimentation control practices will be developed as part of the D & M Plan in consultation with representatives of agencies such as the FERC, U.S. Department of Agriculture Soil Conservation Service (SCS), and the Connecticut Department of Agriculture.

All areas with erodible soils that are cleared of vegetative cover will be stabilized through the use of temporary erosion control devices and measures immediately after clearing. These temporary erosion control devices and measures will be maintained throughout the period of active construction until restoration. They may include but should not be limited to the use of hay mulch, jute netting, silt fences, and temporary water diversions.

Prior to cutting through woodlots or forest plantations on the right-of-way and temporary work space, specimen trees (i.e., large or locally unique trees) marginal to the area (if any) will be flagged and protected from damage by the use of rubber tires, snow fences, etc. Only experienced wood cutters will be employed to clear wooded areas.

To prevent off-right-of-way damage, brush and trees to be cleared will be felled parallel to and within the right-of-way. Care also will be exercised in removing branches overhanging the right-of-way and temporary work space.

Topsoil and subsoil excavated during the pretrenching and trenching operation will not be mixed with foreign material (e.g., debris, stumps, slash). All brush, tree tops, stumps, and other debris cleared from the right-of-way and temporary work space will be chipped or otherwise disposed of, in conformity with special provisions applying to the tract of land involved and all applicable laws, rules, and regulations. Merchantable timber will be cut into tree lengths or as directed by the property owner. All such material that cannot by chipped or otherwise disposed of will be removed from the right-of-way and temporary work space and, as appropriate, hauled to approved dump sites.

Iroquois also will be careful to consider the risks of fire when constructing through forested areas. All construction practices will conform with fire protection regulations, and fire fighting equipment will be maintained on-site. Should the fire hazard be extreme, spark arrestors on construction equipment and vehicles may be required.

After clearing, and prior to trenching, the pipeline right-of-way will be graded as needed to create a level work area for the passage of heavy equipment/vehicles and for subsequent construction activities. Minimum grading will be required where the terrain is flat. However, in areas of rock outcropping or irregular terrain, grade blasting or more extensive grading will be required.

Where blasting is necessary, Iroquois will adhere to the following stringent procedures, as well as applicable blasting permit requirements.

Seismographic surveys will be conducted to monitor vibrations adjacent to existing facilities and dwellings or other structures. In addition, Iroquois will employ a blasting consultant to approve drill patterns, types of explosives, and loading quantities and procedures, as well as the timing of delays and the method, use, and type of matting (when require) to minimize vibration and fly-rock.

When blasting is necessary in the vicinity of an existing pipeline under pressure, dwelling, or other structure, Iroquois will take care of insure that the intensity of the ground vibrations as a result of any particular blast is limited. Loaded drill holes will not be left unattended overnight.

Precaution will be taken to insure that all personnel (construction or otherwise) will be positioned a safe distance from the blasting operations at the time of detonation. Where the pipeline route parallels or crosses existing electrical transmission corridors, Iroquois will take precautions regarding blasting where stray current from the electrical field may be present. For example, the use of electrical detonation caps may be restricted to a safe distance from such transmission corridors.

Grading will be performed to minimize the potential for erosion and to limit the potential for slash or other debris removed from the construction area to enter any body of water. In addition, where practical, grading activities will be scheduled to minimize the time interval between clearing operations and actual installation of the pipe, particularly on approach slopes to watercourses. Alternatively, where grading must occur in advance, temporary erosion control measures will be applied.

Trenching

The trenching operation, which consists of excavating the trench for the pipe, may be performed by any one or all of several methods. In areas characterized by deep soils, the trench will typically be cut by a conventional mechanical backhoe or a rotary wheel ditching machine. The trench will be a minimum of 1 foot wider than the diameter of the pipe, and of such a depth that a minimum cover of 3 feet from the top of the laid pipe will be provided, unless land uses and permits dictate a different depth. For example, the pipeline will be buried to provide at least 4 feet of cover in improved and cultivated agricultural areas; in addition, beneath roads and railroad right-of-way, a minimum of 5 feet of cover must be provided. In rock, a minimum of 2 feet of cover will be provided.

During the trenching operations, temporary ditch plugs will be installed to provide crossings as necessary for property owners, farmers, and wildlife, and to curtail the flow of water along the open ditch. Such crossings/plugs shall be maintained during the various stages of construction.

Open ditches will be generally backfilled within several weeks of opening, except for pre-blasted and excavated rock ditches, final tie-in locations, and test section openings. These will be protected with safety devices and maintained until backfilled adequately. The foregoing restrictions will not apply to boring pits or to excavations for mainline valves, sales meter stations, pig launching/receiving sites and similar facilities as long as adequate safety precautions are implemented.

Underground lines (e.g., utility lines, water supply lines) crossed by the right-of-way will be identified and flagged prior to construction. Trenching operations in the vicinity of all such utility lines will proceed only after appropriate measures have been taken to determine their exact location, and after the appropriate authorities have been notified. Such activities will be under the direction of an Iroquois inspector.

All tree roots encountered in the trench will be cut back far enough to insure that under no circumstances will they come in contact with the pipe. In addition, no slash or parts of stumps, roots, or other foreign debris will be left in the trench.

Standard erosion control practices will be employed to minimize erosion during trenching operations and construction activities in general. In areas with high groundwater, if trench dewatering is necessary, water will be discharged in a manner that minimizes sedimentation and prevents off-site erosion and bottom scour in adjacent waterways.

Generally, trench dewatering discharges to the ground are permitted if there is adequate vegetation along the right-of-way to effectively function as a filer medium and to disperse the energy of the flow. In environmentally sensitive areas (e.g., adjacent to streams), where there is inadequate vegetation, straw bale filters or other appropriate measures will be used to limit siltation and to control erosion and scour. Any trench dewatering will be in accordance with standard procedures as specified in Iroquois' D&M Plan.

Measures also will be taken to minimize free flow of water into the trench and from the trench into any body of water. Construction through watercourses will be scheduled so that the trench is cut just prior to pipe laying operations; flow will be maintained at all water crossings. Where fluming or other similar measures are used, the crossing will be designed to pass high flows and prevent excessive scouring. In addition, trenching across streams and rivers will be in accordance with applicable federal and state requirements.

Stringing

The stringing operation involves moving the pipe from designated storage areas into position along the prepared right-of-way. Storage areas for stockpiling pipe, valves, fittings, and other materials will be determined and arranged for by the individual contractor at locations approved by Iroquois and by the appropriate regulatory agencies.

Pipe and material storage areas will not normally be along or adjacent to the right-of-way, but rather will likely be located near existing industrial/commercial areas and railroad or truck transportation routes. The pipe, which for the Iroquois project will be manufactured in lengths of 40 to 80 feet, will be moved from the storage areas and placed along the right-of-way in a continuous line in preparation for subsequent bending, line-up, and welding operations. Individual joints of pipe will be strung beside the trench on the working side of the right-of-way. The pipe necessary for stream or road crossings will be stockpiled at staging areas (these are normally temporary work room acquired for this purpose in the vicinity of each crossing). Stringing activities will be coordinated with the advance of pipe laying crews. This will minimize the length of time that a specific tract of land is occupied by the various construction spread crews.

Stringing of pipe, weights, and other heavy materials will be suspended during periods of extreme wet weather or unstable ground conditions, when the continuation of such operations could cause irreparable damage to the right-of-way soil structure. As an alternative, Iroquois may consider the use of low ground pressure vehicles for stringing (and other) operations when adverse ground conditions prevail. In addition, Iroquois will observe or seek exemptions to load restrictions on local highways with regard to the movement of pipe and construction equipment and movement of material (e.g., rock) from the right-of-way.

Pipe Installation: Bending, Welding, Coating, Lowering-In, and Tie-Ins

The pipe will be delivered to the construction area in straight sections or joints and bent to conform to changes in the direction of the pipeline alignment and natural ground contours. Individual joints of pipe will be bent to the desired angle in the field using a track-mounted, hydraulic, pipe-bending machine. For example, the machine can be used to bend the pipe to a 21° angle--the maximum bend in the field for a 40-foot section of 24-inch pipe. In certain areas, factory bends may be used (e.g., where sharp changes in direction are required in congested areas).

After bending, the pipe will be lined up and welded in conformance with DOT Federal Regulations, 49 CFR Part 192, SubPart E, "Welding of Steel in Pipelines", and in compliance with the latest edition of API Standard 1104. The pipe joints will be welded together and placed on supports in a continuous pipeline along the side of the trench. After each weld is completed, it will be visually inspected by a qualified inspector. One hundred percent radiographic inspection of all welds will be performed; this exceeds the DOT regulations. Any defective welds will be repaired or replaced.

All pipe will be protected with an external coating of fusion bond epoxy material. The welded joints will be coated with fusion bond epoxy or urethane after inspection. This coating will be applied by the manufacturer prior to shipping. Before the pipe is lowered into the trench, any faults or damages to the coating will be repaired.

Side-boom tractors will be used to lower the pipe into the trench. Inspections will be performed to insure that:

- o The trench is of adequate depth to achieve the minimum cover required over the pipe;
- o The bottom of the trench is free of all foreign matter such roots, welding rods, etc.;
- o The pipe is properly placed on the bottom of the trench;
- o All bends conform to the alignment of the trench; and
- o The external coating on the pipe is not damaged.

If the bottom of the trench is rock, pipe supports will be placed in the bottom before the pipeline is lowered into the trench. Supports may consist of sand bags or polyurethane foam pillows. Alternatively, a protective coating (i.e., a rock shield) may be used.

After the pipe is laid in the trench, the cathodic protection system (a common type of supplementary corrosion prevention system) will be installed. Cathodic protection will be provided using impressed current systems, supplemented by magnesium anodes. All test leads and negative drain leads will be installed during construction.

Backfilling

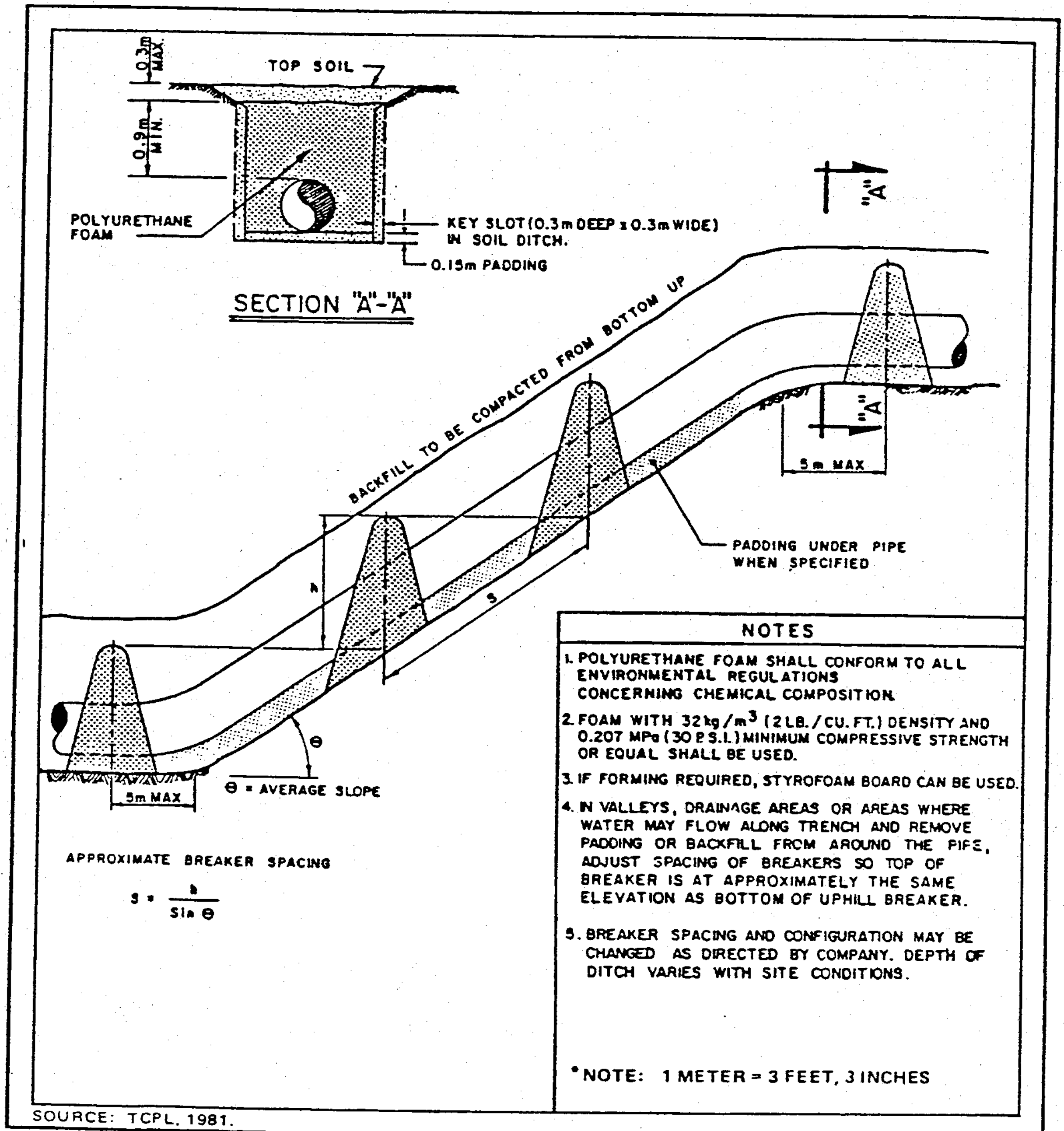
After the pipe is lowered into the trench, inspected, and approved, the trench will be backfilled. Backfill will generally consist of the material originally excavated from the ditch. In some cases, backfill material from other areas may be used. For example, rock will not be backfilled directly onto the pipe. Where such materials are encountered, earth or sand will be hauled in and deposited around the pipe to form a cushion or pad. No topsoil will be used for such padding. Rock will be placed in the trench after the sand padding; any excess rock will be windrowed or removed, in accordance with landowner specifications.

In areas where topsoil has been segregated, the backfilling operation will involve first the replacement of subsoil in the bottom of the trench, followed by the replacement of topsoil over the subsoil layer. This technique will eliminate potential productivity losses from soil mixing in the trench area. Any agricultural drainage tiles cut during the construction process will be permanently reconnected to the drainage system.

Any excess excavated materials or materials unsuitable for backfill will be disposed of in accordance with applicable regulations and landowner specifications. For example, in agricultural areas, rocks larger than 4 inches in diameter in any dimension will be removed to plow depth.

During backfilling, special procedures also will be implemented to minimize erosion, restore the natural contour of the ground, and allow normal surface drainage. On cultivated and improved lands and in wetlands where the topsoil is conserved, the subsoil and topsoil will be returned to match the soil horizons on either side of the trench.

In addition, to prevent erosion along the pipeline trench in sloping terrain, breakers constructed of polyurethane foam or burlap-type sacks filled with sand will be placed within and across the trench (see Figure III-4). Where the trench intersects streams, wetlands, or groundwater and where site conditions might result in drainage from the intersected body of water, the trench will be blocked with impervious materials such as sack breakers or clay. In addition, diversion berms to prevent surface runoff and associated erosion along the disturbed area will be established.



NOT TO SCALE

TRENCH BREAKER PLACEMENT

FIGURE III - 4

Clean-up and Restoration

Clean-up and restoration procedures will be initiated as soon as possible after backfilling. These procedures will typically involve: clean-up of waste or scrap material; regrading to restore original grades and conditions; installation of erosion controls such as diversion berms; fine-grading to prepare a suitable surface for seeding; revegetation as appropriate; the replacement of fences and walls removed during construction; and the restoration of disturbed pavement curb and sidewalks to original pre-construction conditions or better.

Any remaining trash or debris along the right-of-way will be disposed of appropriately, and all disturbed areas will be restored to grade. Then, the entire right-of-way will be promptly final graded and protected by the implementation of site-specific erosion control measures in accordance with approved plans. These may include but are not limited to contouring, reseeding, and/or sodding with soil-holding grasses. Mulch and/or matting will be used on all specified slopes and in other areas as appropriate. The restoration and revegetation of the construction area also will be to the satisfaction of the landowner.

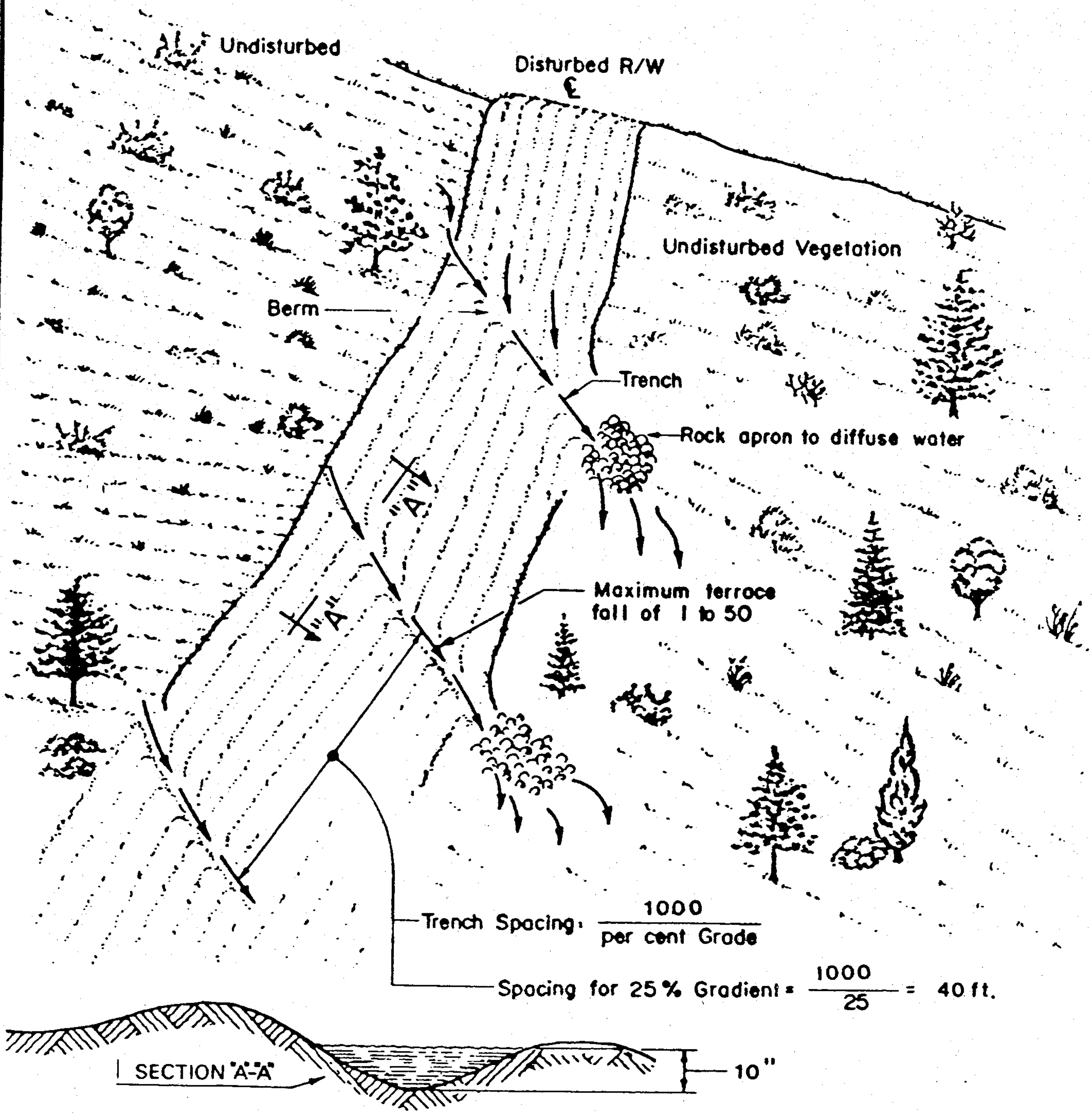
In addition, a revegetation plan will be implemented in accordance with FERC regulations and landowner requests. After the regrading, the right-of-way will be fine-graded and non-cultivated lands will be reseeded as soon as possible to minimize erosion. Revegetation will be accomplished in a manner compatible with preconstruction vegetation patterns, in accordance with the guidelines of 18 CFR Part 2.69 and standard procedures approved by FERC. Cultivable lands, as well as all private and public roads affected by construction, will be restored to their former condition.

For permanent erosion control in areas of the right-of-way subject to soil erosion, Iroquois will, within six working days of final grading (i.e., following replacement of topsoil), seed or seed and mulch the right-of-way. Only where seasonal weather conditions would render reseeding futile will Iroquois postpone reseeding. In such cases, other appropriate methods (e.g., mulching, matting, berming) will be employed to ensure that erosion is minimized.

Terraces, berms, or cross ditches will be constructed as necessary on the right-of-way to divert surface runoff to adjacent vegetated areas or to existing drainage systems (Figure III-5). Terraces will have a maximum fall of one to fifty (1:50) and will be feathered at the ends. All slopes in excess of 30° will be revegetated by techniques such as sodding, seeding, matting hydroseeding, and hydromulching. At locations where seepage could result in slope stability problems, Iroquois will provide appropriate drainage. Particular care will be taken to insure that all drainage ditches are maintained and left unobstructed.

Stream and river beds will be returned to their preconstruction contours, and stream and river banks will be revegetated in a low ground cover and stabilized as appropriate with rip-rap, sand bags, or erosion control fabric. Where necessary at sensitive stream crossings, specific plans for revegetating the stream banks and immediately adjacent slopes will be developed in consultation with the appropriate agencies and landowners.

Fences and historic stone walls will be replaced in accordance with landowner specifications defined at the time of the easement negotiation.



Disturbed area to be revegetated during final clean up (permanent only). Coarse surface material requires less frequent cross trenching. Fine-textured surface requires more frequent cross trenching.

TYPICAL TEMPORARY AND PERMANENT EROSION CONTROL OF CROSS SLOPES

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DATE JAN. 19/87

FIGURE III- 5

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In addition, markers noting the location of the pipeline will be installed on each side of all roads, railways, utility crossings, and property fence lines. These markers will be in accordance with DOT regulations, and will identify the pipeline operator and list a telephone number to call in case of an emergency or an inquiry about the right-of-way.

After the final clean-up and restoration, landowners will be contacted to determine their satisfaction with the right-of-way and temporary work space restoration. Thereafter, periodic aerial and ground inspections of the right-of-way will be conducted to ascertain the effectiveness of the restoration program, and further restoration and revegetation measures will be implemented if necessary. For example, in agricultural areas, the productivity of crops cultivated over the right-of-way will be monitored for at least two growing seasons to insure that the restoration program is effective in returning the land to its preconstruction productivity.

<u>Hydrostatic Testing</u>

The buried pipeline will be hydrostatically tested in accordance with the Federal Safety Standards of the Office of Pipeline Safety (49 CFR Part 192). Throughout most of Connecticut, the Iroquois pipeline will be tested to a pressure equal to or greater than 150% of the maximum allowable operating pressure using water as the test medium. The test duration will be 24 hours. Short sections of pipe will be hydrostatically tested aboveground for four hours and visually inspected. These test procedures exceed DOT's requirements.

Hydrostatic testing will be conducted in segments; the length of each segment will depend on local topography as well as applicable permit requirements. In Connecticut, the Department of Environmental

Protection (DEP) will be consulted to determine SPDES requirements, and an application for a SPDES permit will be submitted to DEP.

Test water will only be obtained from appropriate and approved sources. Withdrawals will not be in such quantities that the water source cannot support aquatic life and withdrawals shall not occur in beaver ponds so as to draw water down more than 2 to 3 inches. Average withdrawal rates are expected to be on order of 1,800 U.S. gallons per minute but could be modified based on site-specific considerations. The water intake will be screened to prevent entrainment of fish and foreign objects.

Upon successful completion of a hydrostatic test, the test water will be discharged into the original source, unless otherwise specified in the SPDES permit. However, at site-specific locations (including those where test water has been reused in adjacent test sections), Iroquois will, if possible, obtain approval to dewater elsewhere.

Test water will not be discharged directly into the source but instead diverted through a nearby vegetated area, permeable berm (straw bales) or into a drainage ditch of suitable capacity. In addition energy deflectors of suitable size will be used to reduce the force of the discharged water and prevent erosion. Since the interior of new pipe is coated and normally clean and free of any dirt or contaminants, it is not expected that any treatment of test water will be required.

No chemical additives will be used for the drying of the pipeline after successful completion of a hydrostatic test. The test section will initially be dewatered using spheres or pigs (i.e., a device propelled through the inside of the pipeline) with the drying performed through the use of numerous runs of foam pigs.

Commissioning Activities

Upon completion of this final drying operation, the pipeline will be internally inspected using devices equipped with instrumentation to detect flaws in the pipeline. Also referred to as pigs, these devices are inserted in the pipe and propelled through it using natural gas or compressed air. After the electronic inspection is completed and all indications checked and if necessary repaired or replaced, the pipeline will be purged of air and loaded with natural gas.

Handling of Petroleum Products and Other Hazardous or Controlled Substances

The Iroquois will provide a spill response and emergency plan as part of its D&M Plan. This plan will be in accordance with FERC recommendations. This plan will detail the Iroquois' proposed methods of handling spills of petroleum products and any hazardous or controlled substance which may be stored or utilized during construction, operation or maintenance of this facility.

III.3.2 Special Land Pipeline Construction Procedures

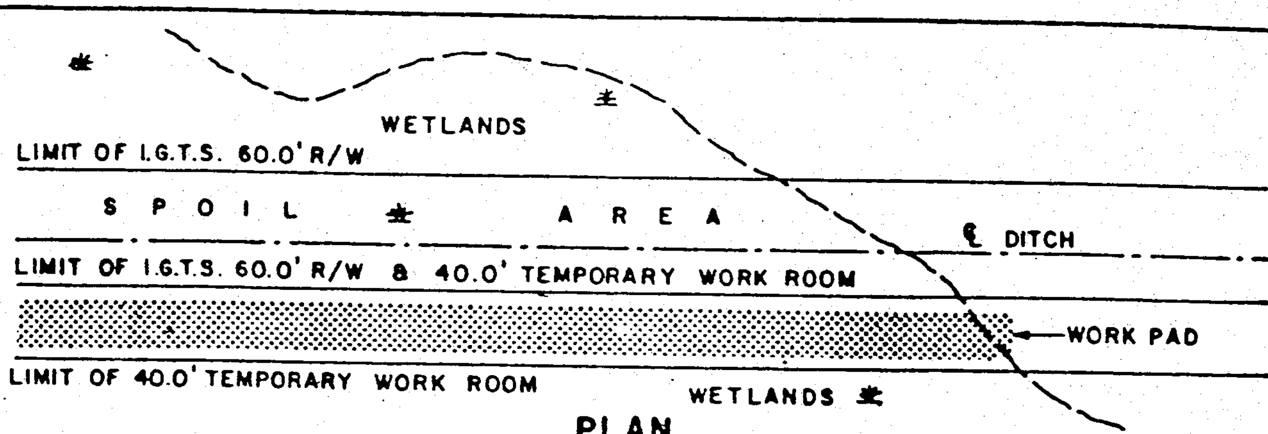
Wetlands

Wetlands are valuable natural resources that provide habitat for a variety of wildlife and plant species, both aquatic and terrestrial. Wetlands also play important roles in controlling runoff, influencing water tables, preventing erosion and flooding, and improving water quality. Iroquois is committed to avoiding or minimizing disruptions to wetlands encountered along its pipeline route. To this end, Iroquois is in the process of conducting site-specific wetlands surveys of the entire pipeline route. In Connecticut, these surveys are being performed by certified soil scientists, as well as biologists.

The construction procedures that will be used to cross wetlands will depend on site-specific conditions. For example, if required due to soil moisture, work pads will be used. Clearing of the right-of-way will not be required except in wooded wetlands. In such areas, trees will be cut by chain saw; in wetlands with saturated soils, stumps will be left in place except in the area immediately over the pipeline trench.

Typical wetland crossing techniques are detailed in Figures III-6 and III-7. The construction procedures that will be used to cross non-flooded wetlands will be similar to those used on dry land areas. In some areas, temporary access across the wetlands for construction equipment, vehicles, materials, and personnel may require the installation of a work pad (log riprap using logs cleared from right-of-way or (preferably) gravel over filter cloth, or both) as dictated by soil moisture conditions. Gravel and filter cloth will be removed following construction. Trenching and pipe installation equipment would use this as an accessway across the wetland. As necessary, culverts will be installed to maintain water flow across the right-of-way during construction. Prefabricated pipe sections will then be either pulled or walked across the wetland, depending on the water table. Weighting of the pipe may be required depending on site-specific conditions. The gravel and filter cloth will be removed after construction, whereas log riprap (if used) will be left in place.

Construction in flooded wetlands will utilize the ditch and pull method, which is similar to the procedure used at river crossings. Swamp mats or log riprap will be used in relatively shallow areas to provide a working surface for the excavation and backfill equipment. This



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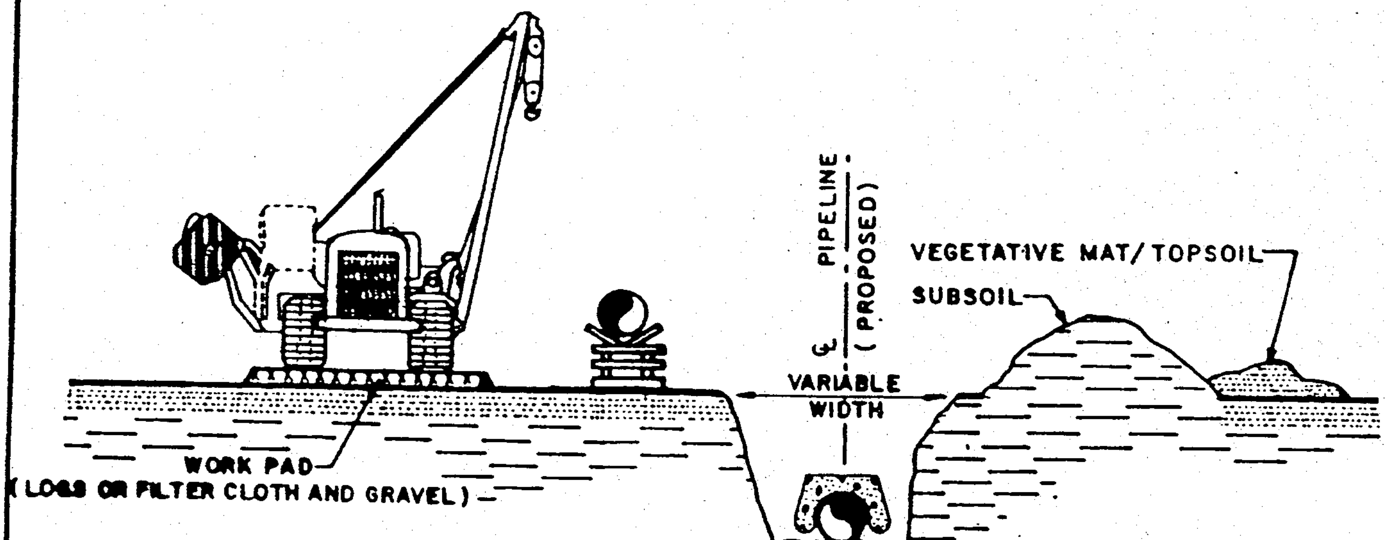

CROSS SECTION THROUGH RIGHT OF WAY

N.T.S.

NOTES

1. WETLAND CROSSING SHALL BE CONSTRUCTED IN ACCORDANCE WITH D.O.T. PIPELINE SAFETY REGULATIONS AND IN COMPLIANCE WITH ALL AUTHORITIES HAVING JURISDICTION OVER SAME.
2. CONSTRUCTION WORK PAD SHALL BE INSTALLED WHERE DICTATED BY SOIL MOISTURE CONDITIONS.
3. TRENCHING EQUIPMENT SHALL WORK OFF MATS AS REQUIRED.
4. CONCRETE SADDLE WEIGHTS SHALL BE INSTALLED AS REQUIRED.
5. A MINIMUM OF 3 FEET OF COVER OVER THE TOP OF PIPE WILL BE MAINTAINED.
6. WHERE POSSIBLE, TOPSOIL SHALL BE STORED SEPARATELY FROM SUBSOIL; WETLAND CONDITIONS MAY PRECLUDE ANY SUCCESSFUL TOPSOIL STRIPPING.
7. CLAY PLUGS OR DITCH BREAKERS WILL BE INSTALLED IN TRENCH AT WETLAND EDGE TO PREVENT CHANGES IN THE NATURAL DRAINAGE PATTERNS. WATER LEVEL AND FLOW IN WETLAND WILL BE MAINTAINED DURING AND AFTER CONSTRUCTION.
8. IF WATER SEEPS INTO TRENCH, PUMPING MAY BE REQUIRED TO INSTALL PIPE. PUMPED WATER WILL BE RELEASED WITH CONTROLLED DISCHARGE WITHIN WETLAND BOUNDARY.
9. ALL CONSTRUCTION TRAFFIC IN THE WETLAND WILL BE RESTRICTED TO THE WORK PAD PROVIDING A WORK PAD IS REQUIRED (SEE NOTE 2).
10. CLEAN UP SHALL INCLUDE REMOVAL OF THE WORK PAD (LOGS WILL REMAIN IN PLACE) AND RESTORATION OF WETLAND.

TYPICAL NON FLOODED WETLAND CROSSING UTILIZING A CONSTRUCTION WORK PAD

Iroquois
GAS TRANSMISSION SYSTEM

Date JAN. 26/87	FIGURE III- 6	REV.

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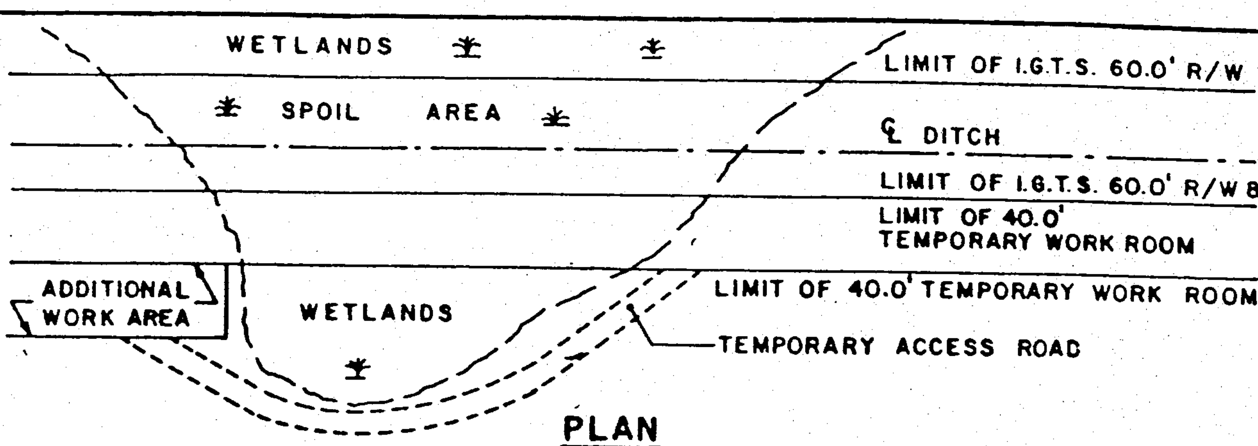

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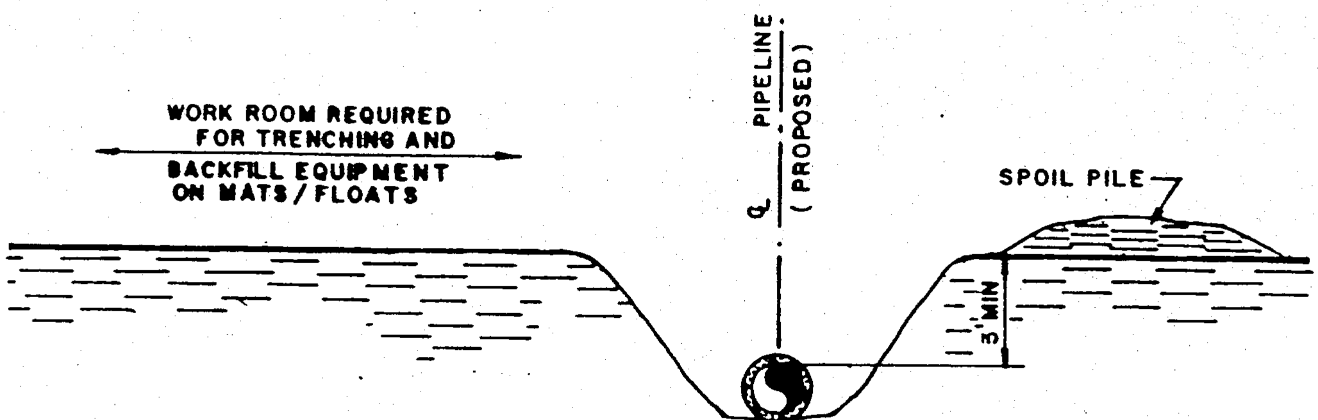

CROSS SECTION THROUGH RIGHT OF WAY

N.T.S.

NOTES

1. WETLAND CROSSING SHALL BE CONSTRUCTED IN ACCORDANCE WITH D.O.T. PIPELINE SAFETY REGULATIONS AND IN COMPLIANCE WITH ALL AUTHORITIES HAVING JURISDICTION OVER SAME.
2. TRENCHING EQUIPMENT SHALL WORK OFF MATS, STILT SLEDS, SHALLOW DRAFT FLEXIFLOAT BARGES OR LOW GROUND PRESSURE EQUIPMENT.
3. WETLAND PIPE SECTION TO BE PRE-FABRICATED AND CONCRETE COATED (NEGATIVE BUOYANCY) IN THE ADDITIONAL WORK AREA.
4. PRE-FABRICATED PIPE SECTION TO BE PULLED IN PLACE. BUOYANCY TANKS MAY BE USED TO ASSIST POSITIONING AND WILL BE REMOVED TO INSTALL PIPE SECTION.
5. BACKFILL EQUIPMENT WILL BE MATTED ACROSS WETLAND IN THE WORK AREA.
6. A MINIMUM OF 3 FEET OF COVER OVER THE TOP OF PIPE WILL BE MAINTAINED.
7. CLAY PLUGS OR DITCH BREAKERS WILL BE INSTALLED IN TRENCH AT WETLAND EDGE TO PREVENT CHANGES IN THE NATURAL DRAINAGE PATTERNS. WATER LEVEL AND FLOW IN WETLAND WILL BE MAINTAINED DURING AND AFTER CONSTRUCTION.
8. CONSTRUCTION TRAFFIC, OTHER THAN EXCAVATION AND BACKFILL EQUIPMENT, WILL DETOUR THE WETLAND ON EXISTING OR TEMPORARY ACCESS ROADS.
9. CLEAN UP SHALL RESTORE THE WETLAND.

TYPICAL FLOODED WETLAND CROSSING UTILIZING THE DITCH AND PULL METHOD	Iroquois GAS TRANSMISSION SYSTEM		
	Date. JAN. 26/87	FIGURE III-7	REV.

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equipment will work from floats in deeper areas. Other construction equipment, vehicles, materials, and personnel will detour flooded wetlands on existing or temporary access roads.

The trench will be excavated using the appropriate equipment such as clamshell dredges or the "yo-yo" ditch method. The "yo-yo" ditch may be employed for relatively short distances. This method involves the use of a wireline/double winch system to which a bucket is attached. The bucket is pulled back and forth across the wetland until the desired ditch depth is achieved. The disadvantages of this method are that control of the bucket is more difficult; areas containing boulders cannot be properly excavated; and large storage areas are required at each end of the trench to contain the excavated material. This process can only be used for short distances through wetlands, whereas clamshell dredges can be used to cast excavated material back into the trench after the pipe is installed.

If rock is encountered, blasting will be necessary. Where possible, the vegetative mat will be stored separately from the subsoil; wetland conditions may preclude any successful topsoil/subsoil segregation. The excavated material will be stored adjacent to the trench. If the trench entering the wetland contains water, ditch plugs will be left in the trench prior to crossing the wetland. This procedure will minimize silt discharges into the wetland and will maintain the water level in the wetland during construction. Following pipe installation, the wetland boundaries will be sealed with impervious plugs to ensure the wetland's hydrologic integrity.

In non-flooded wetlands, the pipe will be strung and welded together on skids adjacent to the trench. The pipe string will then be lowered into the trench and weighted with concrete saddle weights are required.

In flooded wetlands, the pipe will be strung, welded, and weighted (using concrete-coating or bolt-on weights) in work areas outside the wetland. The prefabricated pipe section will then be pulled into place by winch and cable.

The excavated material will be used to backfill the trench, restoring soil horizons where practicable. To maintain flow patterns within the wetland, any excess soil will be disposed of in an approved manner, so as not to obstruct water flow or alter the wetland hydrology. Iroquois will not store petroleum products or refuel equipment within 100 feet of a wetland (except at river crossings where floatation equipment is used).

Cleanup will include removal of construction work pads. Log riprap will be left in place to decompose naturally. Riprap would be removed only if the drainage regime would be impeded or regulations require removal.

Natural topographic and hydrologic conditions will be restored. Permanent access roads through wetlands are not anticipated to be required by Iroquois at the present time.

<u>Typical Stream and River Crossings</u>

Standard water crossing procedures have been established to install the pipe safely and efficiently while maintaining downstream populations of aquatic life, minimizing the extent and duration of sedimentation from construction activities, maintaining an unimpeded flow of water, minimizing conflict with other water uses, and preserving the visual environment in the crossing area. Water crossing procedures typically involve:

- Having equipment and materials for pipeline installation on-site and assembled prior to in-stream trenching;

- Excavating a trench across (beneath) the water body:

- Installing the pipe;

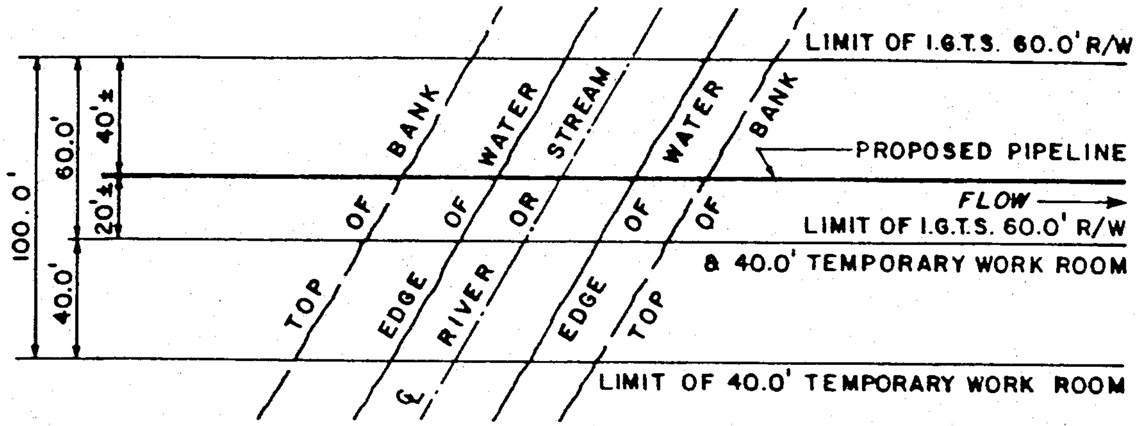
- Backfilling the trench; and

- Restoring the streambed, banks, or shoreline.

Most of the watercourses that the pipeline route will cross in Connecticut are small (i.e., less than 5 feet of water and less than 15 feet wide) or intermediate (i.e., less than 5 feet of water but more than 15 feet wide), and thus will require a minimum amount of in-stream construction.

Several standard techniques will be used to install the pipe across these streams and rivers (see Figure III-8 and III-9). The type of technique used at a particular crossing will depend largely on the width and depth of the stream, as well as the slope and height of the bank; these factors dictate the type of equipment that will be used to excavate the trench and install the pipe (see Table III-2).

Water crossing construction procedures fall into one of two categories, namely, wet or dry. In wet crossings, all construction work, including excavation, installation, and backfilling, will be performed in the water. In dry crossing, water flow is bypassed around the crossing site using flumes through which the water flows, or dams around which the



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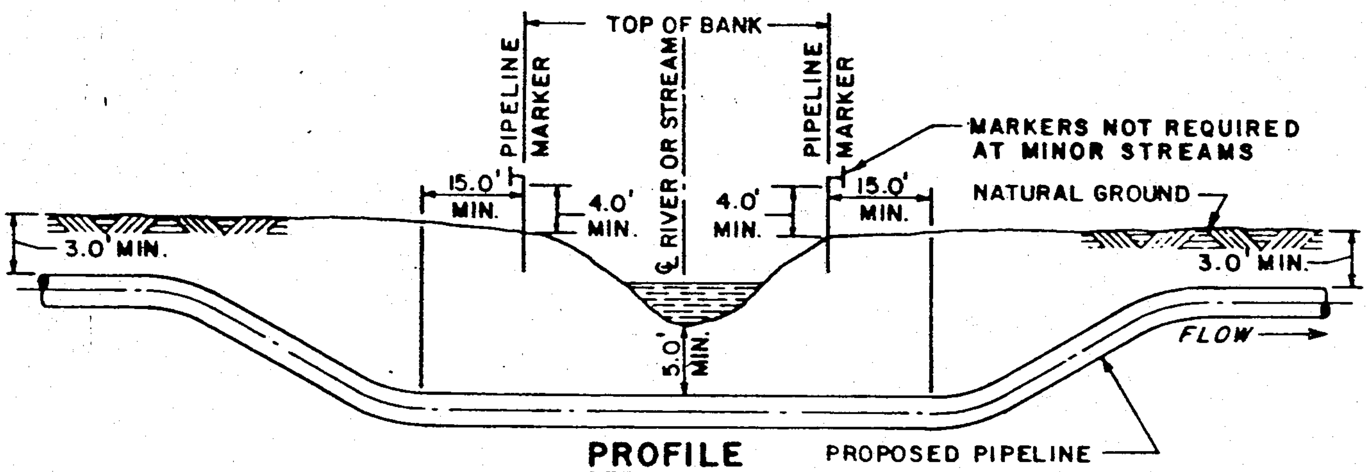

PROFILE

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PROPOSED PIPELINE

NOTES

1. STREAM CROSSINGS (LESS THAN 5' DEEP AND 15' WIDE) WILL BE EXCAVATED BY EQUIPMENT WORKING OFF BANKS WITH SPOIL STORAGE ON THE BANKS.
2. RIVER CROSSINGS (LESS THAN 5' DEEP, GREATER THAN 15' WIDE) WILL BE EXCAVATED BY INSTREAM EQUIPMENT WITH SPOIL SIDECAST ON THE DOWNSTREAM SIDE OF THE TRENCH.
3. RIVER CROSSINGS (GREATER THAN 5' DEEP AND 15' WIDE) WILL BE EXCAVATED BY EQUIPMENT ON FLOTATION DEVICES WITH SPOIL SIDECAST ON THE DOWNSTREAM SIDE OF THE TRENCH.
4. DRY CROSSINGS ARE SHOWN ON ASK-IQ-21.
5. INSTALLATION EQUIPMENT AND MATERIAL STORAGE INSTREAM WILL BE PLACED SO THAT NAVIGATION AND NORMAL FLOW WILL NOT BE OBSTRUCTED.
6. PIPE TO BE INSTALLED STRAIGHT FOR A MINIMUM DISTANCE OF 15 FEET BEYOND TOP OF EACH BANK, MEASURED AT RIGHT ANGLES TO RIVER OR STREAM.
7. TOP OF PIPE TO BE MAINTAINED 5 FEET MINIMUM BELOW RIVER BOTTOM.
8. TEMPORARY WORK ROOM REQUIREMENTS SHOWN ON ASK-IQ-30.
9. THE PIPE WILL BE WEIGHTED (CONCRETE COATING OR BOLT ON WEIGHTS) TO PREVENT FLOTATION.
10. IF EXCAVATED MATERIAL IS NOT SUITABLE AS BACKFILL, SUITABLE BORROW MATERIAL WILL BE USED. UNSUITABLÉ MATERIAL WILL BE DISPOSED OF IN A MANNER AND AT LOCATIONS SATISFACTORY TO THE AGENCIES HAVING JURISDICTION.

TYPICAL WET CROSSING OF RIVER OR STREAM

Iroquois GAS TRANSMISSION SYSTEM

Date: JAN. 26/87	FIGURE III- 8	REV.

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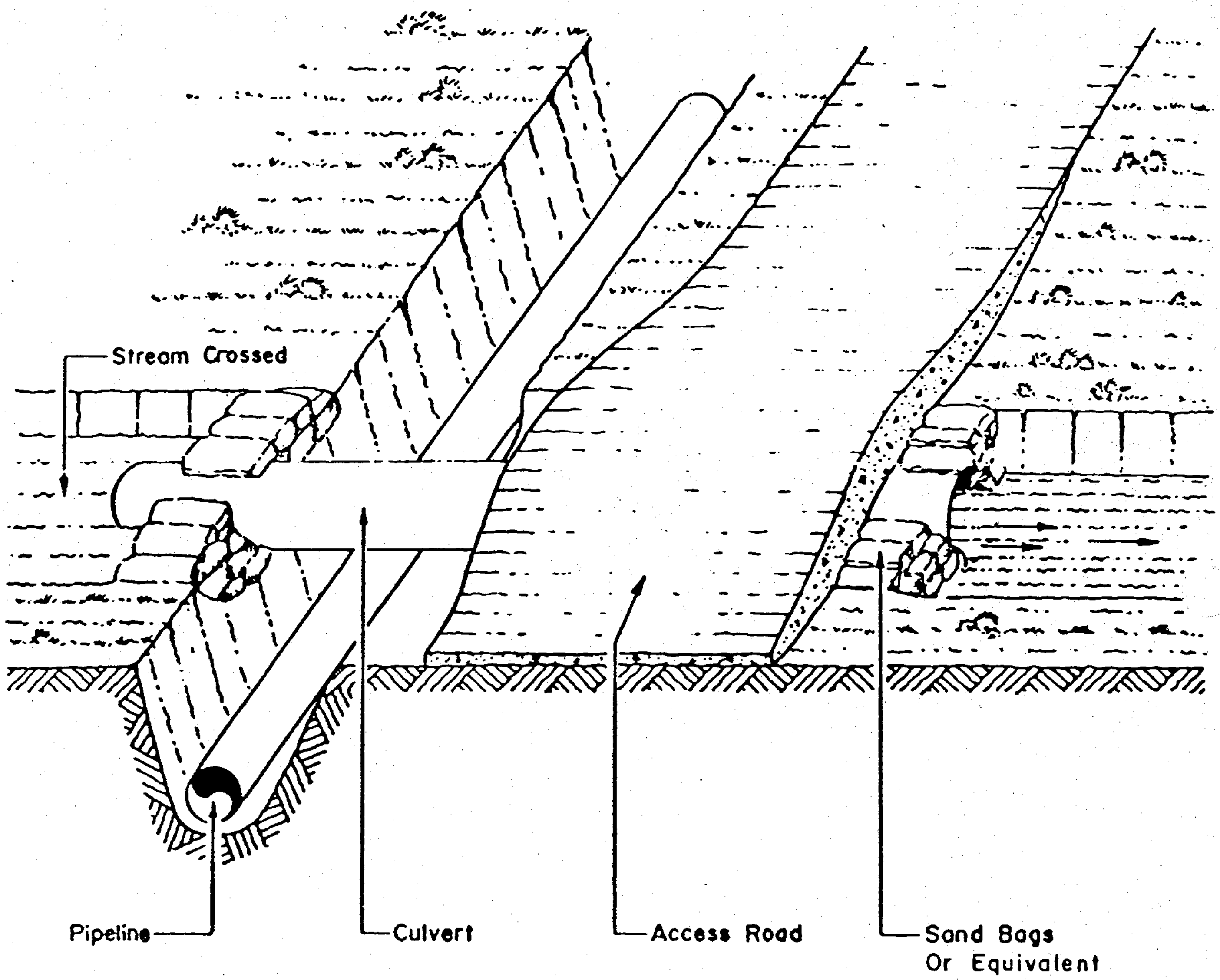


TYPICAL DRY CROSSING

Iroquois
GAS TRANSMISSION SYSTEM

DATE
JAN. 19/87

FIGURE III-9

REV.

F NO.

FORM # ASK-28-109, A SIZE GENERAL (87-01-28)

TABLE III-2

TYPICAL EXCAVATION TECHNIQUES DETERMINED BY RIVER/STREAM DIMENSIONS

River/Stream Dimensions	Typical Excavation Technique
Less than 5 feet of water and less than 15 feet wide	Excavation equipment working off banks with spoil storage on the banks
Less than 5 feet of water and greater than 15 feet wide	Excavation equipment working instream with spoil sidecast on the downstream side of the trench
Greater than 5 feet of water and greater than 15 feet wide	Excavation equipment working from flotation devices with spoil sidecast on the downstream side of the trench

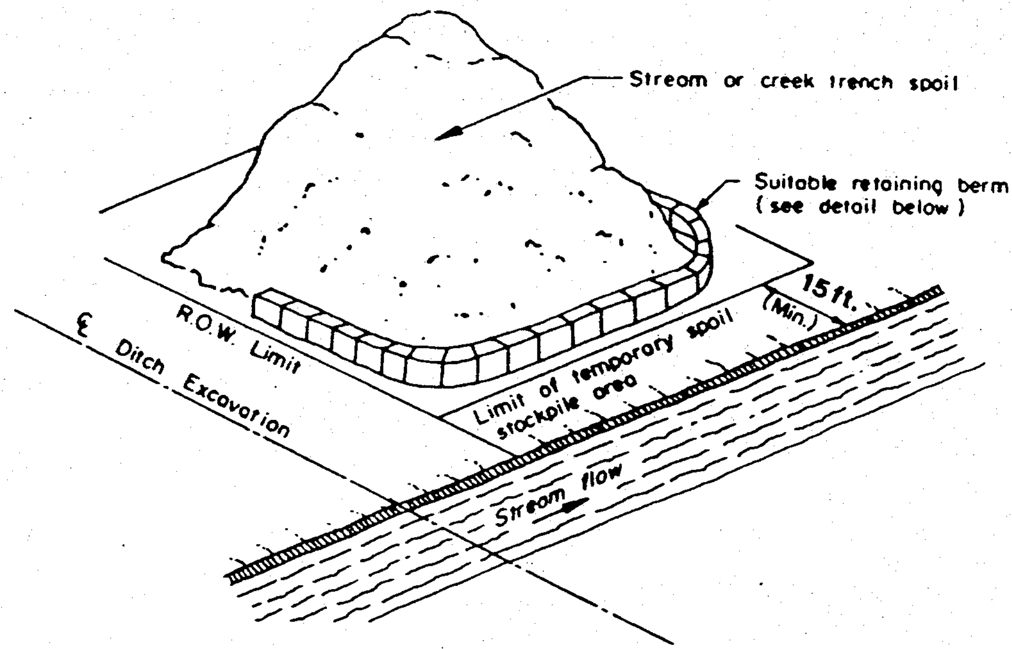
Note:The above-noted dimensions are based on the limitations of the excavation equipment for typical river and stream cross sections. They may not apply to water crossings which have steep, sloping bank approaches.

Source: Iroquois Gas Transmission System 1990.

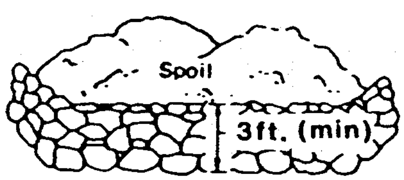
water is pumped, thus allowing construction work to proceed in the dry area.

The standard procedures that will apply to all water crossings include:

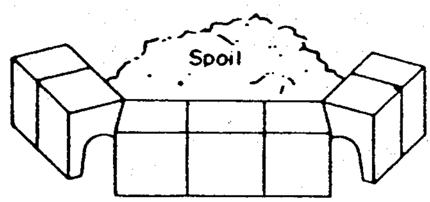
- o Observing schedule restrictions, including the limitation of in-stream activities to avoid conflicts with fish spawning and migration;
- o Maintaining downstream water flow at all times;
- o Confining work to the right-of-way and temporary work space;
- o Maintaining streambed and vegetated banks (or earth plugs) as long as possible (i.e., during mainline trenching);
- o Using appropriate materials when installing equipment and vehicle access across the stream;
- o Minimizing disturbance of slopes and shoreline and controlling downslope runoff (see Figure III-10) for typical spoil retaining berms);
- o Minimizing duration of in-stream work by having the necessary equipment and materials for pipe installation on-site and assembled prior to in-stream trenching;
- o Reestablishing bottom contours as close to original contours as practical;
- o Stabilizing banks with trench breakers, diversion berms, and protective coverings (i.e., rock riprap, vegetation, and synthetic biodegradable mattings);
- o Providing a minimum of 5 feet of cover over the pipe;



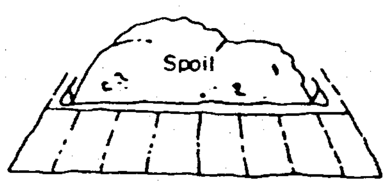
DETAILS - Suggested berm structures
(other structures may be substituted if approved by the company.)



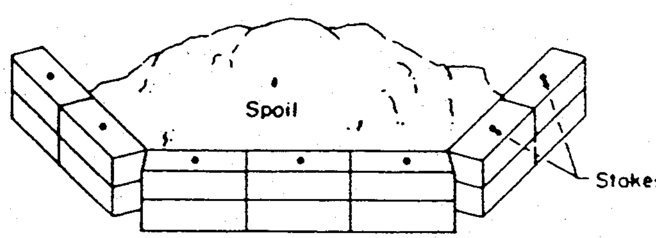
1. Windrow boulders / shot rock



2. Saddle weights



3. Dirt berm



4. Straw bales (staked)

TYPICAL SPOIL RETAINING BERMS

Iroquois
GAS TRANSMISSION SYSTEM

DATE	FIGURE III- 10	REV.
JAN. 19/87		

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- o Providing fish passage during spawning migrations, if construction is permitted to proceed during such times;

- o No washing of equipment or machinery in any watercourse along the construction corridor and not permitting run-off resulting from washing operations to directly enter any watercourse; and

- o No storing petroleum products or refueling equipment within 100 feet of a watercourse, except for river crossings at which floatation equipment is used (and such equipment must necessarily be refueled on the water).

Alternative techniques for crossing streams and rivers with construction equipment are included in Table III-3. The determination of the construction and vehicle crossing method will be based upon the type of fishery and its importance, and upon a number of other factors including, but not limited to, duration of disturbance to the stream, level and impacts of disturbance to the stream, the season during which construction is to occur, engineering feasibility, and the cost of the proposed and alternative crossing methods.

The most common methods for installing the pipe, by general stream type, are discussed briefly below. At most small streams (i.e., less than 5 feet of water and less than 15 feet wide) encountered along the right-of-way, a backhoe, working off the stream bank where possible, will be used for trench excavation. A backhoe could be similarly used for trench excavation in streams with more than 5 feet of water but less than 15 feet in width. Dredged material will be temporarily stockpiled on the right-of-way in a pre-designated area along the stream bank; appropriate measures will be taken to contain the dredged material and to prevent

TABLE III-3

STANDARD OPTIONS FOR TRAVERSING WATERCOURSES WITH EQUIPMENT/VEHICLES

Technique	Application
Ford	Gravel/rock bottom with a water depth of approximately 5 feet or less.
Temporary log bridge	For spans up to 30 feet.
Pre-fabricated bridge	For spans up to 60 feet.
Flume and causeway	Where suitable for flumes/clean fill.
Barge	Water depths in excess of 5 feet. Requires loading and unloading facilities.
Move around	Load and haul equipment around rivers using existing road networks.

Source: Iroquois Gas Transmission System 1990.

sedimentation into the stream. If rock is encountered, blasting may be necessary, involving the use of drilling equipment.

The installation of the pipe across intermediate-sized rivers (i.e., more than 15 feet wide) with less than 5 feet of water and which cannot be flumed will involve the placement of equipment in the stream. Typically, a backhoe will be used to excavate the trench. The crossing of intermediate streams greater than 15 feet wide with more than 5 feet of water and will involve the use of sectional flotation devices to provide a working base for standard excavation equipment (e.g., backhoes, clamshell dredges). In either case, excavated material will be sidecast on the downstream side of the trench, leaving gaps where necessary to allow normal water flow.

At all stream crossings, the pipe will be weighted (either by continuous concrete coating or bolt-on weights) to prevent flotation. Where concrete is required, mixing of the concrete and washing of equipment used for mixing, pouring or casting will not be carried out within 100 feet of a river or stream bank or in any area where contaminants from the concrete may reach a watercourse or wetland. All concrete coating on the pipeline will be cured for a minimum of three days prior to installation of the coated pipe in the watercourse or wetland.

Stream crossings will be perpendicular to the flow, if practical, with the pipeline laid to allow a minimum of 5 feet of cover. Typically, the pipe will be welded together in the make-up areas, and then carried (using sideboom tractors), pulled, or floated along the trench and lowered into place.

After the pipe is lowered into the trench, previously excavated material will be used to backfill the trench. Alternatively, if the excavated material cannot be used as backfill, suitable borrow material will be used (i.e., clean, coarse fill); the excavated material will be disposed of at an approved site.

After the completion of construction, streambeds will be restored to their former elevations and grades, as close to original conditions as practical. All foreign materials resulting from or used during construction of the pipeline will be removed to prevent interference with normal water flow and stream use. Any excavated material not used as backfill will be disposed of in a manner and at locations satisfactory as specified in the D&M Plan. Following grading, all stream bank will be restored and stabilized to prevent subsequent erosion, in accordance with permit requirements. If a crossing site has a high aesthetic value, mitigative measures, such as alignment modifications to reduce line-of-sight visibility or screening with plantings, may be implemented in compliance with 18 CFR Part 2.69.

Any temporary access roads will be located and constructed in accordance with the needs of the individual pipeline spreads, landowner requirements, and applicable regulatory requirements. Upon completion of the construction phase, the temporary access roads will be restored in a manner similar to that described for the right-of-way or to the reasonable satisfaction of the landowner.

If long-term access is needed to certain locations, appropriate measures will be taken for construction of such access and to prevent off-road vehicular use by the unauthorized public.

Housatonic River Crossing

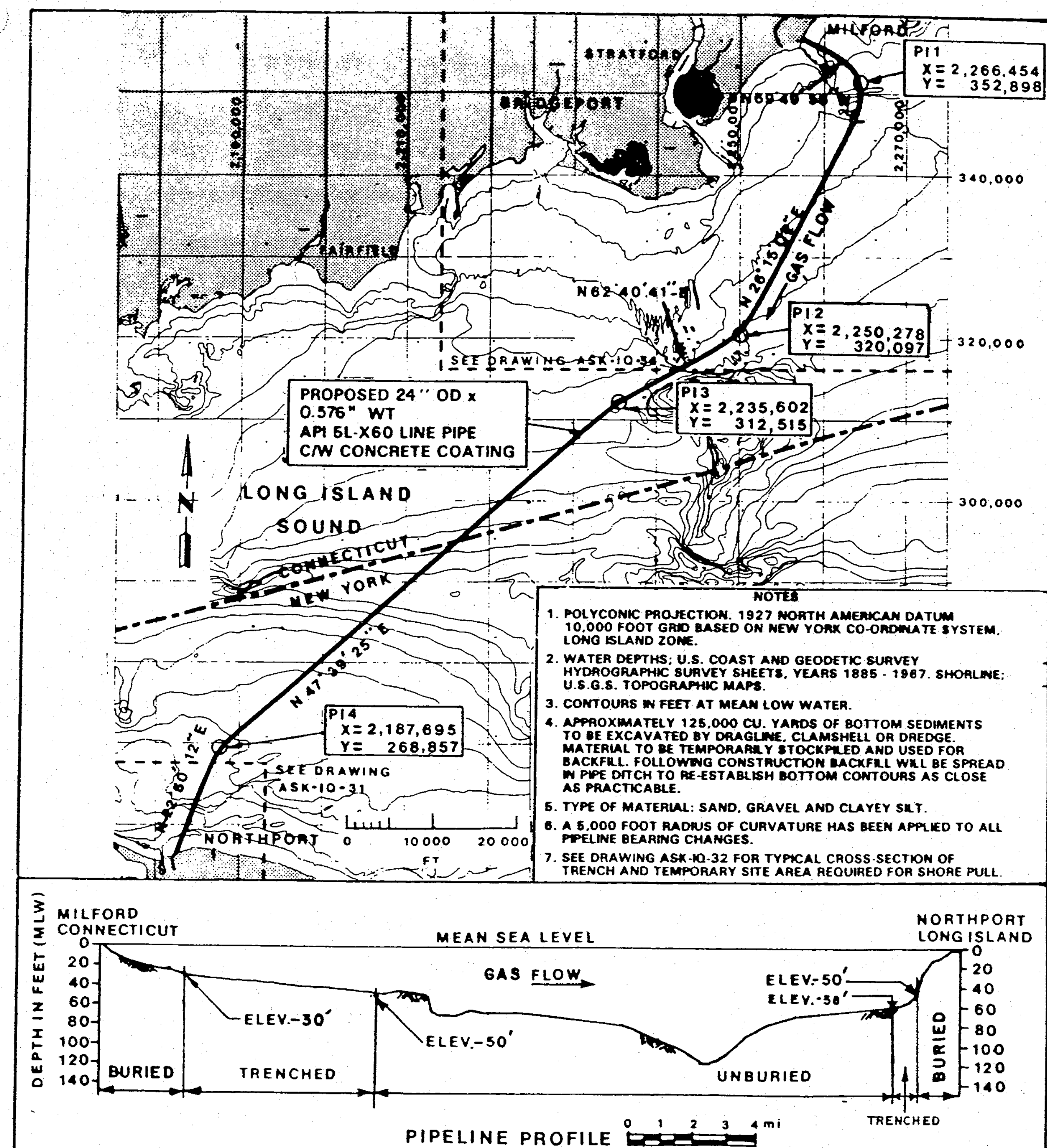
In Connecticut, the Iroquois route will traverse only one river requiring special construction procedures: the Housatonic. Specific details of the installation of the pipeline across this river are shown on the Figure III-11.

As this figure illustrates, the Housatonic River crossing will require the use of floating equipment to excavate the trench and to place the pipe in a trench that will provide for a minimum of 10 feet of cover over the installed pipeline across the river. The trench excavation at the Housatonic River crossing will occur in medium fine sand for the majority of the crossing, although some rock will be encountered near the west (Stratford) shoreline. The hard granite-type rock will require drilling and blasting prior to excavation. A barge-mounted drill will be used to drill blast holes into the rock and subsequently load the holes with explosives.

Before the rock is drilled and blasted, all the existing overburden material will first be removed using a clamshell type dredge. Due to the shallowness of the river and the need to maintain an open channel for boat traffic and tidal flow, some of the excavated trench volume may be placed in a temporary diked storage area located on the Milford side of the river, approximately 400 feet back from the water's edge. The remaining material will be sidecast downstream parallel to the trench excavation.

After blasting has taken place, the rock will be excavated from the trench using a clamshell dredge and temporarily stockpiled on each side of the trench. This material will be later used for backfilling the trench after the pipe has been installed.

Grain size analyses of sediment at the river crossing indicate that most of the material is sandy; thus downstream deposition from the area is



PROPOSED IGTS GAS PIPELINE CROSSING OF LONG ISLAND SOUND

STATE OF CONNECTICUT STATE OF NEW YORK

Iroquois
GAS TRANSMISSION SYSTEM

DATE
FEB 2/87

FIGURE III-11

REV.

expected to be minimal. Analyses also show that the sediments at the river crossing are of good quality and suitable for use as backfill material; thus, Iroquois does not expect to have to remove the excavated material to permanent upland disposal sites or to bring in materials to backfill the trench. In the unlikely event that portions of the excavated material cannot be used as backfill, or if pipe bedding is required, clean borrow material will be imported. As necessary, the excavated material not used as backfill will be disposed of in a manner and at locations satisfactory to the FERC, Corps of Engineers, and Siting Council.

The river crossing installation will require additional temporary work room on both banks of the river. The workroom is required for spoil storage, pipe makeup and winch facilities, pipe storage, welding and concrete-coating areas as well as room for vehicles. Iroquois will require a 6-to-8-acre site on the Milford side of the river as well as a 1-to-2-acre site on the Stratford side of the river.

Concurrent with the performance of the trenching operation, individual lengths of epoxy-coated pipe will be welded together into two strings approximately 375 feet long on the Milford side of the river. After each pipeline string is completed, each welded joint will be x-rayed and concrete coating will be applied to achieve the required negative buoyancy to ensure stabilization beneath the river as well as to provide protection to the pipeline during construction. The pipe strings will be hydrostatically tested as proof of integrity before pulling commences. After successful testing, the pipe will be placed on launching rollers and will be winched across the river.

After the work in the river is completed (e.g., trench excavation) and the trench is checked by divers, the pipeline will be bottom-pulled across the river using a winch. The winch will be located on the Stratford side of the river, west of River Road (Route 110) approximately 175 feet back from the shoreline.

Before pulling of the pipeline commences, a pulling cable from the winch will be attached to the pulling head welded to the first pipe string. Flotation tanks will also be secured along the top of the concrete-coated pipe to reduce the negative buoyancy to a desired pulling weight.

As pulling commences, the first pipe string is advanced into the river until the back end nears the water. Pulling is halted to allow the second string of pipe to be welded to the first, x-rayed and the joint area concrete coated. Following this, pulling re-commences until the pulling head reaches its desired location on the opposite side of the river.

Since the flotation is engineered so as to maintain the pipe string within the pre-excavated trench, navigation will not be impeded. Work boats will be stationed upstream and downstream of the crossing at all times during the pull to warn traffic. The pull may be delayed until the traffic has passed, then operations will resume.

Once the entire length of the pipeline is properly installed and inspected by divers, the flotation tanks will be removed and the pipe will be permanently in place. At this point test heads will be welded to each end and the full pipeline crossing will be hydrostatically tested.

Following successful testing and an internal inspection for deformations of the pipeline, the trench will be backfilled and a second hydrostatic test performed.

After the completion of pipe installation activities, the bottom contours and slope of the river will be restored to near original condition, as will the river banks. Erosion controls, temporary during construction and permanent as part of final cleanup, will be employed as necessary, and the river banks will be revegetated and mulched.

Agricultural Land Crossings

Iroquois will take special precautions when constructing through active agricultural areas to ensure that impacts to cropland, pasture land, and livestock are minimized. The methods that will be used are summarized below.

When necessary, temporary fences will be constructed to prevent livestock from entering or leaving farm property. The length of time the trench will remain open will be minimized, and appropriate accessways across the trench will be installed to allow the passage of livestock and farm equipment. The type of accessways will depend on the soils encountered and the needs of the landowner. Normally, soft plugs are used (i.e., the trench is excavated and spoil material placed back in the trench to construct the accessway). If the trench is in rock, rock topped with gravel will be used to construct the accessway, and where there is an existing road, the road will be left as the access unless rock is encountered.

Any permanent farm fences cut during construction will be repaired to the satisfaction of the landowner or tenant. Similarly, any other property affected during construction (e.g., rutting of farm or access roads, damage to hedges, compaction, drainage ditches, drainage tiles) will be restored to its preconstruction condition; property owners/tenants will be compensated for crop losses during construction and for any reductions in productivity along the right-of-way caused by pipeline construction.

Through cultivated agricultural land, special pretrenching techniques will be used to insure the segregation of topsoil and subsoil. The techniques consist of first stripping the topsoil layer over the trench and subsoil storage area and stockpiling it along the edge of the right-of-way on the opposite side from construction activities, and then redoing the subsoil layer and storing it in a separate pile in front of the topsoil. The topsoil will be removed to its actual depth or to a maximum depth of 1 foot.

Topsoil will be stored separately from subsoil and subsequently replaced with a minimum of handling. The separate topsoil and subsoil storage areas will typically be on the same side of the trench, away from the primary construction areas and accessways. However, where grad cuts result in additional spoil, the spoil may be stored on either side of the construction area. In such cases, the topsoil typically will be stripped from this entire area so that subsoil is not mixed with topsoil. Topsoil will not be piled in a manner that increases its water content. For example, topsoil will not be stored in wet depressions or where it blocks surface drainage. No drains and ditches will be blocked by topsoil or subsoil storage piles.

To avoid extensive rutting or compaction during periods of high soil moisture, measures such as restricting vehicle traffic, reducing loads, employing lower ground-pressure equipments, and rescheduling certain activities may be used. However, even under ideal soil conditions, some soil compaction may occur, particularly under the traveled portion of the right-of-way.

Prior to the replacement of topsoil, Iroquois will test affected agricultural lands for compaction across the right-of-way. In impacted agricultural sections of the right-of-way area, Iroquois will break up all such compaction with deep tillage by such devices as, but not limited to, the deep-shank heavy duty subsoil, the paraplow or the paratill down to the bottom of actual compaction. Following such deep tillage, the agricultural topsoil that has been temporarily removed for the period of construction will be replaced, and, where necessary, additional deep tillage activity will be undertaken during periods of relatively low soil moisture to ensure the desired mitigation and prevent additional subsurface compaction. In the event that subsequent construction or clean-up activities result in new compaction, Iroquois will perform additional deep tillage to alleviate such compaction.

The proposed pipeline will cross some agricultural areas with drainage tile systems. The specific locations and depths of such systems will be identified during consultations with the landowners. Any drain tiles damage, cut, or removed during the pipeline construction process will be replaced. During construction, temporary measures will be used to insure that drainage systems continue to function effectively. For example, when such tile is cut, the open ends of the tile will be carefully covered to prevent the ingress of dirt. The location of such damaged tile will be marked so that the tile can be reestablished after backfill is complete. If necessary to maintain drainage while the pipeline trench is open, a temporary pipe bridge will be installed.

A tile repair crew will permanently repair and replace the drain tile to the complete satisfaction of the landowner. Suitable transline pipe will be used to connect the cut portions of the drain tile. In addition, to avoid the settlement of soil beneath the tiles, the soil under the transline connection pipe will be mechanically tamped.

To restore the soil to former productivity, to enhance structure, and to provide adequate nutrients for seed germination and establishment, the application of fertilizer (and manure, if appropriate and and available) will be recommended. The most common method of fertilizer or manure application is to thoroughly incorporate the material into the upper eight inches of topsoil, usually in conjunction with final tillage.

The inclusion of legumes in the seed mixture used to revegetate the right-of-way will also be recommended, as appropriate. The establishment of a deep-rooted legume crop enhances the development of network of roots within the topsoil and subsoil horizons, thus aiding restoration by contributing to fixation of nitrogen, accumulation of organic matter, and reduction of soil compaction.

Employing timely follow-up to site restoration, Iroquois will examine the agricultural lands for crop productivity on the affected right-of-way. Where crop productivity within the affected right-of-way is less than that of the adjacent unaffected agricultural land, samples of the disturbed agricultural soils will be submitted for pH and basic nutrient requirement tests. Iroquois will undertake to restore pH and basic nutrient levels to those of the area adjacent to the right-of-way.

Although, for the operational life and maintenance of the completed project, Iroquois will effectively respond to reasonable requests of farmland operators concerning the remediation of project effects on agricultural resources, Iroquois will specifically provide a remediation period of no less than two years immediately following the commissioning of the pipeline for operators of affected farmlands to identify any impacts associated with right-of-way construction which are in need of mitigation.

Highway, Railroad, and Utility Crossings

This section describes some of the methods and techniques that will be used to construct the pipeline across existing rights-of-way (e.g., highways, railroads, utility corridors).

Highway, railroad, and utility rights-of-way will be crossed by open cutting, boring, or tunneling. Where required, a pipe casing or sleeve will be inserted and a complete section of pipeline placed therein. In some instances, it may be necessary to prepare a site or temporary work space adjacent to the existing right-of-way that is large enough to accommodate equipment and spoil storage on each side of the crossing. Beneath such crossings the pipeline will be placed at a depth of at least 5 feet, in accordance with DOT regulations.

Normally all railroad crossings will require casings. Highway crossings may be bored using casing, slip-bored, or, where permitted by highway authorities, open-cut and the pipeline installed without casing. In some cases concrete coating may be required. Most local road crossings (unpaved, secondary, and unimproved roads) will be open-cut, whereas major state and interstate highways will be bored or tunneled. Typically, construction across a local road, using the open-cut method, can be completed in one to two hours, whereas construction across major highways, using boring or tunneling, may require several days or weeks to complete. However, if rock is encountered at these major types of crossings, boring or tunneling would likely be very difficult, time consuming, and costly; as a result, consideration may be given to using the open-cut method, while provisions will be made for maintenance of uninterrupted traffic service as outlined below.

Roadside boring and receiving pits will be backfilled for a distance of a least 15 feet from the traveled portion of the road within a week of the pipe installation unless conditions or circumstances warrant an extension of this period.

During construction, every reasonable effort will be made to eliminate delays or public inconveniences at such crossings, and to otherwise avoid restricting normal traffic flow. For example, if the open-cut method is used to cross local roads, traffic flow will be maintained by completing one lane at a time or by constructing a temporary bypass around the work area. In some cases, the road may be closed and a short detour utilized. At crossings, appropriate safety procedures also will be implemented to prevent injuries to workers or to the public at large. Devices to notify the public of construction, such as flagmen, signs, traffic controls, night flashers, and markers, will be used as deemed necessary by the construction supervisor or safety engineer. Cross-over locations will be provided along open trenches or other disturbed areas to permit passage by people and animals. All railroad track beds and road surfaces, if disturbed at all, will be restored to their former condition.

Iroquois will notify any affected electric utility at least two weeks (i.e., 10 working days) prior to the commencement of construction along segments of the pipeline paralleling electric transmission lines. Proposed construction practices governing each segment will be made available to the affected utility as soon as practicable, and in no case later than two weeks prior to construction. Iroquois will adopt any reasonable modification to those practices suggested in a timely fashion. The electric utility may supply an inspector for all parallel construction activities; this inspector will have immediate access to an Iroquois representative(s) with "stop work" authority.

Engineering plans will be submitted to the electric utility for review and concurrence prior to construction. Iroquois will work with the electric utility in monitoring the integrity of the electric transmission structures as is deemed appropriate by the affected electric utility to ensure proper coordination of the cathodic protection of the pipeline with the transmission structures' foundations.

III.3.3. Marine Pipeline Construction

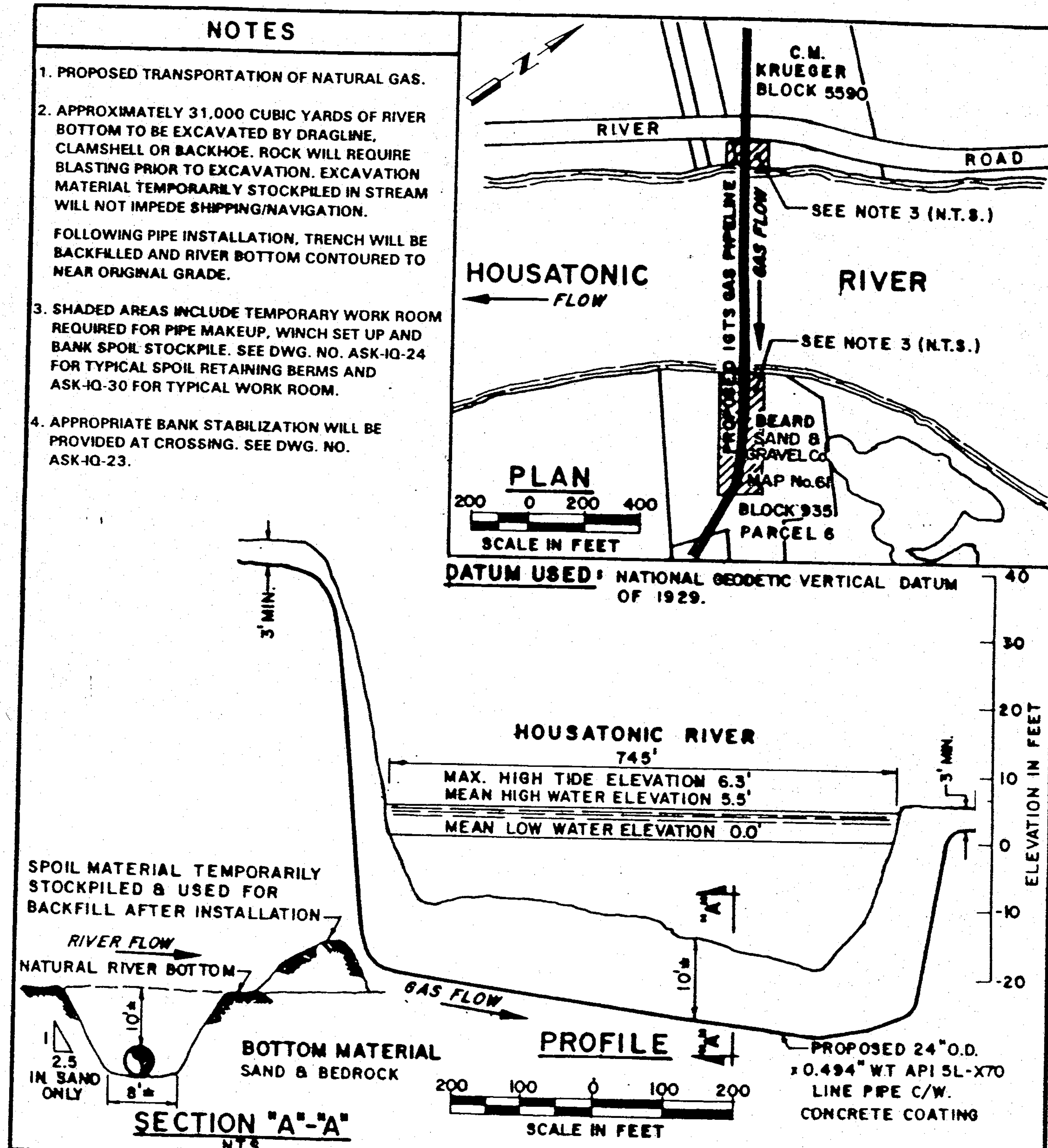
The marine portion of the pipeline is proposed to traverse 26.3 miles across Long Island Sound from Milford, Connecticut, to a landfall at Northport, Long Island. The route enters Long Island Sound on a southerly heading from a landfall at Silver Sands State Park in Milford. The route then turns to the west, passing north of Stratford Shoal, before heading in a southwesterly direction to Northport. Giving due consideration for the location of Stratford Shoal Middle Ground, the route provides the shortest distance with the minimum slope. Water depths along the route (excluding the nearshore areas) typically range from 60 to 100 feet. The proposed crossing of Long Island Sound is shown on Figure III-12; Figure III-13 illustrates the Milford shore approach.

In the fall of 1986, Iroquois conducted a marine survey which included over 500 line miles of high resolution geophysical investigation, 134 soil samples (including 1,000 laboratory and insitu soil tests). Five current meter sites and two tide gauges were deployed (Jacques/McClelland Geosciences, Inc., January 1988). These investigations of the seabed conditions indicated that the route traverses fine-grained sediments, sand

NOTES

1. PROPOSED TRANSPORTATION OF NATURAL GAS.
2. APPROXIMATELY 31,000 CUBIC YARDS OF RIVER BOTTOM TO BE EXCAVATED BY DRAGLINE, CLAMSHELL OR BACKHOE. ROCK WILL REQUIRE BLASTING PRIOR TO EXCAVATION. EXCAVATION MATERIAL TEMPORARILY STOCKPILED IN STREAM WILL NOT IMPEDE SHIPPING/NAVIGATION.

   FOLLOWING PIPE INSTALLATION, TRENCH WILL BE BACKFILLED AND RIVER BOTTOM CONTOURED TO NEAR ORIGINAL GRADE.
3. SHADED AREAS INCLUDE TEMPORARY WORK ROOM REQUIRED FOR PIPE MAKEUP, WINCH SET UP AND BANK SPOIL STOCKPILE. SEE DWG. NO. ASK-IQ-24 FOR TYPICAL SPOIL RETAINING BERMS AND ASK-IQ-30 FOR TYPICAL WORK ROOM.
4. APPROPRIATE BANK STABILIZATION WILL BE PROVIDED AT CROSSING. SEE DWG. NO. ASK-IQ-23.



PROPOSED IGTS GAS PIPELINE CROSSING OF HOUSATONIC RIVER

TOWN OF STRATFORD & CITY OF MILFORD
FAIRFIELD & NEW HAVEN COUNTIES, STATE OF CONNECTICUT

Iroquois GAS TRANSMISSION SYSTEM

Date JAN. 12 /87

FIGURE III-12

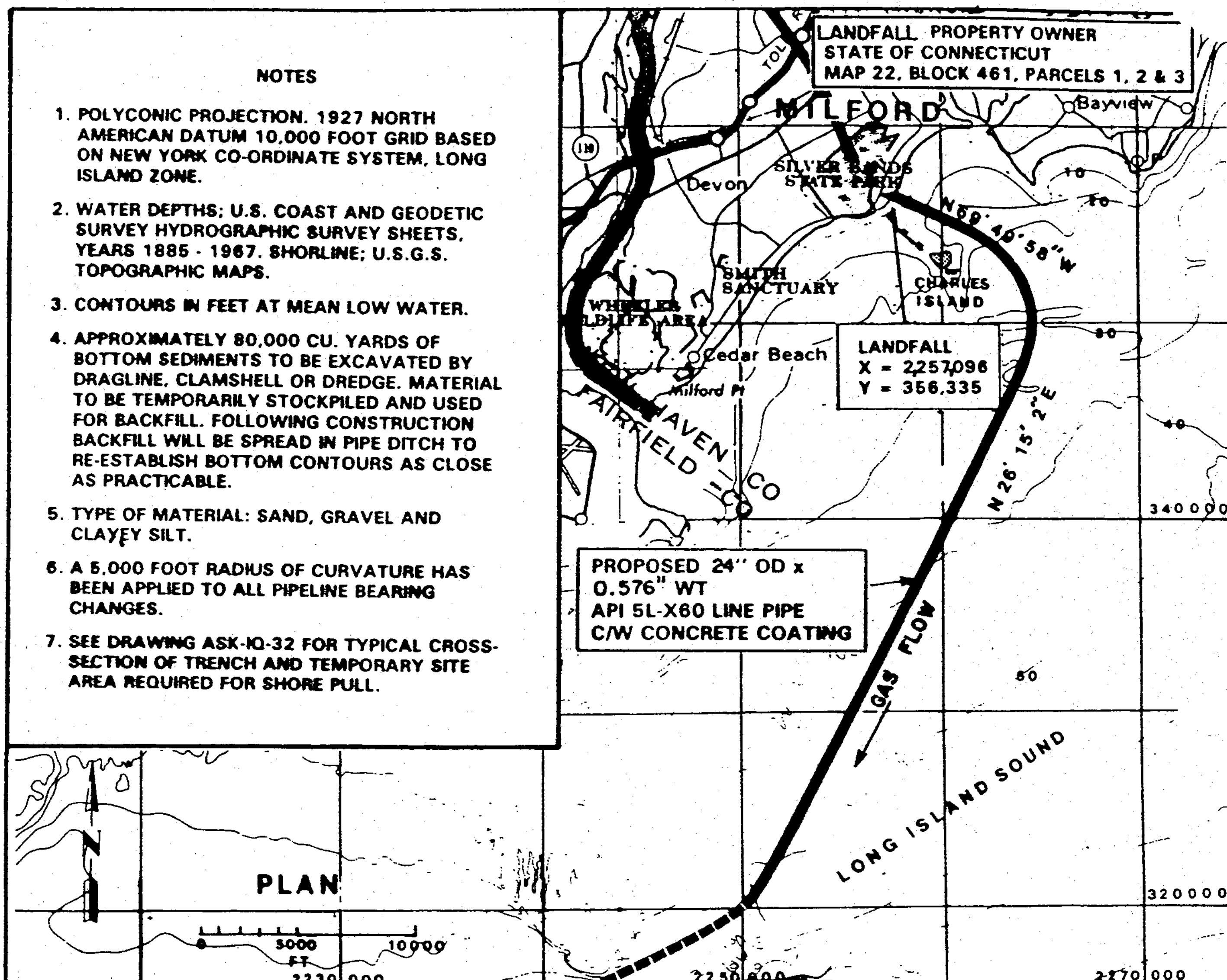
REV.

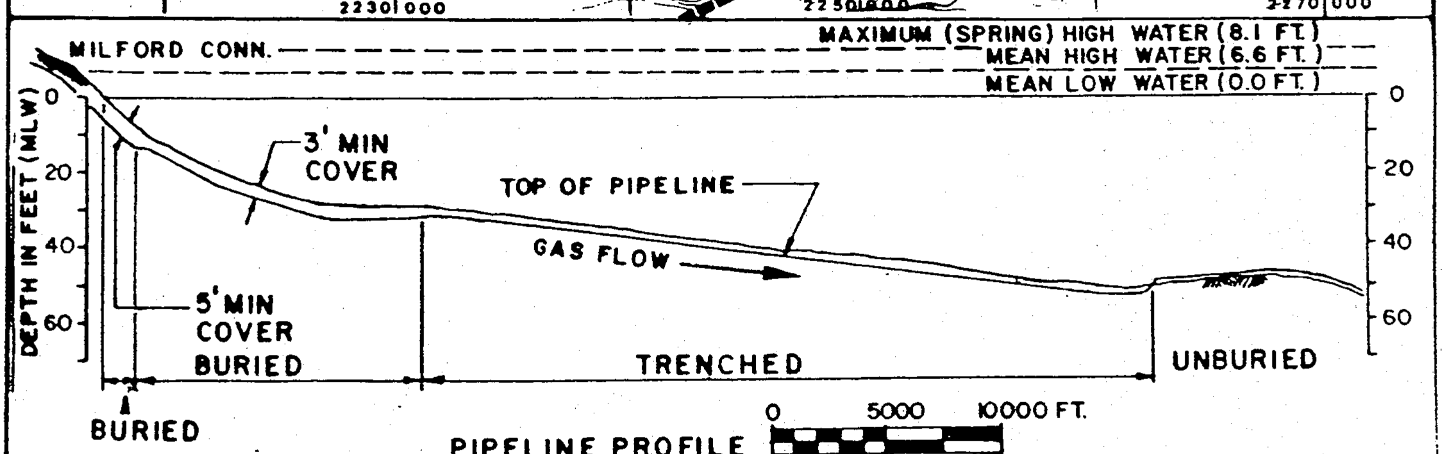
MF NO.

FORM = ASK-20-108, A SIZE GENERAL (87-01-07)

NOTES

1. POLYCONIC PROJECTION. 1927 NORTH AMERICAN DATUM 10,000 FOOT GRID BASED ON NEW YORK CO-ORDINATE SYSTEM, LONG ISLAND ZONE.
2. WATER DEPTHS; U.S. COAST AND GEODETIC SURVEY HYDROGRAPHIC SURVEY SHEETS, YEARS 1885 - 1967. SHORLINE; U.S.G.S. TOPOGRAPHIC MAPS.
3. CONTOURS IN FEET AT MEAN LOW WATER.
4. APPROXIMATELY 80,000 CU. YARDS OF BOTTOM SEDIMENTS TO BE EXCAVATED BY DRAGLINE, CLAMSHELL OR DREDGE. MATERIAL TO BE TEMPORARILY STOCKPILED AND USED FOR BACKFILL. FOLLOWING CONSTRUCTION BACKFILL WILL BE SPREAD IN PIPE DITCH TO RE-ESTABLISH BOTTOM CONTOURS AS CLOSE AS PRACTICABLE.
5. TYPE OF MATERIAL: SAND, GRAVEL AND CLAYEY SILT.
6. A 5,000 FOOT RADIUS OF CURVATURE HAS BEEN APPLIED TO ALL PIPELINE BEARING CHANGES.
7. SEE DRAWING ASK-IQ-32 FOR TYPICAL CROSS-SECTION OF TRENCH AND TEMPORARY SITE AREA REQUIRED FOR SHORE PULL.





PROPOSED IGTS GAS PIPELINE

MILFORD SHORE APPROACH

CITY OF MILFORD

NEW HAVEN COUNTY — STATE OF CONNECTICUT

Iroquois GAS TRANSMISSION SYSTEM

DATE FEB.03/87

FIGURE III-13

REV.

and gravel, and fine-grained sediments overlying sand and gravel. There are no occurrences of outcropping bedrock along the route and, similarly, no occurrences of boulder concentrations along the route were identified.

The marine pipeline will consist of 24-inch outside diameter 0.576–inch thick, high-quality steel pipe, which will be concrete-coated to increase stability. Approximately three to four months will be required to construct the marine portion of the pipeline.

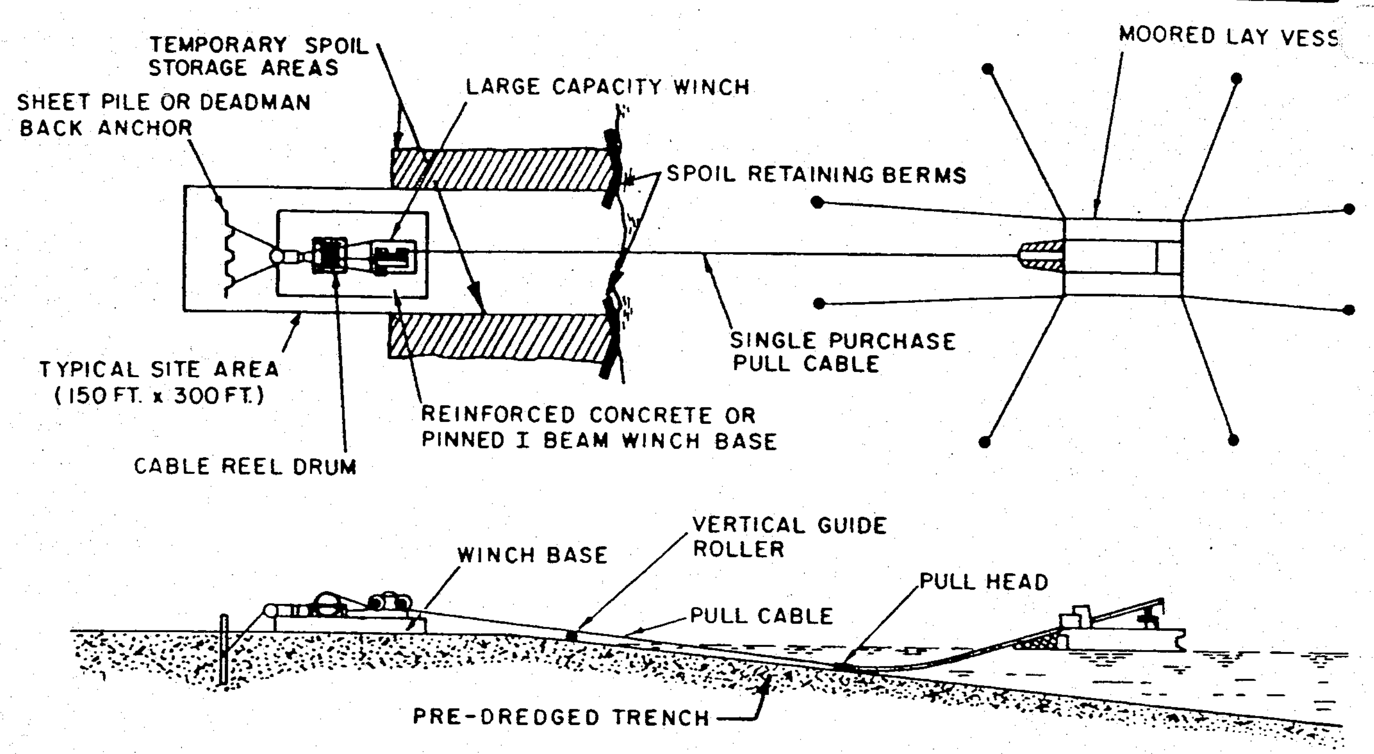
All construction is schedule to be performed to the maximum extent possible in the winter, from January through May. All construction activity must be completed by May 31 because of the prohibition of construction activities in Long Island Sound from June 1 through September 30 in Connecticut, and from June 30 through September 30 in New York.

Construction Techniques

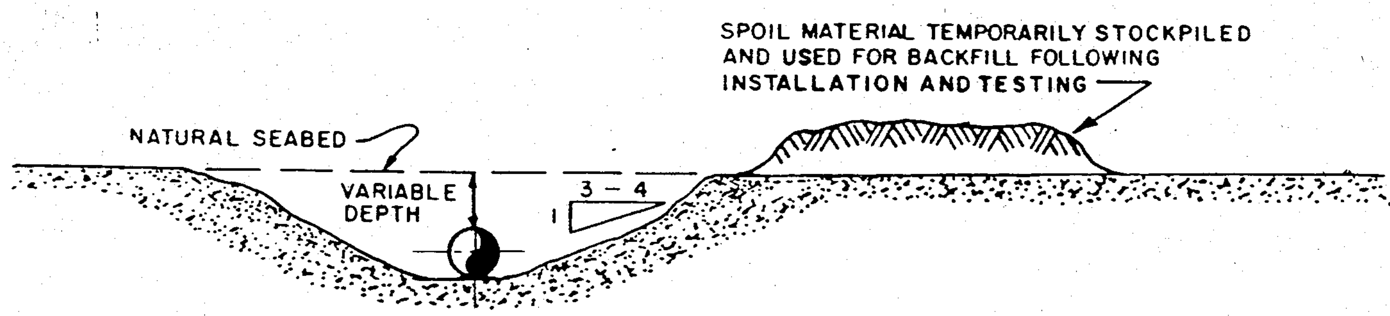
The marine pipeline will be constructed using proven, conventional technology. There are three basic components of the construction of the marine pipeline: the offshore, inshore, and landfall (shore) approaches.

In the offshore area (defined here as the area beyond the 50-to-58 foot water depth, which amounts to about 16 miles of the 26.3-mile route), the concrete-coated pipeline will be laid directly on the sea bottom; no trenching will be required. Given the types of sediments found along the offshore marine route, it is expected that the pipeline will settle into the seabed with time.

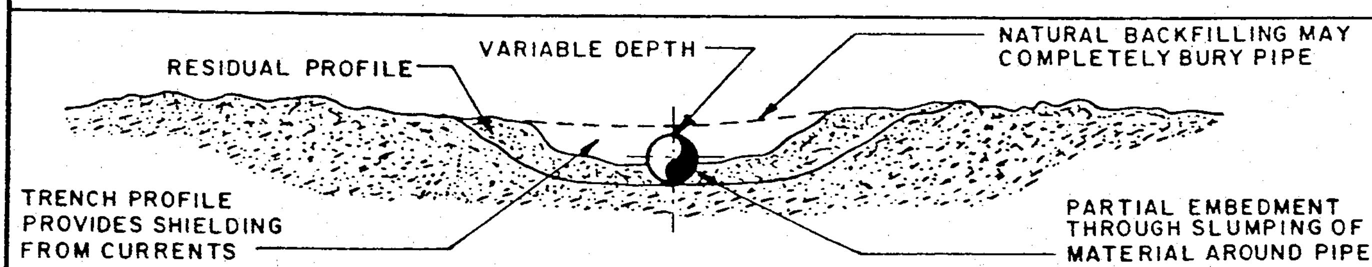
Installation for the offshore pipeline will be performed using a layvessel equipped to join the lengths of pipe, radiograph the welds, and lower the pipe to the seabed. Figures III-14 and III-15 show a typical marine pipeline installation using a laybarge. The layvessel proposed for



TYPICAL SHORE APPROACH CONSTRUCTION : PULL ASHORE METHOD



TYPICAL CROSS – SECTION OF DREDGED DITCH

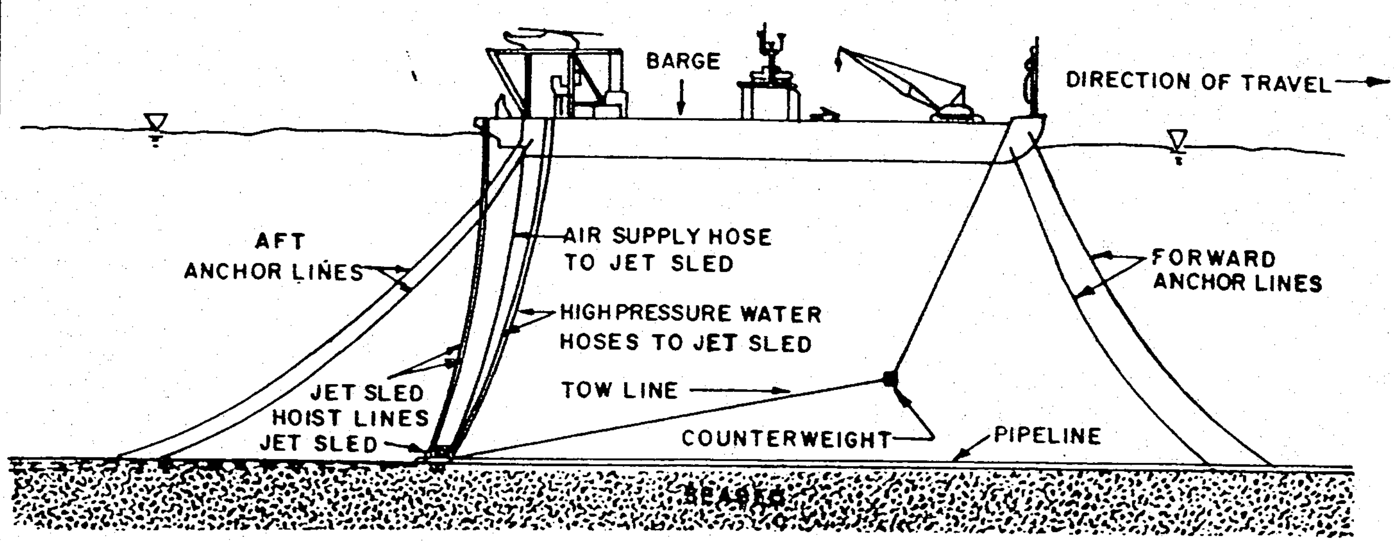


TYPICAL CROSS – SECTION AFTER JETTING OPERATION

TYPICAL CONSTRUCTION PRACTICES FOR THE CROSSING OF LONG ISLAND SOUND

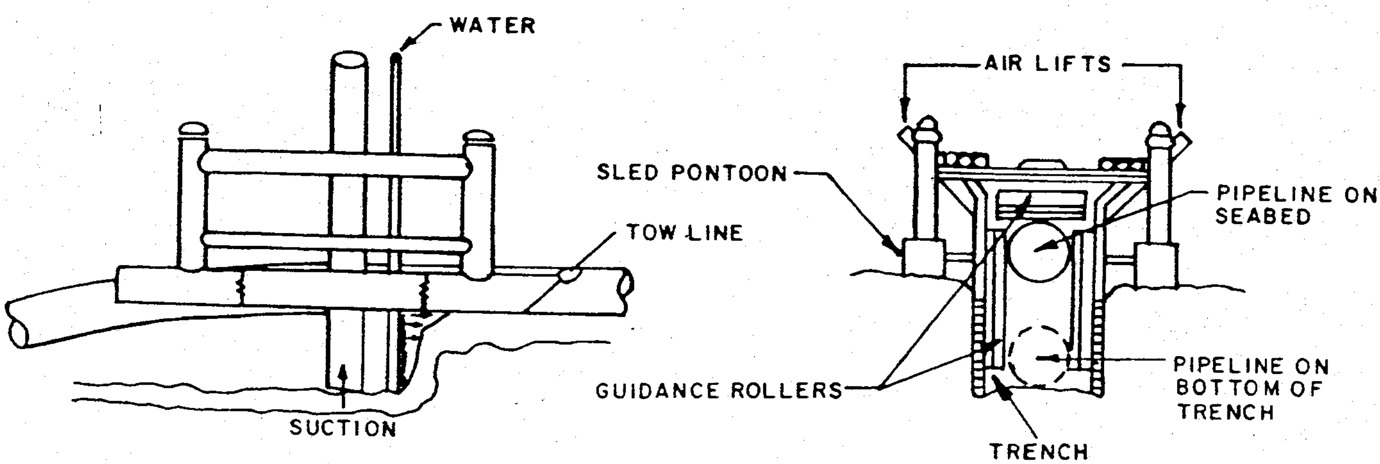
Iroquois GAS TRANSMISSION SYSTEM

DATE		REV.
JAN. 30/87	FIGURE III- 14	



CROSS-SECTION DURING JETTING OPERATION

NTS



DETAILS OF JET SLED

NTS

TYPICAL POST TRENCHING OF PIPELINE UTILIZING THE JETTING METHOD	Iroquois GAS TRANSMISSION SYSTEM	
DATE FEB. 19/87	FIGURE III- 15	REV.

HF No.

FORM = ASK-28-109, A SIZE GENERAL (87-01-07)

the project is a second-generation, flat-bottom vessel of the type that operates in the Gulf of Mexico. Support vessels such as anchor handling tugs, supply vessels, and personnel transportation vessels also will be needed as part of the pipe laying spread. These will be contracted for locally, along with helicopters, catering facilities, and other peripheral pipe laying activity requirements.

The layvessel will be positioned with an array of eight to 10 anchors, which are used to move the vessel forward as the pipeline is constructed. Depending upon the water depth, these anchors may extend up to 1 mile away from the vessel. During the pipe laying operation, the anchors will be continually repositioned by anchor handling tugs. The pipeline segments will be welded together on the laybarge and slipped into the water along the stinger. All construction will proceed sequentially along the pre-defined pipeline route.

It is expected that pipe will be laid at a rate of about 0.6 to 1.0 miles/day. Only one pipe laying spread operation is anticipated for the pipeline; this will consist of one layvessel with a crew of approximately 150 persons. The pipe laying operation, which will be 24 hours a day, will be supported by pipe carriers, supply vessels, anchor handling tugs, a survey boat, and possibly a diving support vessel, which will require a combined work force of between 150 and 250 persons.

During pipeline installation, safety considerations as well as vessel anchoring and anchor handling requirements will necessitate the establishment of an exclusion zone with a 2-mile radius around the pipe laying vessel. This area will be a sliding zone that will advance as installation activities proceed.

The positions of the exclusion zones will be published in appropriate public notices. Vessels engaged in construction activities will show the required shapes and lights as defined by appropriate state and federal regulations.

Both landfalls will be constructed using the pull to shore method. This landfall construction method involves the use of equipment similar to that used to construct the offshore segment of the pipeline; the pipe will be fabricated on the layvessel and pulled to shore using a land-based winch. However, unlike the offshore portion of the marine route, at the two landfalls and in associated nearshore areas, the concrete-coated pipeline will be trenched.

At both the Milford and Northport landfalls, the pipe will be buried through the surf zone to provide a minimum depth of cover of 5 feet, which takes into consideration the shore topography as well as the provision of adequate protection from erosional and scouring processes. In addition, a minimum cover of 5 feet to the top of the pipe will be maintained in the onshore trench; however, cover requirements will also take into consideration beach topography, existing structures (e.g., service roads), onshore tie-in location, and erosion potential. The effect of this analysis will be an increase in the depth of cover required, ranging between 5 and 15 feet.

In the in-shore area (defined in this context as that area between the shore approach and the offshore area) at both Milford and Northport, the pipeline will be lowered into the seabed out to the 50-foot isobath (i.e., water depth).

The layvessel will moor as near to the shore as feasible, given the constraints of vessel draft and anchor spread. Once in position, the pipeline string will be pulled ashore from the laybarge.

A small area (approximately 1 acre) at each of the landfalls will be necessary to allow the placement of a winch with sufficient capability to pull the pipe ashore, the temporary storage of excavated trench material, and the siting of office and parking facilities. The objective of the landfall site preparation will be to ensure that the site is easily accessible for construction support equipment and is ready to accommodate the construction of the trench through the surf zone and extension onshore. The nearshore trench will be excavated by land-based equipment to the limit of accessibility by the barge-mounted dredger(s).

The extent of the onshore trench landward will be limited in order to eliminate any potential for downtrench seepage of water from upland sources. In addition, construction activities will be sequenced so that the shore approach segment of the pipeline will be installed and the trench backfilled (complete with impervious ditch plugs) prior to tying into the land pipeline segment. The tie-in point will be located as close to the highest point in the trench profile as possible, to further eliminate the potential for downtrench seepage.

Two construction methods will be utilized to achieve the required pipeline depth below the seabed--pre-dredging and post-jetting. At both Milford and Northport out to about the 6-foot bathymetric contour, the pipe will be lowered into the trench and buried so that a minimum of 5 feet of cover is provided. Seaward of the 6-foot water depth out to the 30-foot isobath, a minimum of 3 feet of cover will be provided. The following describes the specific construction plans for the Milford inshore area. Table III-4 summarizes this data.

Milford. At Milford, stable sand and gravel occur from the shoreline to approximately the 30-foot water depth. Clayey silt has been observed from this point to approximately the 50-foot contour, where fine to medium sand is encountered.

A pre-dredged trench will be excavated out to the 30-foot water depth; excavated material will be sidecast. The dredger(s), the number of which will be dependent on the contractor's scheduling requirements and weather limitations, will most likely consist of a crane and bucket mounted on a shallow draft barge. A total of approximately 80,000 cubic yards of material will be excavated from the trench. The material excavated from the trench will be used as backfill. Natural sediment transport will assist in restoring bottom contours to preconstruction conditions.

From the 30- to 50- foot water depth (within the clayey silt region) the pipeline will be post-jetted below the seabed. This operation will involve lowering the pipeline below the seabed using conventional high-water-pressure and high-air pressure jets mounted on a steel sled which will be towed along the pipeline via a cable or chain from a surface support vessel. The cutting action of the water jets, combined with the lifting action due to the air pressure, produces a net bottom displacement of sediments from beneath the installed pipe, thus allowing the pipeline to settle to the ditch bottom behind the sled.

The displaced soil will disperse laterally away from the trench and will be deposited back onto the seabed. This disturbance is considered

TABLE III-4

MARINE PIPELINE TRENCHING/BURIAL REQUIREMENTS
(MILFORD,CT)

Activity	Milford
Length of trenching/burial	45,400 feet*
Length of burial to provide 5 feet of cover	1,300 feet
Length of normal burial (3 feet of cover)	12,900 feet
Length of post jetting**	31,200 feet
Onshore trench	Variable

* To 50-foot water depth.

** Jet a minimum of 3 feet below the seabed from 30-to 50-foot water depth; natural processes will serve to infill the trench.

Source: Iroquois Gas Transmission System, 1990.

local and short-term due to the fast and efficient nature of the jetting method (2,500 to 3,000 feet of trench excavated per day). This eliminates the need for cleaning passes prior to pipe installation. In addition, localized infilling of the trench occurs immediately behind the jetting operation, providing partial burial of the pipe; the longer-term flushing influence of the tidal currents and wave action generated from storm activity also provides for natural infilling of the trench and "sweeping" of the seabed immediately adjacent to the trench.

Pipe burial to the 30-foot contour was established in consideration of present and future shellfish activities off Milford, based on the discussions with representatives of the National Marine Fisheries Service (NMFS) and Connecticut Department of Agriculture, Division of Aquaculture. Beyond this point, the clay-silt nature of the sediments are not conducive to shellfish production. (Refer to Sections IV.5 and V.5 for a discussion of marine resources).

III.3.4. Construction Procedures for Auxiliary Facilities

The project will involve the construction of sales meter stations, as well as ancillary facilities such as electronic pig launcher/receiver sites, and mainline valves. Sales meter stations, which are gas measurement facilities, are required at points where custody of the gas is transferred from Iroquois to another company.

No compressor stations are proposed as part of the project. None of the auxiliary structures that will be included in the system will result in the generation of air pollution or noise under normal operating conditions. There are no appurtenant structures, other than the test lead posts, for the cathodic protection systems, which is underground.

Sales Meter Stations and Interconnection Points

There will be three sales meter stations in Connecticut, which will supply gas to Yankee Gas Services Company and Southern Connecticut Gas Company. In addition, there will be two interconnection points supplying gas to Algonquin Gas Transmission Company and Tennessee Gas Transmission Company. Each of these facilities will be similar, but will vary in terms of size of buildings required depending upon the flow of gas to be metered and the extent of pressure reduction required.

At the interconnection points, Iroquois will meter the gas to measure the gas voulme transferred to the two existing interstate pipeline companies and to regulate the volume of gas flow. At the sales meter stations, Iroquois will meter the gas; the LDCs will regulate the gas flow. The interstate pipeline companies and the LDCs will each be responsible for regulating the pressure of the gas received from Iroquois in order to match their respective operating pressures.

Both the Iroquois and the interstate or LDC facilities will be installed in the same building. All pipe runs will be placed either underground or within the building. Valve stems and pressure relief valves will be the only aboveground appurtenances not located within the main building. A smaller building will enclosed the monitoring and electronic recording equipment and, where required, gas heating equipment. The large building will be architecturally designed to look similar to a one-story house, while the instrumentation building will be designed to resemble a tool shed or single car garage. The valve stems and relief valve will be screeded with vegetation. Each sales meter station will be surrounded by a fence. The station site (buildings and gate) will be kept locked when operations personnel are not in attendance.

Valves

Mainline valve assemblies will be constructed within the pipeline right-of-way, and spaced at intervals specified by DOT regulations. The distance between valves will vary as a function of population density, and in Connecticut is expected to be about 8 miles apart. (It should be noted that valve site locations will change as a result of the incoroporation of route variations currently under review by FERC.) Each valve assembly will require a site of approximately 18 feet by 40 feet (within the right-of-way), which will be enclosed by a chain link fence. The valve assembly will be constructed as part of the pipeline.

Pig Launcher/Receiver Sites

Pig launcher/receiver sites will be constructed at the same time as the pipeline. Each will involve a site of about 120 by 210 feet within and adjacent to the right-of-way.

III.3.5 Environmental Inspection

The environmental stipulations, permit requirements, construction conditions, and mitigation measures discussed herein will be incorporated as part of Iroquois' pipeline construction specifications or will be otherwise included in construction contracts. In addition, contractor personnel will be briefed on these environmental protection programs, including any special environmental requirements stipulated as permit conditions.

To ensure compliance with the identified environmental protection measures, permit stipulations and construction contract documents, Iroquois will employ environmental inspectors as part of each construction spread. These environmental inspectors will have directly relevant education, expertise, and technical background in areas such as agriculture, biology, soils, and forestry.

There will be several environmental inspectors on each spread. These are anticipated to be independent consultants working under contract with Iroquois and reporting to the spread environmental coordinator who, in turn, will report to Iroquois' Manager of Environment. The environmental inspectors and the Manager of Environment also will be responsible for keeping FERC and the Siting Council appraised of activities, and for liaising with representatives of other government agencies.

The inspectors will advise construction personnel on environmental matters and will monitor conformance to environmental stipulations. It also will be the responsibility of the environmental inspectors to bring to the immediate attention of the construction supervisor and the Iroquois Manager of Environment any activity which may cause negative environmental impact. Daily meetings will be held between the environmental coordinator, inspectors and the Iroquois construction representative to discuss the environmental implications of the construction, compliance, and possible impacts of the day's activities. Daily written reports (see attached Table III-5) will be submitted by each inspector to the Iroquois construction supervisor. Copies of this report are also submitted to Iroquois' Manager of Environment.

When visitors (e.g., representatives of regulatory agencies) come onto the construction site, they are requested, for safety reasons, to advise the construction supervisor upon their arrival. Visitors are requested to complete a visitor's report (see attached Table III-6) in order that pertinent observations, comments, or concerns are recorded and given

Table III-5
FORMAT FOR ENVIRONMENTAL INSPECTOR'S DAILY REPORT

ENVIRONMENTAL INSPECTOR'S DAILY REPORT

SPREAD: ______________________ WEATHER CONDITIONS: __________________ DATE: ______________________

LOCATION MAINLINE VALVE AND MILEPOST AND RIGHT-OF-WAY NUMBER	LAND USE	ENVIRONMENTAL ISSUE	COMMENTS	RECOMMENDATIONS

IGTS CONSTRUCTION REPRESENTATIVE'S COMMENTS: ______________________________

PREPARED BY: ______________________________

______________________ CONSULTING FIRM

______________________ HOURS WORKED

______________________ IROQUOIS CONSTRUCTION REPRESENTATIVE

Copies to: Iroquois Environmental Affairs Department: Construction Supervisor, Originator
SOURCE: IROQUOIS GAS TRANSMISSION SYSTEM, 1990.

Table III-6

FORMAT FOR IGTS VISITOR'S REPORT

IROQUOIS GAS TRANSMISSION SYSTEM — VISITOR'S REPORT

______________________________	______________________________
VISITOR'S NAME	PROJECT
______________________________	______________________________
REPRESENTING	DATE

VISITOR'S REMARKS:

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ENVIRONMENTAL INSPECTOR'S REMARKS:

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IROQUOIS CONSTRUCTION SUPRVISOR'S REMARKS:

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____________________	____________________	____________________
VISITOR SIGNATURE	ENVIRONMENTAL SIGNATURE	IROQUOIS CONSTRUCTION REPRESENTATIVE SIGNATURE

SOURCE: IROQUOIS GAS TRANSMISSION SYSTEM. 1990.

appropriate attention. When such reports entail environmental matters, it is the responsibility of the environmental inspector to record his/her observations and recommendations or responses. These reports receive the same distribution as the daily written reports.

In the absence of Iroquois personnel, should a situation arise in which there is a clear contravention of environmental specifications and in which the delay necessary for proper communications could result in unnecessary environmental impact, the environmental inspector will take immediate action to have the activity discontinued until the appropriate Iroquois personnel are informed. These situations, though anticipated to be infrequent, will be handled according to the individual circumstances demanded by that particular problem. Contingencies for such events will be worked out during pre-construction planning activities. The environmental inspectors in these situations will have authority to stop-work (i.e., to stop the activities contributing to the problem).

Iroquois will develop a training program for environmental inspection consistent with the outline contained in Table III-7. This training program will include an environmental compliance manual that will detail all of the environment permit conditions and measures to which Iroquois must adhere. In addition, Iroquois environmental inspectors will meet with appropriate regulatory agency personnel prior to construction.

TABLE III-7

OUTLINE OF ENVIRONMENTAL BRIEFING

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1. Introduction of Environmental Inspectors

   - Role of the environmental inspector and specific job functions
   - Lines of communication within Iroquois organization
   - Role with outside agencies and public liaison
   - Reporting forms (Visitor's Report, Environmental Inspector's Daily Report)

2. Environmental Aspects of the Construction (as stated in the Project Description)

   - Adherence to government stipulations and permit conditions
   - Topsoil stripping
   - Locations of restricted work room
   - Timing constraints (i.e., "construction windows")
   - Wetlands avoidance, impact minimization
   - Special mitigative measures (such as use of geotextiles, sediment traps, rip rapping, etc.
   - Subsoiling requirements
   - Temporary erosion control methods at sensitive areas
   - Cultural Resources

3. Changes During Construction Which have Environmental Implications

   - Environmental assessment of change
   - Regulatory procedure and timing
   - Notification to interested parties

4. General Environmental Concerns

   - Spills during construction and cleanup
   - Litter control
   - Drainage repair
   - Regrading
   - Temporary and permanent erosion control methods

III.4. FERC RECOMMENDED CONSTRUCTION MEASURES

In the DEIS, the FERC has recommended various procedures for the construction and operation of the proposed Iroquois pipeline. Such procedures can be found in DEIS Section 7.3, Recommended Measure Nos. 1 to 44, and No. 60; and in DEIS Appendices C and D. Many of the recommended measures are procedures to which Iroquois has already committed, as described in its 1986 ER and 1988 Resource Reports or in its Article VII certificate. As a result, with few exceptions, Iroquois concurs with the FERC recommended measures.

As part of its review of the DEIS, on February 15, 1990, Iroquois submitted comments to FERC on these recommended measures. The FERC recommended measures (i.e., DEIS Section 7.3), as well as Iroquois' comments regarding these measures, are attached herein as Appendix C.

III.5 DEVELOPMENT AND MANAGEMENT PLAN

After Siting Council certification and prior to construction, Iroquois will prepare a Development and Management (D&M) Plan for the project which will be submitted to the Siting Council for its review and approval.

The purpose of the D&M Plan will be to ensure that construction will proceed without significant adverse environmental effects in and adjacent to the right-of-way. During the preparation of the D&M Plan, Iroquois will field review the proposed right-of-way; and will utilize data and input gathered from agencies and individuals to avoid (where possible) or to minimize impacts to town or city-designated wetlands, steep slopes, and other environmentally sensitive areas given environmental, engineering, and economic constraints.

The D&M Plan will include specific information regarding wetlands and stream crossings; erosion and sedimentation controls; construction techniques and schedule; and other data. The D&M Plan will incorporate FERC specifications, as well as any stipulations reached as a result of the Siting Council process.

The construction specifications for the project in Connecticut will contain the Siting Council-approved D&M Plan with appropriate stipulations. Iroquois environmental inspectors will monitor construction activities to insure conformance with the D&M Plan requirements.

IV. DESCRIPTION OF EXISTING ENVIRONMENT

IV.1 PHYSIOGRAPHY, TOPOGRAPHY, AND GEOLOGY

IV.1.1 Physiography and Topography

Two subprovinces of the New England physiographic province are crossed by the Connecticut portion of the Iroquois route. The Taconic Mountains subprovince is first entered where the route rises into the foothills skirting the east side of the Hudson River Valley. Turning eastward near milepost 270 in Dutchess County, New York, the alignment begins to encounter the more mountainous regions of this subprovince, until entering the Hudson Highlands subprovince approximately at milepost 289. The Hudson Highlands continue to the coastal areas of Long Island Sound. These subprovinces are described in more detail below.

The Taconic Mountains (which is encountered in Connecticut only from the New York-Connecticut border through about milepost 289) subprovince is underlain by extremely folded Pre-Cambrian, Cambrian, and Ordovician-aged bedrock. Starting in a region of schist, quartzite and marble, the pipeline route passes south into zones of Pre-Cambrian schist, amphibolite, gneiss and granite. This metamorphic terrain is characterized by alternating ridges and valleys trending generally north-south. Relief in the Taconic Uplands is often very high, with slopes along the alignment generally ranging from gentle to moderate, with frequent short stretches of steep slopes. Stream courses in this region are generally controlled by the elongated structure of the bedrock units. Bedrock outcrops are frequent, especially on the slopes between the valleys and ridges.

Inactive bedrock faults also are relatively frequent and bedrock type often changes from one side of the fault to the other. In metamorphic terrain such as this, the bedrock types are generally foliated, and the foliation angle (i.e., dip) is highly variable.

Glacial till deposits are relatively thin in this region, with depth to bedrock often less than 10 feet. Kame terrace deposits, as well as alluvial floodplain deposits, have often buried the bedrock surface to greater depths. The till is generally quite granular in nature, due to the crystalline nature of the bedrock from which it was derived (H&A 1987).

Most of the route in Connecticut traverses the Hudson Highlands subprovince. Bedrock along this section of the route is comprised of Cambrian to Devonian age schist, gneiss, and amphibolite and characterized by frequent anticlines and synclines which trend in various directions. Streams follow the narrow valleys created by these structural trends. Relief in this region consists of moderately steep to very steep sloping hills (10 to 30% slopes) and gently sloped lands in river valleys. Steep sloped areas become less frequent where the route enters the urbanized coastal area adjacent to Long Island Sound.

Depths to bedrock range from surface to five feet on hill slopes and greater than five feet on river valleys and wetlands. Depth to bedrock is generally deeper between the Housatonic River and the Sound, and ranges from five feet to greater than 10 feet. Bedrock outcrops are found on moderately steep and steep slopes and ridges along most of the route (E & E 1986; 1988; H&A 1987).

IV.1.2 Geological Conditions

The route traverses a region where the surficial geology is principally dominated by Pleistocene age glaciation and the landforms which resulted from it. The underlying bedrock geology presents a complex series of geological conditions where bedrock types and characteristics often times vary over short distances. Contacts between rock types can be gradational, and metamorphic grades may be included within each rock unit. A summary of topographic and bedrock geologic conditions along the route is provided in Table VI-1 and summarized below.

Surficial Geology

The glacial activity left behind a discontinuous layer of till (a heterogeneous mixture of clay, sand, gravel, and boulders), stratified drift, and morainal and glacial lake ice-contact deposits. Surficial geologic deposits in Connecticut can generally be located in an area by the characteristic soils associated with each deposit. Glacial tills in Connecticut are usually noncalcareous, thinner, and more discontinuous than tills in New York, due to the crystalline bedrock in the region. The till in many areas is tight and semicompacted, and exhibits characteristics similar to semiconsolidated rock.

Outwash and ice-contact deposits in Connecticut generally consist of sand, or sand and gravel with minor amounts of silt and clay. These deposits occur principally in valley bottoms or on low-lying flatlands. Outwash is often interspersed with till and bedrock.

Quaternary age alluvial deposits overlie or cut through the glacial deposits along the stream valley and floodplains. These deposits consist

Table IV-1
TOPOGRAPHY AND GEOLOGY: SUMMARY OF CONDITIONS ALONG THE PROPOSED IROQUOIS ROUTE

Location: County	Location: Approximate Milepost	Topographic Description* (mean sea level)	Bedrock Description	Estimated Depth to Bedrock
Fairfield and Litchfield	CT/NY border - 289.5	Steep hills and gently sloping, wide valleys of the Taconic Mountains; elevations range from 350 to 750 feet	Cambrain to Ordovician schist, phyllite, metagraywacke, gneiss, and marble	0 to 5 feet on hills, greater than 5 feet in valleys
Litchfield	289.5 - 299.0	Gently sloping river valleys with steep sloped sides; elevations between 230 to 600 feet	Cambrian to Ordovician granite gneiss, schist, quartzite, and marble	Varies from at surface to greater than 10 feet
Fairfield	299.0 - 307.0	Moderately steep to steep hills and gently sloping stream valleys of the Western Uplands; elevations 260 to 590 feet	Cambrian to Ordovician schist gneiss, diorite and granite	0 to 5 feet
	307.0 - 325.0	Moderately steep to steep rounded hills and gently sloping	Cambrian to Devonian aschist, gneiss, and amphibolite	0 to 5 feet; greater than 5 feet in river valleys
Fairfield/ New Haven	325.0 - 331.0	Glacially dissected N-S trending ridges and valleys with moderately steep to steep to 350 feet	Ordovician schist, gneiss, and amphibolite; some areas of schist, marble, and quartzite	Less than 5 feet
New Haven	331.0-334	Gentle to moderately steep sloping dissected hills and flat lying coastal regions; elevations from sea level to 150 feet	Ordovician to Devonian schists, gneis	Generally greater than 5 fee

Source: H&A 1987.

of unconsolidated sands, gravels, silts, and clays. Alluvial deposits can be found near the pipeline route along the Housatonic River, as well as other smaller streams.

Through the western portion of Connecticut, the pipeline route traverses an intensely folded band of rocks. Bedrock consists of metamorphic, meta-sedimentary, meta-volcanic, and plutonic rocks between Proterozoic and Devonian age. Along the coastal regions of Connecticut, bedrock consists primarily of meta-sedimentary rocks of Paleozoic age.

In most of Connecticut, bedrock consists primarily of granitic gneisses, schists, and marbles. Within the southern coastal section of the pipeline, the bedrock is dominated primarily by schists and meta-volcanic greenstones.

Mineral Resources

The pipeline will traverse areas of Connecticut where mineral resources are exploited for commercial purposes. Various sand and gravel mining operations are or were active in the vicinity of the northern portion of the route through Fairfield and Litchfield counties. The primary mining operations are located in terrace deposits of the Housatonic and Still rivers. Several large minimg operations are active in the Town of New Milford as part of industrial/commercial land development, and over the years dozens of small borrow pits have been utilized east of the route in the Housatonic River Valley between mileposts 290 and 297.

Various sand and gravel mining operations also occur in the vicinity of the route in the City of Milford. For example, on the east bank of the Housatonic River, the pipeline route passes through an inactive sand and gravel mining area; sand and gravel mining is ongoing directly to the north. In addition, sand and gravel mining occurs in the river to the north of the proposed pipeline crossing (i.e., south of the Route 8 bridge between Shelton-Derby).

IV.1.3 Geologic Considerations

The pipeline will cross or pass close to two seismic zones in Connecticut. These fault zones principally follow the region's northeast-southwest structural trend and are essentially an extension of the Hudson Valley into the Hudson Highlands of Connecticut and the Connecticut Lowlands. However, the pipeline does not cross any known active faults which could disturb the pipeline by fault movement.

Earthquakes are generally measured in terms of intensity and magnitude. Magnitude indicates the amount of energy released at the origin of the earthquake (epicenter). It is most commonly measured by the Richter scale (Richter 1958) or the Nuttli scale (Nuttli 1973). However, the magnitude measurement neglects the geology of the area, which governs the extent of damage that will be caused by an earthquake, and has limited relevance when assessing the potential impact to a pipeline.

Intensity indicates the ground-shaking effect an earthquake has on an area. It is based on actual observations and damages, and is a function of all those features that determine the amount of damage. Intensity is measured on the Modified Mercalli Scale (Wood and Neuman 1931), and is most applicable for potential impact assessments.

Intensity values on the Modified Mercalli Scale range from I (least intensive) to XII (most intensive) and are described in Table IV-2.

TABLE IV.-2

MODIFIED MERCALLI INTENSITY SCALE OF 1931

I. Not felt except by a very few under especially favorable circumstances.

II. Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.

III. Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing auto mobiles may rock slightly. Vibration like passing of truck.

IV. During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing automobiles rocked noticeably.

V. Felt by nearly everyone, many awakened. Some dishes, windows, etc., broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.

VI. Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight.

VII. Everyone runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; con siderable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving automobiles.

VIII. Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse; great in poorly built struc tures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving automobiles disturbed.

IX. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with par tial collapse. Buildings shifted off foundations. Ground cracked con spicuously. Underground pipes broken.

X. Some well-built wooden structures destroyed; most masonry and frame struc tures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks.

XI. Few, if any, structures remain standing. Bridges destroyed. Broad fis- sures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.

XII. Damage total. Practically all works of construction are damaged greatly or destroyed. Waves seen on ground surface. Lines of sight and level are distorted. Objects are thrown upward into the air.

Source: Coates 1981.

Pipelines have been demonstrated to be capable of withstanding earthquakes of intensity VII with little damage (California Department of Natural Resources 1983). An earthquake with an intensity of IX or greater could be sufficient to cause damage to a pipeline (as well as to structures, as noted in Table IV-2). However, the probability of this type of an event in the Iroquois project area is extremely low.

Three earthquakes have occurred in the New England area that have had significant intensities on the Modified Mercalli Scale:

- 1727, November - Epicenter in Newberry, Massachusetts, intensity of IX. Damage restricted to walls, chimneys, and foundations of houses. Some soil was expelled from the ground.

- 1755, November - Epicenter was 200 miles off Cape Ann, Massachusetts. Intensity at the epicenter was estimated at IX, and the intensity at Boston was VIII, where damage was primarily restricted to unstable structures.

- 1771, May - Epicenter in Moodus, Connecticut. Intensity of VIII, with damage primarily restricted to unstable structures (Smith 1962).

The geological composition of the ground has a significant impact on an earthquake's range and intensity. Areas of consolidated bedrock, whether of sedimentary, metamorphic, or igneous origin, are less affected than unconsolidated rock at the same distance from an earthquake of a given magnitude.

The Iroquois route passes through a zone of seismic activity in the Hudson Highlands region of Connecticut and passes near a zone of seismic activity in the Connecticut Lowlands east of the alignment. These zones contain a series of thrust faults and shear zones, which trend northeast to southwest. The pipeline also intersects a major overturned thrust fault near the Housatonic River in Fairfield County. The majority of these fault zones are probably of Paleozoic age.

Although the frequency of seismic events in this region is fairly high, earthquake intensities are relatively low. Moreover, there is no historical evidence of an earthquake with sufficient magnitude to trigger ground-shaking, liquefaction, or landsliding in this area that would affect gas pipeline integrity. Thus, the low magnitude of the earthquakes reduces the significance of potential impact to the pipeline.

The Hudson Highlands region, which is located along the Connecticut-New York border, is an area of low magnitude seismic activity (III to V on the Modified Mercalli Scale). Earthquakes of this intensity will not affect the pipeline integrity. Soils in this region are not prone to landsliding or periods of liquefaction, and would only be affected by these secondary processes associated with earthquakes during intense prolonged ground shaking.

The historic seismic activity in the Connecticut Lowlands has generally been in the intensity range of IV to VII on the Modified Mercalli Scale. Earthquake epicenters have occurred near the Town of Middletown, with the greatest percentage of these occurring in the early 1600s. The most recent earthquakes in the area occurred in 1968 (magnitude V on the Modified Mercalli Scale) and were centered south of Middletown. These earthquakes resulted in only minor ground shaking.

Several normal faults are located north of Middletown in the thrust-faulted area of the Hartford and Pomperaug river basins. These faults are probably the result of tectonic activity which occurred in the region during Mesozoic times and are not the result of ground rupture from historic seismic activity.

Along the pipeline route, sandy glacial outwash soils have the greatest potential for liquefaction to occur in conjunction with earthquakes. Liquefaction involves the process whereby saturated, cohesionless soils temporarily lose their strength and liquefy when subjected to dynamic forces such as intense and prolonged ground shaking. This occurs most readily when the water table is less than 50 feet below the ground surface and the soils are predominantly unconsolidated. The potential for liquefaction increases as the groundwater approaches the surface. In addition, the potential for soil liquefaction depends on the amplitude and frequency of the wave motion of the ground shaking and its duration. In general, the less consolidated the soil, the shorter the duration and the less intensity of ground shaking that is necessary to cause liquefaction. More cohesive and consolidated soils will withstand longer periods of shaking before liquefaction occurs.

In Connecticut, the potential for liquefaction causing landsliding is considered minimal, because the majority of the soils that have liquefaction characteristics are located in stream valleys. The nearly flat to gently rolling topography associated with these areas is not conducive for landslide events.

IV.2 SOIL RESOURCES

There are various soil types crossed by the route in Connecticut, as identified by the U.S. Department of Agriculture Soil Conservation Service (USDA SCS). These various soil types are combined into principal soil associations. Soil associations are defined as groups of soil types that geographically occur in a characteristic repeating pattern and can be mapped as a single unit. The soil associations traversed by the Iroquois route are listed in Table IV-3.

Iroquois has noted the locations of prime and unique farmland, as well as the locations of other farmlands of statewide importance along the proposed pipeline route. Prime farmland, as defined by the USDA SCS, is the land that is best suited to producing food, feed, forage, fiber, and oilseed crops. This land produces the highest yields with minimum inputs of energy and economic resources, and farming it results in the least damage to the environment. Prime farmland now may be under cultivation, in pasturage, forested, or under some other use but not in urban development land or under water. The slopes of prime farmland range from 0 to 6% and are not excessively erodible or flooded during the growing season.

The soils traversed along the pipeline route have been identified in terms of characteristics such as hydric and alluvial soil areas, erosion potential, high water table, shallow depths to bedrock, and shrink-swell potential. Of these, hydric soils and highly erodible soils are of particular relevance to the pipeline project.

Hydric and alluvial soils are the basis on which wetlands are defined in Connecticut, whereas the presence of highly erodible soils will signal the

Table IV-3
Soil Associations Along the Proposed Route
in Connecticut

County	Soil Areas/Associates	Mileposts
Fairfield (Sherman)	Stockbridge-George-Nellis	286.6 - 287.5
	Carlisle-Adrain-Saco	287.5 -288.2
Litchfield (New Milford)	Charlton-Paxton-Hollis	288.2 - 291.2
	Hinckley-Merrimac-Hartland	291.2 - 293.1
	Paxton-Hollis-Charlton	293.1 - 295.2
	Hickley-Merrimac-Hartland	295.2 - 299.1
Fairfield	Agawam-Hinckley	299.1 - 300.6
	Hollis-Charlton-Rock Outcrop	300.6 - 304.1
	Paxton-Woodbridge-Ridgebury	304.1 - 306.5
	Charlton-Hollis	306.5 - 307.7
	Paxton-Woodbridge-Ridgebury	307.7 - 310.6
	Agawam-Hickley-Haven	310.6 - 312.7
	Paxton-Woodbridge-Ridgebury	312.7 - 316.9
	Hollis-Charlton	316.9 - 322.2
	Paxton-Woodbridge-Ridgebury	322.2 - 323.5
	Hollis-Charlton	323.5 - 327.4
	Charlton-Hollis	327.4 - 331.0
New Haven (Milford)	Charlton-Hollis-Leicester	331.0 - 331.9
	Agawam-Hinckley-Walpole	331.9 - 333.0
	Charlton-Hollis-Leicester	333.0 - 334.3

Source: USDA SCS

need for more intensive soil erosion control measures during construction and operation of the pipeline. The Iroquois route traverses approximately 7.8 miles of hydric and alluvial soils.

In Connecticut, highly erodible soils/map units are defined as soils with a maximum potential for erosion that equals or exceeds eight times the tolerable erosion rate; this is represented by the formula RKLS/T > or = 8. Based on a review of the soil map units in Fairfield, Litchfield, and New Haven counties that qualify as highly or potentially highly erodible land, the proposed pipeline route will traverse an estimated 4.1 miles of highly erodible and 4.3 miles of potentially highly erodible land (USDA SCS 1986).

Portions of the route (e.g. in New Milford, Shelton) traverse agricultural lands. In some of these areas (e.g., new Milford), landowners have installed drainage systems to enhance the movement of water from the surface soil layers.

The exact location of the existing drainage systems along the right-of-way will be determined during the centerline survey and land acquisition phase of the project. Iroquois will continue to consult with the local soil and water conservation districts to identify drainage systems planned as part of farm plans, and will flag all existing tile systems prior to the start of construction. Iroquois has committed to repair or replace any damaged individual tiles or drainage systems which cannot be avoided.

IV.3 WATER USE AND QUALITY

IV.3.1 Surface Water Resources

Connecticut has established water use classifications as well as associated water quality standards based on considerations for public health, water supplies, and recreation; propagation and protection of fish, shellfish, and wildlife; and economic and social development. In Connecticut, any unclassified waters are assumed to have an "A" classification, regardless of actual water quality.

In Connecticut, only one major drainage basin (i.e., the Housatonic River Basin) is traversed by the pipeline route. In the Housatonic River Basin, the Iroquois route traverses several subbasins including the Still and Farmill river watersheds. In addition, the route crosses the lower region of the Housatonic River. The lower region of the Housatonic River is considered navigable from its mouth (at Long Island Sound) to its confluence with the Naugatuck River approximately 5.3 miles upstream from the pipeline crossing location (Melberg 1986).

In Connecticut, 47 streams will be crossed (2 intermittent, 45 perennial). Water usage and quality in the Housatonic River Basin range from AA to B (see Table IV-4).

In the lower Housatonic River, from its confluence with the Naugatuck River and downstream, high coliform bacteria, extensive resource extraction, and potential metal toxicity have historically degraded water quality and use. The Naugatuck River discharge, which has similar water quality problems, contributes to the poor water quality. Nonetheless, the southernmost portion of the lower Housatonic River currently has water quality sufficient to support seedbeds for oysters, and is one of the best such areas in the Northeast (Volk 1990).

TABLE IV.-4

Rivers and Streams Traversed by the Proposed Iroquois Route in Connecticut

County/Town	Approximate Milepost	USGS Quad No.	Stream or River	Watershed Index No.	Present Class	Proposed Class	Year of Survey	Major Fish Species	Bottom Type (B)/ Bank Vegetation-Cover (C)	Stream Width (W), Depth (D)/ Comments
Fairfield										
Sherman	287.80	--	Wimisink Brook	N/A	A	—	1988	—	D-MBA; C-3	—
Litchfield										
New Milford	288.90	--	Perennial tributary to Morrissey Brook	N/A	A	—	N.D.A.	—	—	—
	289.15	--	Morrissey Brook	6017	A	—	1988	—	D-SG, BG; C-1	—
	289.85	--	Perennial tributary to Morrissey Brook	N/A	A	—	N.D.A.	—	—	—
	291.70	--	Billymuck Brook	N/A	A	—	1988	—	D-BG; C-3	—
	292.85	--	Rocky River	N/A	A	—	1988	—	D-MBA; C-3	—
	297.00	--	Perennial tributary to Still River	N/A	C/B	—	N.D.A.	—	—	—
	297.50	--	Still River	6000	C/B	—	1988	—	D-MBA; C-2	—
Fairfield										
Brookfield	301.55	--	Intermittent tributary to Still River	N/A	C/B	—	N.D.A.	—	—	—
	304.85	--	Perennial tributary draining unnamed marsh	N/A	A	—	N.D.A.	—	—	—
	305.10	--	Perennial tributary draining unnamed marsh	N/A	A	—	1988	—	D-BG; C-3	—
Newton	306.15	--	Perennial tributary draining unnamed marsh	N/A	A	—	1988	—	—	—
	306.45	--	Pond Brook	6018	A	—	N.D.A.	—	—	—
	309.75	--	Perennial tributary to Cavanaugh Pond	N/A	A	—	N.D.A.	—	—	—
	311.20	--	Pootatuck River	6020	B/C	—	1988	—	D-R, Gr; C-3	—

Key at end of table.

County/Town	Approximate Milepost	USGS Quad No.	Stream or River	Watershed Index No.	Present Class	Proposed Class	Year of Survey	Major Fish Species	Bottom Type (B)/ Bank Vegetation-Cover (C)	Stream Width (W), Depth (D)/ Comments
Newton (Cont.)	312.50	—	Intermittent tributary to Pole Bridge Brook	N/A	A	—	1988	—	B-HDA; C-3	—
	312.55	—	Pole Bridge Brook	N/A	A	—	N.D.A.	—	—	—
	312.70	—	Pole Bridge Brook	N/A/	A	—	N.D.A.	—	—	—
	313.45	—	Perennial tributary to Housatonic River	N/A	A	—	N.D.A.	—	—	—
	314.00	—	Perennial tributary to Housatonic River	N/A	A	—	1988	—	B-HDA; C-3	—
	314.15	—	Perennial tributary to Housatonic River	N/A	A	—	N.D.A.	—	—	—
	314.95	—	Perennial tributary to Housatonic River	N/A	A	—	N.D.A.	—	—	—
Monroe	316.95	—	Halfway River	6022	B/A	—	1988	—	B-Rd; C-3	—
	318.40	—	Boys Halfway River	N/A	A	—	1988	—	B-HDA; C-3	—
	318.85	—	Hurds Brook	N/A	A	—	N.D.A.	—	—	—
	319.35	—	Perennial tributary to Means Brook	N/A	AA	—	N.D.A.	—	—	—
	319.40	—	Perennial tributary to Means Brook	N/A	AA	—	1988	—	B-HDA; C-3	—
Shelton	320.15	—	Perennial tributary to Means Brook	N/A	AA	—	N.D.A.	—	—	—
	320.80	—	Perennial tributary to Means Brook	N/A	AA	—	N.D.A.	—	—	—
	321.25	—	Perennial tributary to Means Brook	N/A	AA	—	N.D.A.	—	—	—
	321.70	—	Perennial tributary to Means Brook	N/A	AA	—	N.D.A.	—	—	—
	323.75	—	Perennial tributary to Shelton Reservoir	N/A	AA	—	N.D.A.	—	—	—
	324.15	--	Perennial tributary to Shelton Reservoir	N/A	AA	—	N.D.A.	—	—	—

County/Town	Approximate Milepost	USGS Quad No.	Stream or River	Watershed Index No.	Present Class	Proposed Class	Year of Survey	Major Fish Species	Bottom Type (B)/ Bank Vegetation- Cover (C)	Stream Width (W), Depth (D)/ Comments
Shelton (Cont.)	324.25	--	Perennial tributary to Shelton Reservoir	N/A	AA	--	N.D.A.	--	--	--
	326.30	--	Perennial tributary to Farmill River	N/A	A	--	N.D.A.	--	--	--
	326.65	--	Perennial tributary to Farmill River	N/A	A	--	N.D.A.	--	--	--
	326.90	--	Perennial tributary to Farmill River	N/A	A	--	N.D.A.	--	--	--
	327.30	--	Farmill River	N/A	Sc/SB	--	1988	--	B-Rd; C-3	--
Stratford	329.25	--	Cemetery Pond Brook	N/A	A	--	1988	--	B-NDA; C-3	--
	329.50	--	Cemetery Pond Brook	N/A	A	--	N.D.A.	--	--	--
	329.60	--	Pumpkin Ground Brook	N/A	--	--	N.D.A.	--	--	--
	329.70	--	Pumpkin Ground Brook	N/A	--	--	N.D.A.	--	--	--
	329.80	--	Pumpkin Ground Brook	N/A	--	--	N.D.A.	--	--	--
	329.85	--	Pumpkin Ground Brook	N/A	--	--	N.D.A.	--	--	--
	330.40	--	Perennial tributary to Pecks Mill Pond	N/A	A	--	N.D.A.	--	--	--
	330.85	--	Housatonic River	6000	Sc/SB	--	1988	--	B-Rd; C-2	--
New Haven										
Milford	332.60	--	Beaver Brook	N/A	A	--	N.D.A.	--	B-NDA; C-2	--

37 Perennial
2 Intermittent
vs.
11 Perennial
5 Intermittent

Key at end of table.

Other Abbreviations

N.D.A.: No data was available from New York State Department of Environmental Conservation (DEC) or the stream had not been surveyed by DEC.

Bottom (B) material: Cl = Clay, M = Mud, Mk = Muck, St = Silt, Sd = Sand, Bk = Block, Gr = Gravel, R = Rubble, Bo = Boulder, Br = Bedrock, Det = Detritus, Rd = Rock Ditch

Habitat (C): Streamside vegetation cover or quality: 1 = poor; 2 = medium; 3 = high.

Of the other streams and rivers crossed by the pipeline in Connecticut, only the Still River (Class C/B) has been reported to have poor water quality. This is because a 10-mile stretch of the river in Danbury does not support its classification due to municipal and industrial discharges (DEP 1988). This area is approximately 10 miles south (i.e., upstream) of the proposed Iroquois crossing in New Milford.

In Connecticut, the pipeline route crosses three protected watersheds that are currently being used as or have the capability of being potable water supplies (see Table IV-5). The pipeline crosses about 4 miles of the eastern Means Brook Reservoir watershed. The stream crossing in the watershed is about 1.0 mile upstream of the reservoir. In this watershed, the route also passes within 0.1 miles of the Boys Halfway Diversion. This diversion directs water away from Lake Zoar toward the Means Brook Reservoir, via Means Brook. Means Brook Reservoir feeds the Trap Falls Reservoir but is not used directly as a water supply. The pipeline also crosses approximately 0.25 miles of the very southern tip of the Shelton Reservoir No. 2 watershed. This reservoir system is currently inactive. Both of these watersheds are part of the Main Stem of the Bridgeport Hydraulic Company. A third reservoir in this same system, Trap Falls, is within 0.5-mile of the pipeline, but the watershed is not protected. The Trap Falls Reservoir serves eastern Bridgeport, parts of Shelton, and the whole Stratford area (Lyen 1988).

In the City of Milford, the Iroquois route crosses the watershed of the Beaver Brook Reservoir. This reservoir was part of the South-Central Connecticut Regional Water Authority. In 1982, the watershed was officially declassified as a water source. The Water Authority is currently in the process of selling this land. The City of Milford acquired much of the

Table IV-5
Municipal Surface Water Sources Within
1.5 Miles of the Pipeline Route

Municipality	Source	Population	Distance Pipeline	On-Stream***
Monroe				
Bridgeport Hydraulic Co. Main Stem	Boys Halfway Diversion**	5,325	0.1	No
Shelton		24,858		
Bridgeport Hydraulic Co. Main Stem	Means Brook Reservoir		1.0	Yes (down)
	Shelton Reservior No. 2 (I)**		0.4	Yes (down)
Trumbull				
Bridgeport Hydraulic Co. Main Stem	Trap Falls Reservoir**	33,849	0.4	No
Milford				
South Central Connecticut Regional Water Authority **	Beaverbrook Reservoir (I)	51,133	0.3	Yes (down)

** Part of a larger water supply system.
*** Indicates whether pipeline crosses a stream either influent (down) or effluent (up) to the source.
(I) Inactive: Not currently in use.

Source: Connecticut Atlas: Community Water Systems in Connecticut 1987.

land for preservation and recreational use; the remainder of the land has been either acquired for private development or remains unpurchased (South Central Connecticut Water Authority 1988). The pipeline route will cross two parcels of land that the Water Authority has not yet sold.

Sediments

The sediments of the rivers and streams that will be crossed by the pipeline route can be expected to vary in terms of both type and quality. The basic quality of the sediments generally reflects the quality of the individual stream or river traversed.

The pipeline route has been aligned to avoid known areas of poor sediment quality. In siting the route, the avoidance of areas where stream sediments had been contaminated with heavy metals and other hazardous substances was of particular concern. The alignment across the Housatonic River, which is known to have reaches with sediments contaminated with PCBs, was evaluated with special care.

To determine the sediment quality at the proposed pipeline crossing of this river, Iroquois commissioned two separate sediment sampling and analysis studies. Samples were analyzed for PCBs, pesticides, and priority pollutant metals. A summary of the analytical results from these studies is described briefly below.

Sediment samples were collected in 1986 from the Housatonic River crossing location. No PCBs or pesticides were detected, and most metals were found at levels consistent with natural conditions (E & E 1986a). However, copper and chromium were detected at levels considered above natural conditions --36.5 to 68.9 mg/kg and 19.4 to 26.6

mg/kg, respectively. (Note that sediments that contain less than 25 mg/kg of either metal are considered to be not polluted). Theoretical EP toxicity tests, however, showed that violations of water quality standards would not occur due to resuspension of sediments during construction.

Additional studies performed in 1987 at the same location (but involving sampling at project depth) did not find copper or chromium at hazardous levels (H & A 1987), but did detect di-n-octyl-phthalate and di-ethyl-phthalate in the sediments. These two phthalate esters are considered priority pollutants by the EPA; however, no numerical standard or criteria have been developed. They were detected at concentrations that exceed levels of acute toxicity to fresh and salt water organisms. However, due to the analytical technique used (EPA Method No. 625), the concentration detected in the laboratory may actually be significantly higher than the concentrations that will be released into the water column during dredging (H & A 1987). This and the short time during which dredging will occur minimize the possibility of adverse environmental effects occurring due to construction activities.

Flood Hazards

The principal flood-prone areas of concern traversed by the proposed pipeline occur in downstream areas of tributaries that have large drainage sheds which experience high flows during the annual spring runoff period. Occasional late summer and fall floods usually result from hurricanes or coastal storms. Reviews of national flood insurance maps published by the Federal Emergency Management Agency (FEMA) indicate that various 100-year floodplains are crossed by the pipeline (refer to the maps in Volume 2). Historical flow data for the Housatonic River (which is under flood management) indicates that during spring runoff, flows increase substantially. Low flow periods typically range from early summer to late fall.

IV. 3. 2 Groundwater Resources

Connecticut relies heavily on groundwater as a water supply; in most of the municipalities along the pipeline route, either community or private wells provide potable water supplies. The state is underlain by two major types of water-bearing materials -- bedrock and unconsolidated deposits. The entire state is underlain by bedrock with discontinuous areas of stratified drift with water-bearing capabilities. These areas of stratified drift are capable of producing large amounts of water. These deposits of coarse and fine grained sand and gravel occur almost exclusively beneath watercourses and lowlands. While all till and stratified drift areas are capable of bearing some amounts of water, only those areas with a water saturated thickness of greater than 10 feet normally will supply a productive yield. In the areas of minimal till and stratified drift, bedrock aquifers are the primary sources of groundwater wells.

Connecticut recently enacted legislation designed to advance groundwater protection in the state (PL 89-305; An Act Concerning Aquifer Protection Areas). This legislation calls for: municipalities to designate Aquifer Protection Areas; a comprehensive system of land use regulations to protect public drinking water within Aquifer Protection Areas; and requires the state to develop regulations and provide technical assistance and education programs on groundwater protection. This program is ongoing.

The proposed pipeline route crosses one federally-designated aquifer, the Pootatuck Aquifer. This aquifer, which was designated a sole source aquifer by the U.S. Environmental Protection Agency in March 1990, has a potential yield of 4.0 million gallons per day (mgd), which is only being partially developed. Numerous potential contaminant sources may prevent full utilization of this aquifer, but most problems originate in the lower half of the aquifer (i.e., in the vicinity of Botsford). The pipeline crosses the upper section which is designated as GA.

The route also passes near, through, or above unconsolidated aquifers associated with other watercourses or lowlands. The high yielding Lower Housatonic Aquifer in the Shelton area potentially can yield 22.6 to 26.2 mgd, while the Means Brook Aquifer in Monroe/Shelton can provide a moderate yield of 1.8 mgd (Connecticut DEP 1978). In New Milford, the New Milford Rural Water Company's five wells draw from a stratified drift aquifer located adjacent to the Housatonic River; the five wells in this field pump at rates varying from 250 gpm to 1000 gpm. The proposed pipeline route is located a minimum of 0.6 miles west of these well fields. The Town of Brookfield recently commissioned a study of the Gallows Hill Aquifer -- a primarily stratified drift aquifer located within the Still River Valley in an area generally defined as from the Brookfield - New Milford boundary south to the intersection of Laurel Hill Road and Route 7 (Leggette, Brashears & Graham, Inc. 1987, 1988). This study has indicated that the thickest part of the aquifer is west of the Still River, and that the aquifer cold potentially produce 1.5 mgd if fully developed. Test drilling and sampling results demonstrate that the best location for the development of a public well would be west of the Still River and Route 7. The proposed pipeline route will cross the eastern border of the aquifer boundary (i.e., on the east side of the Still River, adjacent to the Conrail and CL & P easement).

In addition to the above aquifers, Connecticut is characterized by groundwater areas that are not as productive as those mentioned above, but are able to supply the water needs of individual residences, communities, or businesses. These sources can be either stratified drift or bedrock, although the bedrock type is the most predominant. Bedrock groundwater is transported through open fractures in the rock. These sources can be found at any depth within the bedrock. Because of the occurrence of exposed bedrock in Connecticut, it is possible that excavation for the pipeline might intercept some groundwater veins. On the other hand, the pipeline also traverses the Still River, below which lies an unconsolidated aquifer composed of mainly fine grained stratified drift. However, composition of the aquifer varies. Parts of the aquifer can yield up to 2,000 gpm to individual wells, while other areas might yield as little as 1 to 100 gpm (Connecticut DEP 1978).

Groundwater Quality

As noted above, groundwater in the region typically occurs in a mixture of consolidated to unconsolidated deposits. The quality of groundwater from consolidated rocks is generally good, having low dissolved solids. Higher dissolved solids and localized hardness, iron, and manganese problems occur from unconsolidated deposits.

In general, the groundwater in Connecticut is of good quality except in highly urbanized areas and in areas of spills or contamination associated with waste sites. The majority of the pipeline route crosses land below which groundwater is identified as "GA" indicating presumed suitability for direct human consumption with no treatment. Isolated locations along the Still River in the vicinity of the pipeline have been deemed GB/GA waters (Connecticut DEP 1987). These are still designated drinking water sources but prior treatment might be necessary. Table IV-6 identifies the community and public drinking water wells in the vicinity of the proposed pipeline route.

After the pipeline crosses the Housatonic River, the groundwater quality generally deteriorates, except for the Beaver Brook watershed, which has a GAA designation. This designation is assigned all potential or existing water supply watersheds. It must be recognized that this designation might no longer be indicative of the water quality in the Beaver Brook watershed. The watershed was declassified as a water supply watershed in 1982 because of its vulnerability to spills. The area at the proposed Housatonic River crossing is designated as GB/GB/GC, indicating areas of prior contamination to the groundwater supply. As a result, no water supplies can be developed in this area. The rest of the aquifers underlying Milford are designated GB, which means that these waters are appropriate for industrial processes and cooling waters. They can be used as a water supply with adequate treatment (Connecticut DEP 1987).

There has also been some concern expressed about the quality of groundwater in Silver Sands State Park in Milford, although groundwater in this area is not used for drinking water supplies. This is because part of the park (i.e., the northwestern corner) was previously used as a municipal landfill. The landfill has been closed for some time;

Table IV-6
Municipal Groundwater Sources
Within 1.5 Miles of the Pipeline Route

Municipality	Groundwater Source	Population Served	No. of Wells	Approximiate Distance from Route (miles)
Connecticut				
Litchfield				
New Milford	West Falls Mobile Home Park	162	3	0.2
	Forest Hills Estates	270	2	0.5
	Lords Mobile Home Parke	195	1	1.0
	River View Court Associations	44	1	1.1
	New Milford Heights, Inc.	400	1	0.3
	Sunny Valley Farms	36	2	<0.1, 0.3
	Birch Grove Associations, Inc.	280	4	0.4
	Candlewood Trails Association	320	5	0.4
	Lone Oaks Water Co. Inc.	270	2	0.1
	Mill Brook Water Co.	600	5	0.3
	Hi-Vu Water Co.	200	4	0.2
	Candlewood Lake Condominiums	216	1	0.3
	Indianridge Water Co.	216	2	1.5
	Candle Terrace Estates	240	5	1.4
	New Milford Rural Water Co.	5700	5	0.6, 1.3
Fairfield				
Brookfield	Brookfield Elderly Housing	43	1	0.3
	Rural Water Co., Inc. Brook Acres	220	1	0.1
	Silvermine Manor	100	1	0.3
	Newbury Crossing	132	4	0.2
	Ledgewood Association	96	3	0.1
	Dancon Corporation Brookwood	300	3	0.6
	Dancon Corporation Butternut Ridge	128	4	0.4
	Rollingwood Condominiums	880	1	0.3
	Sandy Lane Village	424	2	0.4
	Brookfield Hills Condominiums	108	2	0.3
	Lake Lillianoah Shores	130	2	1.4
	Rural Water Company, Inc. Brookfield Division	876	10	1.2
	Candlewood Acres Holding Co.	120	2	1.1
	Bethel Consolidated Co., Berkshire Corp.	0*	1	1.2
	Stony Hill Village	486	4	0.3
Newtown	Greenridge Inc., Water Division**	564	1	0.3, 1.4
	Eagle Hill Rehabilitation**	108	2	0.8
	Fairfield Hills Hospital	700	3	1.5
	Olmstead Water Supply Co., Inc.	282	3	0.7
	Lake Zoar	72	1	1.5
Shelton	Bridgeport Hydraulic Co. Main Stem***	24,858	2	1.5
	Ansonia Derby Water Co.***	30,300	21	1.0

* Primarily Commercial use
** Part of a larger well system
*** Part of a larger water system including stream diversions, reservoirs, and additional wells.

Source: CT DEP: Community Water Systems.

a closure plan has been prepared and is currently being implemented, including the capping of the landfill with fly-ash. The pipeline route is not planned to traverse the area of the former landfill; it will be aligned generally to the east of the landfill along an access road leading to the beach from Route 1.

In 1986, Iroquois authorized an investigation of groundwater quality along the route in the park. The study, which was conducted in August 1986, showed the groundwater and soil along the route to be of good quality, generally reflecting natural conditions with some saltwater intrusion. The results of analyses of the groundwater and soils samples collected from Silver Sands State Park were presented in the 1986 ER, Volume 2, Appendix I.

IV.4 VEGETATION AND WILDLIFE

IV.4.1 Vegetation

The principal upland vegetation types along the Iroquois route include forest lands, open (old) fields, agricultural areas, and urban land (see Table IV-7). Iroquois is in the process of conducting biological surveys of the route where access permission from landowners can be obtained. The results of these surveys will be used to prepare the D&M Plan and to supplement the following discussion of vegetation types.

There are four major forest zones in Connecticut: the northern hardwoods-hemlock-white pine; transition hardwoods-hemlock-white pine; central hardwoods-hemlock-white pine; and hardwoods. The proposed route traverses all of these zones, except the northern hardwoods-hemlock-white pine type.

Forestland, primarily deciduous, is the most common vegetation type traversed by the route in Connecticut. The route crosses approximately 29 miles (61%) of forest vegetation along its 47.5-mile length. Forest types common in the transitional hardwoods and central hardwoods zones of western and southern Connecticut include oak/hickory, elm/ash/red maple and maple/beech/birch. The coniferous forest traversed along the pipeline route in Connecticut consists mostly of natural stands of the white pine/red pine/hemlock and oak/pine forest types.

The pipeline route also traverses agricultural land and other open areas in non-forested native vegetation. Many of the open areas are dominated by vegetation that is in an early stage of secondary succession. Often, these successional areas (also referred to herein as "other open lands") will become dominated by forest vegetation which

Table IV.-7

Major Vegetation Types Along the Iroquois Route *

	Land Use										
	Forest		Cropland/Pasture		Open Old Field		Open Water		Developed Land		Total
State/County	Miles	%	Miles	%	Miles	%	Miles	%	Miles	%	Total
Litchfield	6.1	56	2.0	18	1.5	14	--	--	1.3	12	10.9
Fairfield	21.8	65	0.7	2	5.5	16	0.1	<1	5.5	16	33.5
New Haven	1.2	39	--	--	1.2	39	0.1	3	0.6	19	3.1
TOTAL CONNECTICUT	29.0	61	2.7	6	8.2	17	0.2	<1	7.4	15	47.5

* NOTE: Totals not exact due to rounding.

Source: Iroquois Gas Transmission System 1990.

is typical of the various forest zones through which the pipeline traverses. The process of secondary succession on abandoned agricultural lands generally proceeds from annual and perennial grasses and herbaceous plants, such as goldenrod, teasel, and various composites; to shrubs such as dogwood, spirea, honeysuckle, and viburnum; to early successional tree species such as white pine, aspen, maple, and birch; and ultimately to mature forest vegetation typical of the major forest zones.

In addition to these upland vegetation types, the pipeline route traverses areas in which various types of wetlands are present. The alignment of the pipeline so as to avoid or minimize wetlands crossings (to the extent practical) was a primary routing criteria. Wetlands avoidance continues to be of prime importance to Iroquois, and as biological field investigations are completed of wetlands, Iroquois will continue to pursue minor route refinements to reduce or avert wetlands crossings, if possible.

For the purposes of this report, wetlands along the route have been delineated according to the federal uniform procedures (1989), as well as based on the prevalence of hydric and alluvial soils -- the sole basis on which regulated wetlands are defined in Connecticut. These include soils identified by the USDA SCS as poorly and very poorly drained, alluvial, and floodplain soils (see Appendix D). Maps showing the wetlands along the route are included in Volume 2. The following discusses the wetlands along the route, by general vegetation type.

The wetland types that occur along the Iroquois route are identified based on a wetland classification system developed by the USFWS for the National Wetland Inventory (NWI) (Cowardin et al. 1979).

As shown in Appendix D, the route traverses approximately 7.8 miles of Connecticut designated wetland areas. These figures are based on an analysis of published soil surveys and maps, as well as NWI maps, 1989 aerial photography, and general field observations (e.g., from road crossings and from walkovers of selected properties on which landowner permission was obtained).

The wetland types crossed by the route include forested swamps (palustrine forested), shallow or deep (emergent) marsh (palustrine emergent), shrub swamp (palustrine scrub-shrub), wet meadows (palustrine emergent), and bays. In addition, intertidal flats along the Housatonic River are traversed. The most common wetland types encountered are forested and shrub swamps.

IV.4.2 Wildlife Resources

Wildlife inhabiting the region traversed by the pipeline are adapted to the different habitats available. Certain species have distinct habitat preferences or requirements and are found only in certain areas, whereas other species are more or less cosmopolitan in their distribution within the various habitats available. While overlaps of distribution between habitat types commonly occur, most wildlife species do have specific habitat preferences that are generally reflected in their distribution.

Because the pipeline route encompasses most of the major vegetation types found in Connecticut, it is likely that most of the common wildlife species occurring in the state will be present along the route. The following discusses some of the wildlife species that are typical for each of the major vegetation types found along the pipeline route. Wildlife species of special concern, including federal or state-listed endangered or threatened species, as well as critical wildlife areas that may be located in the vicinity of the Iroquois route also are described.

Forestland

Forest vegetation is the most abundant vegetation type along the pipeline route in Connecticut. In general, forest vegetation supports a high diversity of wildlife by providing a variety of food sources and cover. Many wildlife species exhibit a specific preference for either coniferous or deciduous forest types, or for various age classes of forest stands; whereas other species are more ubiquitous and may be present in a wide range of forested habitat types. In addition, wildlife species may exhibit seasonal habitat preferences.

Mammal species which generally can be expected to occur in forested vegetation types along all or portions of the pipeline route include: white-tailed deer, eastern or New England cottontail, raccoon, coyote, gray and red fox, striped skunk, chipmunk, gray and red squirrel, flying squirrel, Virginia opossum, and numerous small mammals such as deer mouse, white-footed mouse, red-backed vole, woodland jumping mouse, and various species of shrews and bats.

Numerous bird species utilize forested habitats along the route, either as year-round residents, breeding residents, or transitory migrants. Birds typical of forested areas, but necessarily common, include raptors such as the great-horned owl, barred owl, screech owl, Cooper's hawk, goshawk, sharp-shinned hawk, red-shouldered hawk, and broad-winged hawk; gallinaceous birds such as ruffed grouse, and wild turkey;

woodpeckers including the red-bellied, downy, hairy, pileated, as well as the yellow-bellied sapsucker and common flicker; and numerous species of songbirds including flycatchers, swallows, chickadees and nuthatches, crows and jays, wrens, kinglets, thrushes, vireos, warblers, and sparrows.

Many species of reptiles and amphibians, collectively referred to as herptiles, also occur in forested areas in Connecticut. Herptiles which may occur in forested areas along some or all of the route include salamanders such as the eastern newt and redback, two-lined, blue-spotted, spotted, tiger, Jefferson, marbled, slimy, and dusky salamanders; toads and frogs including the American toad, Fowler's toad, wood frog, and gray tree frog; the eastern box turtle; and snakes including common garter, eastern ribbon, hognose, racer, copperhead, and timber rattlesnake.

Active and Abandoned Agricultural Lands

Agricultural and open lands support wildlife adapted to early successional vegetation communities. Species inhabiting these communities rely on the agricultural crops as well as herbaceous vegetation, grasses, shrubs, and young trees for food and cover. Open lands which are bordered by forest habitat generally support the greatest variety of wildlife because of the interspersion of different habitat types (the so-called "edge effect").

Mammalian wildlife species typical of these habitats include small mammals such as meadow voles, short-tailed shrews, meadow jumping mice, and deer mice; mammalian predators such as the red fox, coyote, short-tailed weasel, skunk, and raccoon; woodchuck; eastern cottontail rabbit; and white-tailed deer. Birds typically found in agricultural and open areas include raptors such as the American kestrel, red-tailed hawk, and barn owl; ring-necked pheasant; barn swallows, crows, robins, catbirds, several species of warblers (e.g., yellow, common yellowthroat, Nashville, chestnut-sided); finches and sparrows (indigo bunting, field sparrow, chipping sparrow, northern cardinal, rufous-sided towhee, house sparrow, song sparrow); and blackbirds (red-winged blackbird, brown-headed cowbird, common grackle, eastern meadowlark).

Herptiles are also abundant in agricultural/open areas. Typical species include the American toad, eastern spadefoot toad, Fowler's toad, leopard frog, pickerel frog, garter snake, ribbon snake, brown snake, ringneck snake, green snake, and milk snake.

Wetlands and Aquatic Habitats

Freshwater marshes and other aquatic habitats, such as streams, ponds, and lakes, provide excellent habitat for a wide range of wildlife species. Many of the wildlife species typical of upland forested habitats (as discussed above) also utilize forested swamps. Similarly, shrub swamps, shallow marshes, and wet meadows are frequented by wildlife species which are typical of early successional upland vegetation types.

However, many wildlife species are found primarily in or closely associated with wetlands or other aquatic habitats. These include mammals such as mink, beaver, otter, muskrat, and water shrew; and birds such as pied-billed grebe, wading birds (great blue heron, green-backed heron, yellow- and black-crowned night herons, American and least bitterns), rails (yellow, sora, black, Virginia), waterfowl (mallard, black duck, teal, wood duck, Canada goose), raptors (marsh hawk, short-eared owl), snipe, woodcock, black tern, belted kingfish, tree swallow, marsh wren, waterthrush, prothonotary warbler, and swamp sparrow.

Herptiles are particularly adapted to wetlands and aquatic habitats. Typical species include most of the salamanders at some time in their life cycle; frogs such as spring peeper, cricket frog, mink frog, bullfrog, green frog, leopard frog, and pickerel frog; turtles such as snapping turtle, stinkpot, and mud turtle, spotted turtle, bog turtle, wood turtle, painted turtle, and Blanding's turtle; and the northern water snake.

Coastal Areas

Coastal areas in general encompass many valuable wildlife habitats, including:

- Open water areas, such as bays, coves, rivers, and Long Island Sound itself;
- Tidal marshes;
- Mud flats;
- Sandy beaches; and
- Offshore islands.

Open water, marshes, and mud flats produce vast quantities of essential food for birds, including insects, worms, amphipods, crabs, clams, snails, finfish, widgeon grass, wild rice, and eelgrass. Beaches and islands provide very specialized and limited nesting habitats for a number of rarer species.

Birds that occur in the coastal area include summer residents, spring and fall transients, and winter residents. Summer residents are, for the most part, those species that actually breed on the coast. Some characteristic marsh breeders are the seaside sparrow, sharp-tailed sparrow, clapper rail, mallard, and black duck. Herons and egrets such as the great blue heron, black-crowned night heron, and snowy egret feed in the marshes and mud flats and nest on low trees and shrubs on offshore islands. Beaches are used as nesting areas by common, roseate, and least terns, as well as by the threatened piping plover.

Transients generally are sighted along the coastline in the greatest abundance during migration from August to November and from March through May. Several groups of birds are particularly notable as coastal migrants. These include the shorebirds, birds of prey, and waterfowl. Shorebirds, including plovers, turnstones, sandpipers, and yellowlegs, nest in the arctic tundra and winter as far south as South America. During migration they stop in the Connecticut-Long Island area to feed in the tidal marshes and mud flats. Birds of prey, including the endangered peregrine falcon, often congregate along the coast, mainly in autumn.

One of the most important groups of migrants that move along the coastal area are waterfowl, many of which winter along the coast and form a prominent group of wintering coastal birds. Significant concentrations of ducks winter in Long Island Sound and the protected coves. Greater scaup, black ducks, mallards, and Canada geese are the most abundant wintering species, but others, including red-breasted mergansers, common goldeneyes, buffleheads, scoters, American widgeons, canvasbacks, and oldsquaws, also have significant populations. Species occurring less frequently include gadwalls, pintails, green-winged teal, shovelers, ruddy ducks, redheads, ring-necked ducks, snow geese, and brant.

Cetaceans (whales) and pinnipeds (seals) are occasionally observed in Long Island Sound. Such occurrences are relatively rare, however, because the Sound is largely cut off from the Atlantic where these species typically occur. Sightings are usually more frequent in winter than in the summer. Harbor seals are sometimes seen near rocks off Stonington and Groton, and one was seen in the lower Housatonic River. On rarer occasions, odontocete whales (harbor porpoise) may be sighted in the Sound or major tidally influenced rivers. In very rare instances, as in 1975 near Groton, finback whales have beached along the shoreline.

Species of Commercial or Recreational Importance

Several wildlife species likely to be present along the route are commercially or recreationally important. These include those wildlife species that are hunted for sport or trapped for their commercial value. Tables A-3 and A-4 in Appendix 3A of Iroquois' 1988 Resource Report No. 3 identify those species of birds and mammals that are legally hunted in Connecticut, as well as those mammals that are trapped.

IV.4.3 Freshwater Fisheries

The Iroquois route will cross 43 streams and 4 rivers in Connecticut (see Table IV-4). These streams and rivers include both upland (headwater) and lowland types, as well as the tidally influenced Housatonic River. Various physical and chemical parameters, such as temperature, dissolved oxygen concentration, current, and substrate composition, determine the type of fishery and benthic communities associated with each of these streams. In addition, tidal intrusion will influence the type of organisms that will be present at the Housatonic River crossing.

Upland or headwater streams are generally characterized by moderate to steep surrounding topography, resulting in swift currents over boulder, cobble, or gravel substrates. The velocity of the current prevents deposition of silt and other fine particulate matter. Water temperatures are usually low (<70 degrees F), and dissolved oxygen concentrations are high as a result of both the physical contact of the turbulent waters with atmospheric oxygen (such as found in riffle areas), and the higher solubility of oxygen in water with a lower temperature.

Fish inhabiting these types of streams are of the cold-water variety, most notably including members of the Salmonidae (salmon and trout), which are specifically adapted to such environments. Associated benthic macroinvertebrate communities are characterized by the presence of suspension feeders, such as the members of Hydropsychidae and Simulidae, as well as carnivorous members of Ephemeroptera, Plecoptera, and Trichoptera. These organisms are usually found in riffle areas, and are important food sources for trout.

In lowland streams, the surrounding topography is less undulating and results in streams with comparatively slower currents than found in upland or headwater streams. Streams of this type, such as the Still River, usually drain larger watersheds, and include the major rivers and their larger tributaries within the project area. The slower currents in the streams increase the deposition of fine particulate matter, resulting in bottom substrates composed of silt, sand, and organic material.

Compared to upland streams, lowland streams also generally have higher maximum temperatures, lower dissolved oxygen concentrations, and higher turbidities. Because these conditions are generally not suitable for cold-water fisheries, lowland streams usually support only warm-water species. Typical warm-water species of recreational value include smallmouth and largemouth bass, bluegill and sunfish, yellow perch, and chain pickerel. However, where ambient conditions permit, lowland streams may also support resident cold-water fish populations.

Macroinvertebrate organisms found in lowland streams are characteristically tolerant of high temperatures and siltation (turbidity), and are adapted to living on or in soft substrates. Benthic communities dominated by Chironomidae and Oligochaetae are generally indicative of warm-water or disturbed aquatic habitats.

The fishery resources in the streams and rivers crossed by the pipeline route may generally be classified as either cold-water or warm-water. In general, cold-water fisheries are considered to be more sensitive than warm-water fisheries because the fish species which comprise cold-water fisheries are less tolerant of habitat disturbance and poor water quality. In addition, cold-water fisheries are considered by many to provide greater recreational and aesthetic value.

Although most of the streams and rivers crossed by the pipeline route provide some recreational fishery resources, several streams have been identified as being particularly important from a recreational standpoint (see Table IV-8). Some of these streams are important because they support self-sustaining (i.e., native) trout populations, while others are stocked with hatchery - raised trout.

Table IV-8
Important Fisheries Resources
In Rivers and Streams Crossed by the Pipeline

County/Town	Stream or River	Principal Fisheries
Fairfield		
Sherman	Wimisink Brook	Native trout
Litchfield		
New Milford	Morrissey Brook	High-quality fishery, stocked trout
	Bullymuck Brook	Native trout
	Rocky River	Unknown
Fairfield		
Newtown	Pond Brook	Stocked trout
	Pootatuck River	Stocked trout
Shelton	Farmill River	Stocked brook, brown, rainbow trout, searunbrown trout
Stratford	Housatonic River	Striped bass, blue fish, winter flounder, searun brown trout

Source: DEP (Orciari 1986); FERC DEIS Appendix E 1989

Anadromous Fisheries

In addition to cold-water and warm-water fisheries, both the Housatonic and Farmill rivers support small populations of anadromous fish. Anadromous species of importance which may occur there include the striped bass; American shad; and blue-back herring. The shortnose sturgeon may be present in the lower Housatonic, but this has not been confirmed.

IV.4.4 Description of Unique Ecosystems or Communities

Vegetation

In the general vicinity of the route through Connecticut, various unique or unusual geologic, hydrologic, and edaphic (i.e., soil) conditions exist which support unique plant communities or critical habitats. The Iroquois route in Connecticut traverses within 1.5 miles of various identified unique plant communities, many of which are designated as Natural Areas – that is, areas that are significant for one or more of the following reasons: geologic, hydrologic, biologic, archaeologic, cultural, aesthetic, or research/educational aspects (see Table IV-9). Four of these Natural Areas are traversed by the pipeline route: Candlewood Mt. Trail and Kelley Slide Natural Area; Still River Meanders Natural Area; Paugussett State Forest Natural Area; and the Boys Halfway River Cave Natural Area. With the exception of these four natural areas, none of the communities which contain assemblages of plant species of concern are traversed by the Iroquois route.

The route is within the ranges of several plant species that are considered species of concern by either the federal or state governments. Each agency has its own system of determining the status

Table IV-9
Natural Areas Within 1.5 Miles of the Pipeline Route

Location			
Approximate Milepost	Approximate Distance From Pipeline (Miles)	Municipality	Description
288.70	0.9	New Milford	Tory Cave Natural Area-naturally formed cave with four chambers; third largest cave in Connecticut
288.90	1.3	New Milford	Housatonic River Road Natural Area - dirt road along eastern shore of river - aesthetic value
291.80	0.0	New Milford	Candlewood Mt. Trail and Kelley Slide Natural Area - scenic trail across large ledges, outcrops, small caves
292.20	0.4	New Milford	Lime Kiln Quarries Natural Area - old lime quarry
294.40	0.3	New Milford	Fort Hill Natural Area -old Indian lookout point
296.10	1.1	New Milford/Bridgewater	Lovers Leap Natural Area - steep cliffs and hemlock forest along Housatonic River - National Register of Historic Landmarks.
297.15	0.0	New Milford	Still River Meanders Natural Area - large, diverse floodplain area
298.10	1.0	New Milford/Brookfield	Old Bridge Pond Nature Park Natural Area - 8-acre area of granite bluffs, ledges among mixed hardwood forest
294.9 - 299.9	0.7	New Milford/ New Fairfield	Vaughn's Neck Natural Area - 3-mile peninsula in Candlewood Lake.
301.70	0.1	Brookfield	Old Lead Mine - Natural Area Inventory

Location			
Approximate	Approximate Distance From	Municipality	Description
308.80	0.4	Newtown	Milleken Tract Natural Area - 790 acres of undisturbed woodland including hemlock gorges and mixed hardwoods; part of the Paugussett State Forest
310.80	0.6	Newtown	Rocky Glen State Park natural area described as a deep shaded ravine on Pootatuck River dominated by old growth hemlock; primarily important for its aesthetic value.
314.6-316.4	0.0	Newtown	Paugussett State Forest Natural Area - Forest associated with Five-linked skink (Eumeces fasciatus), and False mermaid (Floerkea prosperpinacoides). Unmanaged woodland.
316.60	0.6	Newtown	Greater Quarter Road Striations Natural Area; Unusual geologic features.
318.3	0.0	Monroe	Boys Halfway River Cave Natural Area; limestone caves.

Source: Connecticut DEP, 1986, 1988, 1990.

of these species of concern, the details of which are provided in Table IV-10.

Only one federally endangered plant species is known to potentially occur in the general vicinity of the pipeline route -- the small-whorled pogonia (Isotria medeoloides). The small-whorled pogonia, one of the rarest orchids, is endangered because of habitat losses and specimen collecting (USFWS 1980a). It occurs in small colonies in dry woodlands from New Hampshire and Vermont, south to North Carolina, and west to Illinois and Michigan. No extant or historic populations of the small-whorled pogonia are known to occur within 1.5 miles of the Iroquois route. However, historic records of the small-whorled pogonia are known from Litchfield, Fairfield, and New Haven counties (Mitchell and Sheviak 1981).

In addition to the small-whorled pogonia, the northern monkshood (Aconitum noveboracense) is listed by the federal government as threatened. The northern monkshood prefers rich woods, shaded ravines, and damp slopes, generally associated with extremely steep talus slopes or cliffs of either sandstone or limestone. No records of the northern monkshood are known for the area within 1.5 miles of the route (Hanlon 1986; Sperry 1988; Von Oettingen 1988).

In addition to the threatened or endangered status, the federal government has identified plant species as "candidates" for listing. Two plant species designated as "C2" candidate species are known to have occurred within 1.5 miles of the pipeline route (see Table IV-10); these include the quillwort (Isoetes sp.) and Parker's pipewort (Eriocaulon parkerii). The "C2" species are those which are likely suitable

Table IV-10

Descriptions of Designation Status For Species of Concern Identified By The Federal Government and Connecticut

Status Designation	Description of Status
Federal	
E	"Endangered Species," determined by the U.S. Department of the Interior to be in danger of extinction throughout all or a significant portion of its range.
T	"Threatened Species," determined by the U.S. Department of the Interior as likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.
C1	Candidate, Category 1 - Taxa with sufficient information to list as endangered or threatened.
C1*	Candidate, Category 1 - Taxa with sufficient information to list but no known extant sites (believed extinct).
C2	Candidate, Category 2 - Taxa which may be appropriate for listing but for which more data a re needed.
3B	Taxa no longer considered taxonomically distinct by the U.S. Fish and Wildlife Service, and thus not appropriate for listing.
3C	Taxa shown to be more abundant, widespread, or better protected than previously thought and, therefore, not in need of official listing.
Connecticut Natural Diversity Data Base	
Present Designation	
1	Rare Species; 1 to 5 occurrences in state. Rare species are those which are currently present, but usually as isolated populations at less than 5 stations.
2	Infrequent or Declining Species; 6 to 12 occurrences in state. Infrequent species are defined in category #1, but stations may number up to 12. Declining species are those undergoing a longer-term decline in numbers; there may be more than 12 stations.
3	Range or Habitat Limited Species; species that are very local in Connecticut distribution, but with greater than 12 occurrences. Some may be common within restricted areas. All are rare because their habitat is uncommon in Connecticut or by being at the edge of their range.
4	Species Reported Between 1945 and 1975; species with no presently documented Connecticut populations.
5	Species of Indeterminate Status; species that have been included on the list but for which insufficient data are available to place them in another category.
6	Species Possibly Extinct in State; not reported since 1945.
7	Unsubstantiated Record.
Proposed Designation	
	E = Endangered T = Threatened Sc = Special Concern

Source: Connecticut DEP Natural Resources Center 1986, 1988, 1990.

candidates for listing as either threatened or endangered, but for which additional data are needed to support the designation.

The Natural Diversity Data Base, which is maintained by the DEP, lists plant species of state concern. A species is listed and categorized if it meets the criterion of having 12 or fewer extant populations which have been reported since 1975. The Natural Diversity Data Base was consulted in 1986, 1988, and 1990 to determine the presence of designated species of concern within 1.5 miles of the Iroquois route in Connecticut. As shown in Table IV-11 there are various reported locations of plant species of special concern within 1.5 miles of the pipeline route.

Threatened and Endangered Fish and Wildlife Species

The federal government (i.e., USFWS and NMFS), as well as Connecticut, have identified fish and wildlife species which are threatened, endangered, or otherwise of special concern within Connecticut.

The federal government has listed the eastern cougar, Indiana bat, bald eagle, peregrine falcon, and shortnose sturgeon as endangered in Connecticut. In addition, the piping plover is listed as threatened along the east coast of the United States, including Long Island Sound.

Of these endangered and threatened species, only the bald eagle, peregrine falcon, shortnose sturgeon, and piping plover could occur in the portions of Connecticut through which the pipeline route traverses (Gill 1986; Joseph 1986; Hanlon 1986; Von Oettingen 1988; Sperry 1988; Patch 1988). Although marine mammals, including endangered whales, may occur occasionally in Long Island Sound, the area in the

Table IV-11
Plant Species of Special Concern Within
1.5 Miles of The Pipeline Route in Connecticut

Location						
General Milepost	Distance from Pipeline (miles)**	Town	Scientific Name	Common Name (last observed)	Status*	
					Federal	State
287.6	0.1	Sherman	Castilleja coccinea	Scarlet Indian-Paintbrush (1989)	--	E
288.0	1.2	Sherman	Juglans nigra	Black walnut (1989)	--	--
			Cardamine douglassii	Purple cress (1903)	--	T
296.5	0.5	New Milford	Agrimonia parviflora	Small-flowered agrimony (1935)	--	E (6)
296.5	0.5	New Milford	Bouteloua curtipendula	Side-oats grama grass (1936)	--	E (1)
299.5	0.1	Brookfield	Hypericum pyramidatum (1989)		--	E
			Equisetum variegatum (1989)		--	SC
			Agrimonia parviflora	Small-flowered agrimony (1989)	--	E
299.6	0.4	Brookfield	Juglans nigra	Black walnut (1989)	--	--
299.9	0.1	Brookfield	Draba repetans	Carolina whitlow-grass (1989)	--	SC
300.5	0.5	Brookfield	Thuja occidentalis	White cedar (1989)	--	T
306.5	0.4	Newtown	Cardamine douglassii	Purple cress (1913)	--	T
312.0	1.5	Newtown	Equisetum pratense	Meadow horsetail (1916)	--	SC
315.5	1.0	Oxford	Floerkea prosperpinacoides	False Mermaid (1904)	--	E (1)
317.5	0.8	Oxford	Bouteloua curtipendula	Side-oats grama grass (1907)	--	E (1)
317.5	0.8	Oxford	Saururus cernuus	Lizard's tail (1907)	--	E (1)
317.5	0.8	Oxford	Cacalia sauveolens	Indian plantain (ca.1900)	--	SC (6)
327.0	0.7	Shelton	Phaseolus polystachyus (ca.1900)		--	SC
327.0	1.3	Shelton	Carex agnatilus var. altier (1981)		--	SC
			Heteranthera reniformis	Kidney-Leaf Mud Plantain (ca. 1900)	--	SC
327.1	1.0	Milford	Sagittaria montevidensis	Arrowleaf (1989)	--	SC (2)
327.1	1.0	Milford	Isoetes sp. (eatonii)	Quillwort (1989)	C2	E
327.1	1.0	Milford	Sagittaria subulata	Arrowhead (1989)	--	SC (3)
327.1	1.0	Milford	Zannichellia palustrus	Horned pondweed (1989)	--	SC (2)
327.1	1.0	Milford	Orontium aquaticum	Golden Club (1981)	--	SC (3)

Location						
General Milepost	Distance from Pipeline (miles)**	Town	Scientific Name	Common Name (last observed)	Status*	
					Federal	State
327.8	0.5	Stratford	Orontium aquaticum	Golden Club (1981)	--	SC (3)
		Stratford	Podostemum ceratophyllum	(1905)		SC
		Stratford	Sagittaria montevidensis ssp. spongiosus	(1985)		SC
		Stratford	Eriocaulon parkerii	(1916)	C2	E
		Stratford	Heteranthera reniformis	(1907)		SC
331.0	0.9	Stratford	Hudsonia tomentosa	False beach heather	--	T (1)
		Stratford	Cacalia suaveolens (1896)		--	SC (6)
		Stratford	Sagittaria montevidensis (1981) ssp. spongiosus		--	SC (2)
330.7	0.2	Stratford	Saururus cernuus	Lizard's tail (1988)	--	E (1)
331.3	1.3	Stratford	Triosteum angustifiolium	Narrow-leaved horse gentian	--	--
332.0	0.5	Milford	Pityopsis faleata	Sickle-leaved golden aster (1906)	--	E (1)
333.4	1.2	Milford	Panicum amarum	Panic grass	--	-- (2)
333.4	1.2	Milford	Opuntia humifusa	Pricly pear cactus	--	-- (2)
334.2	0.1	Milford	Aristida tuberculosa	Beach needle grass (1920)	--	T (1)

* Status: See Table IV-10 for designation.
** Mileposts and distances are generalized.
Source: Connecticut DEP Natural Diversity Data Base (1986, 1988, 1990).

vicinity of the proposed pipeline route does not constitute normal habitat for these species.

The peregrine falcon occurs primarily as a migrant throughout the region traversed by the pipeline. The peregrine frequents coastal areas and major rivers, and is known to occur in the coastal areas of Long Island Sound. The principal cause for the peregrine's endangered status is the accumulation of chlorinated pesticide residues in the environment, which causes reproductive impairment and eggshell thinning (USFWS 1980). Cooperative rearing and release (i.e., hacking) programs are currently being conducted by the USFWS in several northeastern states in an attempt to establish viable falcon populations in the eastern United States. These programs involve the release of adult birds, as well as the placement of young birds in nest areas where food is provided until the birds fledge. None of these rearing and release sites is located along the preferred route of the pipeline, and the only potential for peregrine falcons to be found in the vicinity of the proposed pipeline would be during migration. Although migrating falcons could occur anywhere along the Iroquois route, the most likely areas would be along the shoreline of Long Island Sound.

The bald eagle is primarily riparian in distribution, and nests, forages, and overwinters in proximity to coastal areas, lakes, and rivers. Causes for the decline of the bald eagle to its endangered status include lowered reproductive success as the result of pesticide residue contamination, illegal shooting, significant reduction of undisturbed nesting habitat, and significant habitat alteration (USFWS 1979). The bald eagle nests and migrates in the region traversed by the entire proposed pipeline route. No active bald eagle nests are known to occur in the vicinity of the proposed route (Gill 1986; Joseph 1986; Von Oettingen 1988; Sperry 1988; Patch 1988).

Winter concentrations of eagles are usually found in association with major rivers. In the vicinity of the pipeline route in Connecticut, eagles are known to winter along the Housatonic River. Eagles are usually found in fast water areas which remain free of ice.

The portion of the Housatonic River below Stevenson Dam which is 0.8 miles from the Iroquois route in the Town of Monroe, is an important bald eagle wintering area (Bogue and Jackson 1986), most likely because the fast water below the dam keeps the water from freezing and provides open water for feeding.

The shortnose sturgeon inhabits inshore coastal areas and estuaries of the Atlantic Ocean. During the spawning period, this fish is attracted to major freshwater inflows of large rivers, which it ascends during its anadromous migration. Impoundment and pollution of its spawning habitat are the principal causes for the decline of this species. Population of shortnose sturgeon are thought to occur in the tidally influenced portions of the Housatonic River, but there have been no recent confirmed sightings (Ludwig 1986; 1988; 1990; Gunn 1990).

Piping plovers are found along sandy beaches in coastal areas or inland lakes, or on alluvial islands of mud, sand, or gravel in rivers. They nest and feed along open shorelines with little vegetation. The primary threats to the piping plover are modification and destruction of habitat and disturbance to nesting adults and newly hatched chicks.

In the vicinity of the Iroquois route in Connecticut, breeding populations of piping plovers are found on Milford Point, a National Wildlife Refuge located 2 to 3 miles west of the pipeline landfall at Milford in Silver Sands State Park. At present, between two and four pairs of plovers are known to nest on Milford Point.

State-listed Species of Concern and Critical Wildlife Habitats

In addition to the federally designated threatened or endangered species, Connecticut has identified species of special concern which are in need of some protection.

Eleven such sightings of wildlife species of special concern have been reported to occur within 1.5 miles of the pipeline route (see Table IV-12). These species include the common loon, golden-winged warbler, cliff swallow, Cooper's Hawk, purple martin, timber rattlesnake, Swainson's thrush, five-lined skink, least tern, and grasshopper sparrow (Murray 1986; 1988; 1990). None of the reported locations of these species of concern is in the immediate vicinity of the pipeline right-of-way. The nearest reported sites are records for the cliff swallow and purple martin located 0.2 miles from the pipeline route in New Milford.

In addition to the known locations of either federally or state-listed wildlife species of concern, the DEP has identified other wildlife habitats of special interest or value. These include significant wetlands and critical habitats for wildlife species of special interest (see Table IV-13).

Table IV-12
Wildlife Species of Special Concern Within
1.5 Miles of The Pipeline Route in Connecticut

Approximate Milepost	Location: Approximate Distance from Pipeline (miles)	County	Town	Scientific Name	Common Name (last observed)	Status*: State	Status*: Federal
287.2	0.7	Fairfield	Sherman	Accipiter cooperi	Cooper's Hawk (1989)	T	--
293.4	0.3	Litchfield	New Milford	Vermivora chrysoptera	Golden-winged Warbler (1985)	SC	--
293.8	1.1	Litchfield	New Milford	Gavia immer (Unconfirmed)	Coomon loon (1985)	E	--
295.3	0.9	Litchfield	New Milford	Catharus ustulatus	Swainson's thrush (1985)	--	--
296.1	0.2	Litchfield	New Milford	Progne subis Hirundo pyrhonata	Purple martin (1983) Cliff swallow (1975)	SC --	-- --
296.3	0.8	Litchfield	New Milford	Crotalus horridus	Timber rattlesnake (1975)	E	--
300.5	0.5	Fairfield	Brookfield	Clemmys muhlenberg	Bog Turtle (1978)	E	C2
309.0	1.0	Fairfield	Newtown	Haliaeetus leucocephalus	Bald Eagle (1989)	E	E
315.0	1.0	New Haven	Oxford	Eumeces fasciatus	Five-linked skink (1987)	T	--
332.1	0.6	New Haven	Milford	Ammodramus savannarum	Grasshopper Sparrow (1984)	E	--

* Status: Connecticut: State = Proposed Status(E = Endangered; T = Threatened; SC = Special Concern)
Note: Locations are generalized.

Source: DEP Natural Resources Center 1986, 1988, 1990.

Table IV-13
Designated Significant Wildlife Habitat
Within 1.5 Miles of the Pipeline Route in Connecticut

	Location			
Approximate Milepost	Approximate Distance From Pipeline	County	Town	Description
299.8	0.4	Fairfield	Brookfield	Significant Wetland
306.4	0.0	Fairfield	Newtown	Significant Wetland
308.8	0.4	Fairfield	Newtown	Milleken Tract Natural Area/Wintering Bald Eagles.
324.4	0.0	Fairfield	Shelton	Significant Wetland
328.2	1.0	New Haven	Milford	Great Flat-Wetland of Special Concern; Orontium aquaticum, Sagittaria montevidensis, Isoetes sp., Sagittaria subulata, Zanchiella palustris reported as present or historical
328.4	1.2	Fairfield/ New Haven	Shelton/ Stratford/ Milford	Farmill river - Wetland of Special Concern; Orontium aquaticum ,Podostemum caratophyllum, Sagittaria montevidensis, Eriocaulon parkerii, Heteranthera veniformis present or historical records.

Source: Connecticut Natural Diversity Database 1986-1990

IV.5 MARINE RESOURCES

This section describes the environmental features of Long Island Sound in the vicinity of the marine pipeline route. These include physical characteristics (e.g., salinity, currents, tides); bathymetry, geology and sediments; and water uses and quality.

IV.5.1 Physical Characteristics

Long Island Sound is a large estuarine mixing basin encompassing approximately 928 nautical square miles (1,229 square miles). It is approximately 113 miles long with a maximum width of 21 miles near the Quinnipiac River in Connecticut.

The eastern end of the Sound is delimited from the more open coastal waters of Block Island Sound by Fisher's Island, Great Gull Island, and Plum Island. This eastern-most portion of the Sound is commonly referred to as "The Race". The western portion of the Sound is bounded by a tidal strait--the East River.

The mean depth of Long Island Sound is approximately 65 feet, with maximum depths of 328 feet in the east end and 115 feet in the central and western basins. Its total volume is estimated to be 16.8 x 10^{12} gallons, or 15.4 cubic miles (USGS and NOAA 1973).

Long Island Sound is a polyhaline estuary receiving its principal freshwater input from the Connecticut, Housatonic, Thames, and East rivers. The Connecticut River alone supplies 70 to 80% of the freshwater input into the Sound. As a result of the influx of freshwater, a two-layer stratification of the water column occurs. An upper freshwater layer flows seaward while a lower, saltwater layer migrates up-estuary. This classic estuarine flow is a function of the net interaction of freshwater influx, friction, and tidal mixing. Because tidal motion is moderate in the Sound, mixing occurs at most depths and vertical exchange occurs downward as well as upward. Thus, a moderately stratified estuarine basin is produced. The two-way vertical mixing causes the salinity of both upper and lower layers to increase seaward, with the salinity of the deeper layer always exceeding that of the surface. This vertical exchange tends to bring a greater volume of water to the surface layer, increasing both seaward surface flow and up-estuary flow in the deeper layer.

The eastern third experience minimum tidal range (2.5 feet) and maximum strength, while the western region is subjected to maximum tidal range (7.3 feet) and minimum strength. Average current speed at flood and ebb tide is 1.4 knots measured at a location approximately 1.3 miles offshore from Eatons Neck, Long Island. The variation in tidal range and current strength generates a 12.4-hour period of oscillation, which produces a large, resonant, co-oscillating tide that is heavily damped by tidal friction from the main lunar component. This produces a mixed semidiurnal configuration within the Sound.

Current patterns in the Sound and adjacent estuarine realms are due to the effects of tidal streaming, estuarine circulation, meteorological stress, basin shape, and bottom topography. The surface and near-surface circulation is fairly well defined, and corresponds well with observed wind patterns (Bokuniewicz 1976). A predominant, easterly surface drift merges with a cyclonic current following the shoreline in the western end. This produces a weak anticyclonic eddy in the broad central region. Another anticyclonic eddy, of strong current strength and small size, is found between the mouth of the Connecticut River and Long Island Shoal. These eddies appear to supply water to an eastern drift that parallels the Long Island Shore and moves out through the eastern passes. At the eastern end, surface water flows out of the Sound into Block Island Sound, and oceanic bottom water flows into the Sound through a channel known as "The Race". In addition, a U.S. Army Corps of Engineers study (1977) found the mean currents to be the dominant energy source for sediment transport.

Wave data obtained at Western Long Island Disposal Site No. 3 (Eatons Neck) indicate that little disturbance of the bottom at the disposal site by wind-generated waves is probable (U.S. Army of Corps of Engineers 1977). Sufficient wave heights develop only during easterly winds of prolonged duration, since there is little effective fetch from any other quadrant. Normally, winter storm winds do not maintain a consistent direction long enough to develop wave height-to-length ratios large enough to disturb the bottom in water depths greater than 55 feet. The principal effect of wind on the bottom in the deeper waters is apparently to increase tidal stream turbulence.

Temperature gradients vary seasonally, with the western part exhibiting lower values during winter and higher temperatures in summer. Surface water temperatures range from 34 to 66 degrees F in the eastern end and 32 to 73 degrees F in the western end. A slight vertical temperature profile occurs during the summer with surface temperatures ranging from 68 degrees F in the western end and 64 degrees F in the eastern section, and bottom temperatures of 63 degrees F and 61 degrees F, respectively. Maximum differences between surface and bottom temperatures are approximately 9 degrees F in the central Sound (Riley 1959).

The chemical regime of the Sound and its estuaries is strongly influenced by the two-layer movement system created by the estuarine circulation. Well-oxygenated, cold, dense, saline waters occur below the surface throughout a large area of the eastern Sound. Warmer, less-oxygenated freshwater of lower density remains at the surface and is flushed out to sea. As a result, lighter suspended inorganic and organic materials, including pollutants from inland sources, reside in the surface layer and are carried seaward. Alternatively, nutrient-rich bottom waters circulate to the surface to maintain equilibrium.

Horizontal and vertical variation of the Sound's chemical parameters are directly influenced by its bathymetry and interaction with waters from Block Island Sound and freshwater input from coastal rivers. Freshwater drainage and the two-layer transport system tend to develop and maintain a vertical salinity gradient throughout the Sound (Riley 1959). During the fall and winter, mixing destroys these vertical gradients and promotes an isohaline column (Kester and Courant 1973). An east-west salinity gradient also occurs in the Sound, ranging from 31 parts per thousand (ppt) at the Race to 25 ppt at the extreme western end.

Oxygen concentrations in the surface waters of Long Island Sound reach supersaturation during the spring phytoplankton bloom, as production of oxygen by these organisms (mostly diatoms) exceeds utilization. Oxygen content of the bottom water declines during the spring bloom and early summer, corresponding with phytoplankton fallout from the surface layer. Subsequent bacterial decomposition of the organisms results in a net utilization of oxygen in the bottom layer, causing minimum oxygen saturation values of 50%. During the fall and winter, the Sound's waters are undersaturated with respect to oxygen. This is due to (1) an increase in vertical mixing and advection in the water column as a result of the breakdown of stratification, and (2) a corresponding oxidation of nutrients by benthic and pelagic microorganisms with no photosynthetic recharge of oxygen in the surface layer.

IV.5.2 Bathymetry

The overall bathymetry of Long Island Sound is varied. However, in general the bathymetry is rougher in the western part of the Sound than in the eastern part.

The pipeline route will traverse areas of relatively regular bathymetry between Milford and Northport. Specifically, the pipeline will enter Long Island Sound at Silver Sands State Park, and will traverse due south. The alignment is approximately 2,000 feet east of a tombolo and Charles Island. The tombolo (a large spit of sand that extends seaward toward Charles Island) is a locally unique depositional feature. The tombolo consists of sand, gravel, and cobbles. Although awash at high tide, it is almost entirely exposed at low tide. This nearshore area consists of a broad gently sloping platform, which slopes to a 25-foot water depth at a distance of approximately 1.3 miles from shore. At approximately the 25-foot isobath, the proposed alignment turns west, passing north of Stratford Shoals, and then proceeds on a southwest heading to Northport.

Stratford Shoals is an area of rough bathymetry (particularly within a 2-mile segment just north of the shoals), thought to be dominated by megaripples, i.e., a small field of bedforms in which seafloor erosion and relatively steep slopes could occur (J.P. Kenny 1986a). This is the only area of irregular bathymetry along the Iroquois route. A further discussion of this irregular bathymetry is presented below under geological constraints. Water depths in Long Island Sound along the offshore portion of the Iroquois route range typically from 60 to 100 feet. The maximum water depth along the route is 115 feet, which occurs in the central basin of the Sound.

IV.5.3 Marine Geology

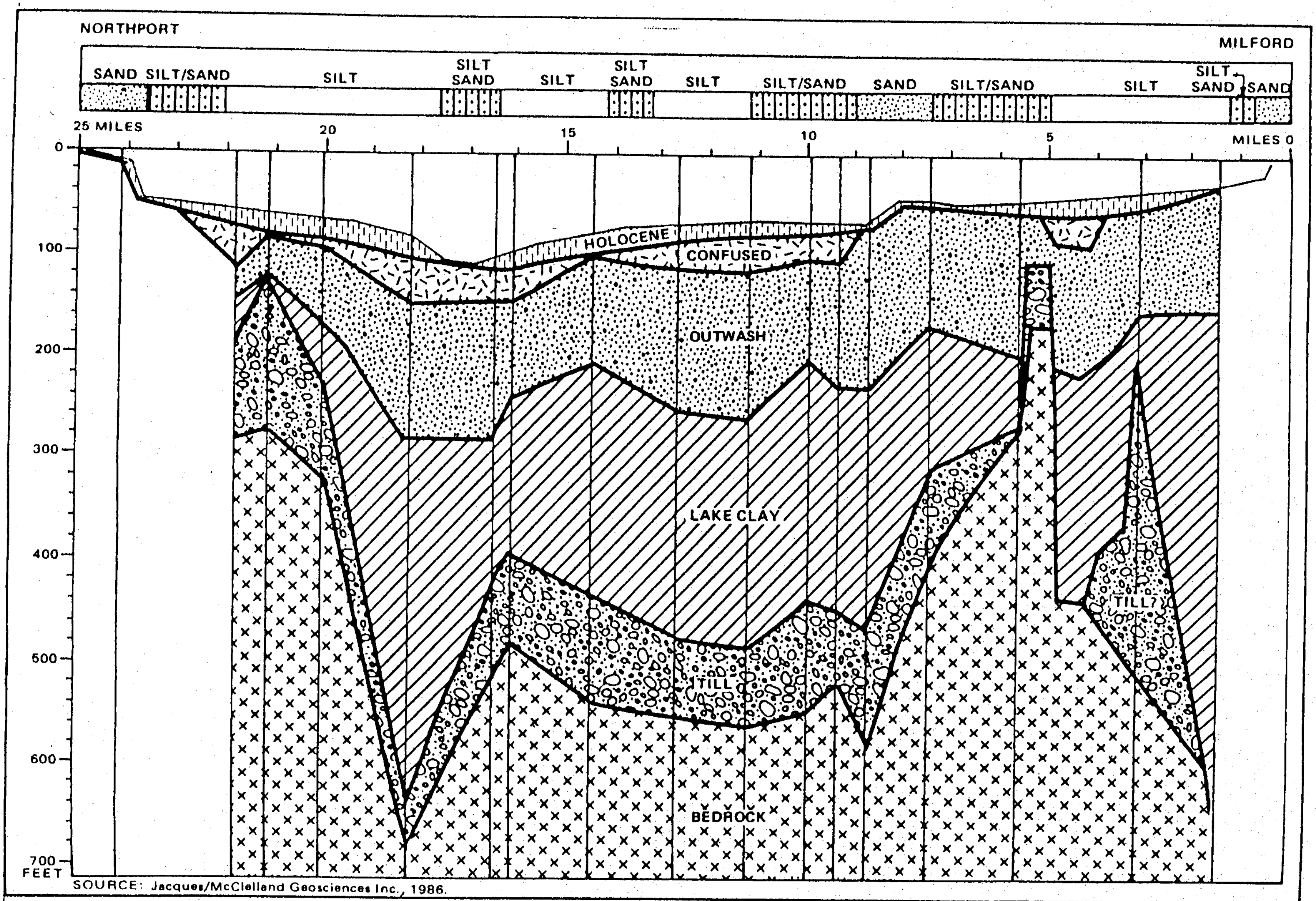
Long Island Sound was formed as a result of a series of geologic events, dating to the paleozoic age when the proto-Atlantic Ocean was formed and occupied parts of what is now the Atlantic Coastal plain. Of principal significance in the formation of the present-day Long island Sound are the repeated ice events during the Pleistocene age. Specifically, as the ice withdrew north from the Long Island area to the mainland, terminal moraines and large volumes of glacial outwash were deposited adjacent to the present north shore of Long Island and blocked the eastern and western ends of the present Sound. This created a freshwater lake (Lake Flushing) at the location of the present-day Long Island Sound.

In this environment, lacustrine clays were deposited. Further, as the continental ice sheet continued to retreat, large amounts of outwash were deposited over the clay by the glacial rivers that emptied into Lake Flushing. At the same time, similar deposits from outwash and terminal moraines were laid down along the southern shore of the lake (i.e., the present northern shore of Long Island). About 11,000 years ago, Lake Flushing drained when the blockage at the eastern end was breached. Subsequently, as the sea level rose and invaded the area, the existing deposits were reworked in the littoral zones and by strong bottom currents, and Holocene marine deposits were laid down.

This geologic history has created an identifiable stratigraphic succession of sediments in Long Island Sound. Figure IV-1 shows the distribution of the stratigraphic profile crossed by the proposed Iroquois route. The deepest unit is the crystalline bedrock which forms the stratigraphic basement complex. This formation, which outcrops near Milford, consist primarily of subparallel belts of metamorphic and igneous rock of Early and Middle Paleozoic age. They are mainly schists, gneisses, and granites, cut in places by dikes of Triassic diabase.

The basement complex is overlain by semiconsolidated coastal plain sediments of primarily Cretaceous age. These sediments, in ascending order, consist of: the Raritan Formation (fine to coarse sand interspersed with beds/lenses of primarily clay, silt, clayey and silty sand, and some lignite and pyrite); the Magothy Formation (fine to coarse sand with interstitial clay, silt, and lignite); the Monmouth Group (interbedded marine deposits of clay, silt, and sand, containing much glauconite and lignite); and the Mannetto Gravel (stratified fine to coarse sand and gravel) (Jensen and Soren 1974). The coastal plain sediments are treated as a single seismostratigraphic unit. In the geologic sense these sediments are considered to be bedrock (because of their age); however, they are not particularly rock-like, and are regarded as soils from an engineering viewpoint.

Glacial ice-contact deposits, primarily of late Pleistocene age, comprise the next unit in the stratigraphic column. The glacial deposits include drift, moraine, and till. In the vicinity of Milford, the till is predominantly silty sand with frequent cobbles and boulders. The



STRATIGRAPHIC PROFILE CROSSED BY THE PROPOSED PIPELINE

FIGURE IV - 1

composition of the offshore glacial deposits is unknown. Descriptions of the till and drift deposits on Long Island indicate only that it contains grain sizes ranging from clay to boulders.

The glacial ice-contact deposits are overlain by lacustrine clay, which was deposited during and immediately after the retreat of glacial ice from Long Island Sound (i.e., when the area was a lake). These deposits attain a thickness of more than 300 feet in basin areas.

A glacial outwash overlies the lacustrine deposit. Toward the center of the Sound, the outwash deposit conforms to the underlying lacustrine clay, and it is often indistinguishable from it on the basis of seismic reflection. The outwash deposit is coarse-grained close to the Connecticut shore, and grades into fine-grained where it extends into the center of the Sound. This unit occurs in thicknesses of up to about 300 feet.

The next unit in the stratigraphic succession is referred to as the "mottled" or "confused" zone. The unit is relatively thin and rarely exceeds 100 feet in thickness in the Iroquois project area. It was probably formed as a result of the draining of Lake Flushing, fluvial erosion, and stream braiding in an estuarine environment as the sea level rose and the Sound became marine. The textural character of this unit is probably interbedded sands and silts, and potentially organics, typical of such deposits

The uppermost unit in the stratigraphic column is the Holocene, which was formed by the reworking of underlying deposits by modern hydrodynamic process, and by the deposition of fine-grained marine sediments. Its textural character varies, but tends to be coarse-grained in nearshore zones, and fine-grained in water depths greater than about

30 feet. Along the pipeline route it can be expected to vary in thickness from a veneer to about 50 feet, and averages about 30 feet. The central portion of the route traverses a deep bedrock basin mantled with glacial till, moraine, and drift. This basin is filled with a thick section of lacustrine clay overlain by outwash, which is in turn overlain by thinner deposits of the "confused" zone and Holocene sediments. Near Milford, the route crosses a thick section of lacustrine clay and outwash, filling what is interpreted to be the glacially overdeepened Triassic valley (Jacques/McClelland Geosciences, Inc. 1986).

IV.5.4 Sediments

Long Island Sound currently receives sediments primarily from the Connecticut rivers and the wave-cut cliffs of the north shore of Long Island. Secondary sources include exchange with the continental shelf and concentrations derived from oceanic influx. Sedimentation is strongly related to seasonal patterns of freshwater input; spring runoff delivers most of the annual fluvial sediment input to the Sound. This material is reworked during the rest of the year by tidal currents and, to some extent, by meteorological turbulence.

Previous investigations of seabed conditions in Long Island Sound (e.g., U.S. Coast and Geodetic Survey 1967-1969; U.S. Coastal Engineering Research Center 1967; Thomas 1985; Ocean Systems, Inc. 1968), indicate that the surficial sediments that the proposed pipeline traverses include sand and gravel, fine-grained sediments (i.e., mud), and fine-grained sediments overlying sand and gravel (Jacques/McClelland Geosciences, Inc. 1986). These sediment types occur along the route in alternating sequences.

There are no known bedrock outcrops along the route and no known occurrences of concentrations of boulders in the offshore areas. However, some areas of boulders or cobbles may be located in the nearshore areas (J.P. Kenny 1986b).

Sand and gravel are the primary surficial sediments encountered in the nearshore areas along the Iroquois route. The pipeline route also will cross several large areas where fine-grained sediments occur at the seafloor. Geotechnical properties indicate that these sediments are consolidated and are soft at the seafloor, but become progressively harder with depth. Silt size particles also increase with depth. Colloidal organic matter is present and may cause silty materials to appear to have high plasticity.

Near portions of the pipeline route, fine-grained sediments also exist as a relatively thin deposit, overlying sand and gravel. The underlying sand and gravel is either a sandy facies of the Holocene sediments, the confused zone, or glacial outwash.

The surficial geology of the Milford shore approach shows that the backshore of the landfall is composed of glacial outwash, with sand beach deposits making up the shoreline (Flint 1968). Charles Island, however, is composed of glacial till. The shore of the island is dominated by cobbles and boulders up to 10 feet in size, which are the erosional remnant of the till. The bathymetry around the island suggests that the till extends to at least 1 mile from the shore along the axis of the tombolo and the island.

Active sand transport occurs along the shore in the vicinity of the Milford landfall. Groins extending from shore show accretion of beach sand on their eastern sides, and erosion on the west, indicating transport to the west. Moreover, the shore along the land separating Silver and Myrtle beaches is rocky and apparently eroding despite efforts to stop it.

The nearshore area at the Milford landfall also is identified as an area of potentially significant westward (i.e., toward the tombolo) erosion (DEP 1979). However, a review of historic shoreline changes near the landfall indicates that the shoreline has remained relatively stable over the past 150 years, and that the area east of Charles Island is accreting slightly (DEP 1979).

The route has been aligned to avoid both areas of known contamination (and thus to minimize the potential for the introduction or relocation of contaminants as a result of pipeline construction) and known disposal areas where non-natural type sediments could be encountered. In addition, Iroquois conducted a sampling and analysis program along the pipeline route in Long Island Sound. The results of this program, which show that the pipeline will intersect sediments that are relatively free of chemical pollutants, are summarized below.

Sediment was sampled and analyzed along the proposed 26.3-mile pipeline route across Long Island Sound (ERCO 1987). The objective of the sampling and analysis program, which was conducted as part of marine geotechnical evaluations, was to characterize the sediment along the route both physically and chemically. A total of 62 locations were sampled; of these, a total of 19 sediment samples (cores) from the Milford landfall were tested for environmental purposes. In addition, 30 samples, including three cores and 27 surface grab samples, were collected from along the deep-water portions of the marine route and tested for environmental purposes.

Both bulk sediment and elutriate tests were performed as part of the analysis program. Bulk sediment analysis was performed on each sample to determine grain size distribution, and to identify concentrations of total organic carbon (TOC), water content, trace metals (copper, nickel, zinc, mercury, lead, arsenic, cadmium, and chromium), PCBs, and oil and grease. Sediments from the core and grab samples were characterized in accordance with the sediment classification system published by the New England River Basins Commission (1980), which is based on both contaminant levels and sediment characteristics. Using this system, 24 of the core samples and four of the grab samples were determined to consist solely of Class I sediment. Class I sediments have the following characteristics: the sand fraction is 40% or greater; the TOC content (via loss on ignition) is less than 5% of weight; oil and grease is at or below detectable levels of 0.2% weight; and water content is less than 28% weight.

In addition to the bulk sediment analysis, elutriate tests were performed on seven of the samples that were found to contain more than 10% silt/clay (regardless of Class I categorization); six of the samples were from Milford (see discussion in the following paragraph). The purpose of these analyses was to test the leachability not only of the constituents that were found in excess of Class I criteria but also of trace metals and PCBs.

Overall, 19 samples were analyzed for environmental purposes at Milford. Of these, 13 met the criteria for characterization as Class I sediments. The remaining six samples were found to contain silt/clay in excess of 10% (i.e., ranging from 17% to 94%); thus, these samples were tested further to determine the leachability of trace metals and organics.

This testing involved the performance of triplicate elutriate analyses. The results of this additional testing showed that none of the mean elutriate concentration exceeded the federal water quality guidelines (EPA 1986).

In general, the results of the sampling program showed that the sediments encountered in water depths of less than 30 feet at both Milford and Northport consist primarily of sands, with the exception of an area east of the Charles Island tombolo, where sediments were found to contain higher percentages of silt and clay. In the offshore area, the sediments were found to contain higher percentages (74% to 94%) of silt/clay.

Although some trace metals and organic compounds (TOC) were found in the sediments, with the exception of one core taken at the Northport landfall, none were found at concentrations that resulted in violations of federal water quality criteria when tested for leachability (i.e., elutriate testing). Thus, the construction of the Iroquois marine pipeline is expected to have only minor, highly localized water quality impacts (as a result of near-field turbidity and sedimentation), and negligible impacts on the aquatic environment.

IV.5.5 Marine Biological Resources

The pipeline route will traverse various marine communities associated with the intertidal (littoral) and subtidal zone. These habitats support numerous marine species in Long Island Sound and can be broadly classified as estuarine due to the dilution of the Sound by its freshwater tributaries.

The subtidal zone is characterized by two major components: the benthic (bottom) and pelagic (water column) habitats. The subtidal zone exists below the spring low tide line. In Long Island Sound, the upper limit of the brown algae, Laminaria, coincides with extreme low water spring tides, and formally demarks the upper limit of the subtidal area. The benthic environment supports a wide variety of mobile and sessile organisms existing within and on the surface of the substrate. Substratum type is the major factor controlling the distribution of the benthic species. The pelagic environment displays a greater variation in physical and chemical parameters, such as salinity, nutrient availability, and dissolved oxygen, than the benthic environment especially in areas of freshwater influx. The biota are represented by planktonic (floating) and nektonic (swimming) organisms, ranging from diatoms to finfish.

The intertidal zone is that area defined by tidal fluctuation along the shoreline, encompassing the shoreline from mean high to mean low water during the daily tidal cycle. It also includes additional areas resulting from extra high and low water as a consequence of the monthly spring tidal phases. The intertidal zone is represented by sand and mud flats, along with rocky shoreline influenced by tidal splash and surge. Both benthic and pelagic organisms are represented in this zone. However, due to tidal fluctuation, intertidal organisms are exposed to severe environmental extremes, alternating between complete submergence in seawater to nearly dry terrestrial conditions. The variation promotes differences in thermal and salinty characteristics, environmental stability, and nutrient supply. These factors, in combination with the nature of benthic substrata, determine to a large extent the composition and structure of the biological communities inhabiting these areas.

The biological communities associated with these intertidal and subtidal habitats include several major submergent and emergent plant assemblages consisting of seaweed communities, tidal marshes, and eelgrass beds. Of these assemblages only the seaweed communities will be crossed by the pipeline. In addition, the pipeline will encounter assemblages of planktonic and benthic organisms as well as various pelagic organisms.

Commercial Marine Resources

The estuarine waters of Long Island Sound support a variety of finfish and shellfish, although less than one dozen species are of commercial or recreational significance (U.S. Department of Commerce, NOAA, 1980). The major taxa of importance in Long Island Sound include finfish, crustacea (lobsters, crab, shrimp), and mollusks (oysters, hard and soft shell clams, mussels, scallops).

The following discusses the principal finfish, crustaceans and mollusks likely to be found along the proposed pipeline route in Long Island Sound, and their importance to the commercial and recreational fisheries. In addition, specific areas in which resources are concentrated and which are of commercial importance will be identified for each faunal group. An analysis of the commercial fishery in Long Island Sound in the vicinity of the pipeline (E & E 1987) can be found in Appendix 3B to Resource Report 3: Vegetation and Wildlife (E&E 1988).

Finfish

The finfish that occur in the Sound can be categorized as resident populations, seasonal migrants, or spurious occurrences. The commercial fishery is primarily dependent upon the seasonal migrant and resident populations. Spurious species such as tropical fish carried northward in the Atlantic coastal currents are of little ecological or economic importance. As a result, these species will not be discussed further.

Seasonal migrants occur in the Sound mostly in the summer and comprise the bulk of the commercial fishery. The predominant species include scup (Stenotomus chyrsops), butterfish (Peprilus triacanthus), striped bass (Morone saxatilis), weakfish (Cynoscion reglalis), summer flounder (Paralicthys dentatus), and menhaden (Brevoortia tyrannus).

Resident populations are notably more important to the commercial fishing industry during the colder months of the year. These species include winter flounder (Pseudopleuronectes americanus), windowpane flounder (Scophthalmus aquosus), cunner (Tautogolabrus adspersus), blackfish (Tautoga onitis) and the forebeard rockling (Enchelyopus cimbrius). The winter and widowpane flounder support the winter trawl fishery in the Sound.

Otter trawler activities presently occur in the area of the route across the Sound. During the summer, trawlers catch scup, summer flounder (fluke), weakfish, and butterfish. A menhaden fishery also occurs in the Sound during the warmer months. Menhaden are pelagic, planktivorous fish, and since they feed in the euphotic zone, they are captured with near-surface gear.

Several species of fish migrate into the Sound on a seasonal basis for spawning purposes. These include anadromous species such as striped bass and the alosids (herring). The striped bass is a valuable commercial and recreational species of fish. It generally spawns in the freshwater reaches of rivers where moving water keeps the semibuoyant egg from settling to the bottom. Spawning does not occur in the Sound proper. The alosids follow a similar pattern of reproductive behavior. Nursery grounds for these species are in the higher saline areas of estuaries, such as the lower Connecticut River. They occur in eastern Long Island Sound as they migrate from the ocean to the Connecticut River and back again after spawning. Juveniles migrate to the ocean in October.

Weakfish also spawn in Long Island Sound during the summer, with eggs and fry occurring between May and August. Juveniles occur in bays and in the Sound in late summer and early fall. During the winter, the fish migrate farther offshore. Scup reportedly spawn in the Sound in late spring and early summer. Juveniles were found to overwinter in the Sound in 1971-75 (Thomson 1978), but little current information is available on the present distribution of juveniles. Butterfish spawn in the coastal waters near, as well as in, the Sound itself. The spawning season is in June, July, and August and the eggs are pelagic and positively buoyant. Summer flounder occur in bays, harbors, and mouths of estuaries in the Sound during the summer months. They spawn while migrating offshore in the fall. Menhaden appear in the Sound in April and remain until late fall. They spawn from April to October in continental shelf water.

Of the resident species, only the winter flounder is of any real commercial value. Windowpane flounder is caught, but commonly used as lobster bait or thrown back. Cunner is regarded as a recreational species. Blackfish and rockling contribute a low percentage to total commercial landings. They inhabit bottom areas and feed primarily on echinoderms and crustaceans.

Winter flounder is a permanent resident of the Sound. Adults migrate seasonally, moving into deep water during summer and back to shallow waters or estuaries during winter. The adults typically inhabit mud or grassy areas, but can also be found on sandy, estuarine bottoms. Spawing occurs in the bays of rivers that feed Long Island sound (e.g., the lower Housatonic River), typically during December to May. The eggs are demersal and usually found on mud flats in about 1 foot of water. The larvae and juveniles remain in the bays and inshore areas until they are at least two years old. Adult winter flounder are commercially landed primarily in Block Island Sound, and secondarily in the eastern and central sound regions.

Commercial Finfishing Activities. Commercial finfishing in Long Island Sound is primarily oriented around groundfish (i.e., winter flounder, summer flounder, and scup). Otter trawls are the principal gear used.

Otter trawling occurs in the Sound year-round. The target species during the summer months are mainly scup, fluke, and butterfish. In the winter the predominant species is winter flounder. Lobster is taken incidentally during the entire year, although the trawlers are only permitted to offload 100 lobsters per day.

The trawl fishery in the Sound is highly mobile during the summer months, with Connecticut vessels moving freely into New York waters and vice versa. Of fish caught by fishermen offloading at Connecticut ports, 55% of the catch is taken from the area bounded by the Housatonic River on the west and the Connecticut River on the east. Eleven percent of the catch is taken from the area west of the Housatonic River, and the remaining 34% is taken from the area east of the Connecticut River and west of the Connecticut/Rhode Island border. During January through

June, the catch is fairly small and constant. However, from July to October, catch size increases substantially, and the total catch from those four months represents 55% of the average annual landings from western Long Island Sound. The landings decrease again in November and December.

In the vicinity of the preferred Iroquois route, there are several areas that are heavily fished; the exact fishing locations depend on the season of the year and the abundance of the target species present. In general, the Smithtown Bay area (i.e., the area less than 90 feet deep and between Eatons Neck and Crane Neck) is heavily fished during the summer months (June through early October). Trawling also occurs near Stratford Shoals and the Middle Grounds during the summer; winter fishing similarly occurs in the Stratford Shoals area.

There is wide variation in the size and weight of otter trawl gear used in the Sound. The maximum size of gear is dependent in part upon the size of the fishing vessel and in part upon the bottom characteristics. The vessel size class composition has remained relatively constant during the years 1983, 1984, and 1985. In general, about 75 to 80% of the trawlers fishing the Sound are less than 50 feet long. The gear used by these vessels is relatively lightweight. The trawl doors are the conventional wood and steel rectangular design and weigh up to 400 pounds each. The weight of the doors is restricted by the winches placed on board the vessels. The trawlers use drag chains or "tickler" chains, which may weigh more than 150 pounds.

There are, however, several large vessels (60 feet plus) that fish in the Sound. These vessels are offshore trawlers and are equipped with heavier trawling gear. The otter trawl doors on these vessels can weigh up to 1,000 pounds each. Many of the trawlers also use roller gear in parts of the Sound. For example, in the vicinity of Stratford Shoals and Middle Grounds, roller gear makes otter trawling more effective because of the rough bottom characteristics.

In addition to groundfish, the menhaden fishery has also operated in the Sound in the past. Historically, the menhaden fishery was a viable industry in the Sound since the mid-1800s. However, fishing activity currently is at a low point because of declines in the species abundance.

The operating characteristics of the menhaden fishery differ considerably from the otter trawl fishery. A large menhaden fishery operating unit consists of a mother ship, two purse boats, and a spotting aircraft. The mother ship (upwards of 600 gross registered tons dead weight ((tdw)) provides the hold capacity, supplies, quarters, and transportation for the crew and purse boats. The spotter aircraft locates a good size school of fish and directs the purse boats to the fish. The purse boats must move together since each boat contains half of the net, which is 1,200 feet long. After the net is set around a school of fish, a heavy weight descends all the way to the bottom in a free fall. The vessels can operate throughout the entire Sound area except in exclusion zones near the mouths of rivers and in sheltered bays. The menhaden fishery operates in the warmer months of the year, and the bulk of the catch occurs from June through August or early September.

Shellfish

Shellfish resources in Long Island Sound include decapod crustaceans and bivalve mollusks. Of the crustaceans, the American lobster (Homarus americanus) is the most important and represents the most economically significant and active fishery in the Sound. Other important crustaceans include the blue crab (Callinectes sapidus), red crab (Cancer irroratus), and green crab (Carcinus maenus). Green crab is sold as blackfish bait. Shrimp (sand and grass) are common but not economically important.

Commercially valuable mollusks in the Sound include the hard clam (Mercenaria mercenaria), the soft or steamer clam (Mya arenaria), the conch (Busycon canaliculatum), the American oyster (Crassostrea virginica), and the bay scallop (Aequipecten irradians). The sea scallop (Placopecten magellanicus) and long-finned squid (Loligo pealei) contribute a low percentage to commercial landings of all species. The blue mussel (Mytilus edulis) is an edible species, but never has been consistently harvested in large amounts in the Sound. Mussels in most existing beds are small in size due to overcrowding and high intraspecific competition. This limits their marketability by constraining growth and keeping them at undesirable sizes. The shellfish of major economic importance are discussed below in greater detail.

Lobster. In the Sound, lobster seasonally migrate between nearshore rocky waters in the summer and deeper offshore waters in the winter. In general, lobster congregate in areas of natural rocky substrate or artificial reefs, which affords the most protection in terms of crevices and burrowing space. However, lobsters will establish residence in soft bottom areas provided the sediment is cohesive enough to permit burrowing and to prevent water collapse. Tagging studies indicate that lobsters in eastern Long Island Sound undergo extensive migration, some as far as the continental shelf (Briggs 1980, 1990). However, a prolific population exists in the Middle Grounds, an area south of Stratford Shoals, Connecticut. This is a region of rough bathymetry, and includes various crevices and holes suitable for lobster habitat. The seasonal movements to nearshore waters in the spring and to deeper Sound waters in late summer is related to water temperature changes. As egg-bearing females are consistently caught in the Sound, it can be inferred that spawning either occurs in the Sound or berried females migrate into the Sound after spawning. Females typically carry the eggs for 10 to 12 months, after which time planktonic larvae are released and occupy the water column during early summer.

The proposed Iroquois route will not traverse any major lobster migration areas or habitats. This is because the route generally avoids areas of rough bathymetry and is located just north of Stratford Shoals and east of the prime lobster habitat in the western part of the Sound. However, the route will cross areas that are frequented by lobsters and in which lobster fishing occurs.

Pots are the principal gear used by commercial lobstermen. Lobster pot fishing, which is highly seasonal, is conducted by both full- and part-time fishermen. The gear required for catching lobsters is minimal and relatively inexpensive, while the return on fishing effort can be significant because of the high price paid for lobsters. Thus, in the Sound, there are a great many operators fishing a small number of pots.

Fishing activities for part-time operators occur mainly in the late spring, summer, and early fall. In contrast, the full-time lobster pot fishermen fish year-round, although in the months of January and

February the catch per unit effort is quite low and fishing activities are usually at a minimum.

The pots are generally set in trawl lines of 5 to 10 pots; the total weight of the trawl line averages 100 to 200 pounds.

Overall, in the summer, lobster fishing activities are widely scattered across Long Island Sound. However, in the winter months the fishing effort is greatly reduced and more localized in the western portion of the Sound.

Mollusks. Mollusks have historically been of economic significance in the Long Island Sound area. Prior to World War II, Long Island Sound supported a major oyster industry which produced about 3 million bushels annually. Soft shell clams, hard shell clams, Atlantic bay scallops, blue mussels, and whelks were also harvested for consumption in the early 1900s.

However, the shellfish industry in the Sound declined substantially in the middle part of this century due to unsuitable water quality. Many commercial and recreational shellfishing areas were closed to the public because waters did not meet bacteriological standards. These water quality problems were caused by contamination from failed septic systems, improperly maintained or outdated sewage treatment facilities, poor marina sanitations, and uncontrolled upland runoff (Connecticut Aquaculture Commission 1986).

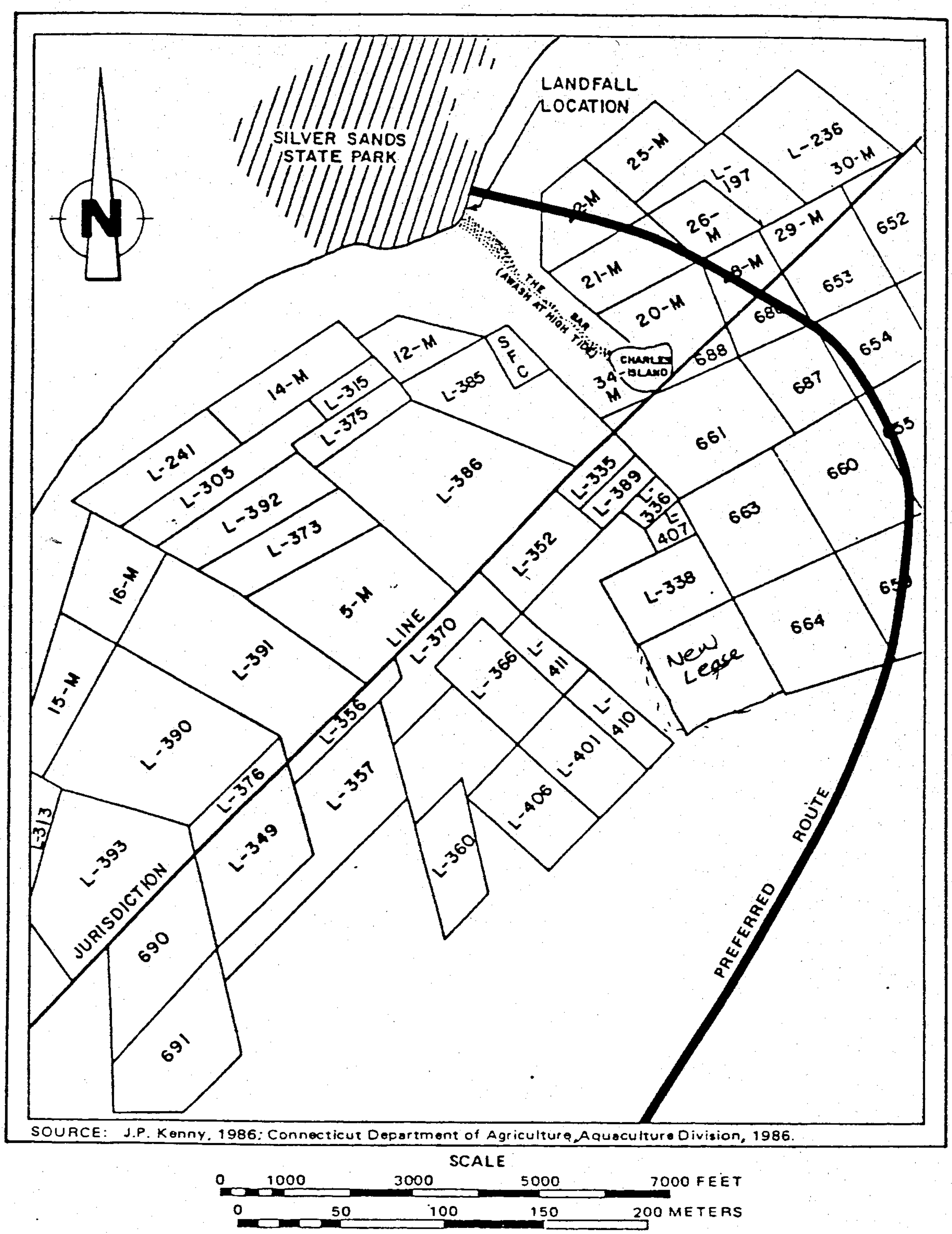
In recent years, however, programs have been actively pursued to restore the Long Island Sound shellfish industry. The State of Connecticut views its shellfish resources as an important industry -- one that is to be enhanced through the infusion of capital and the improvement of habitat. For example, in 1983, Connecticut established an Aquaculture Commission (composed of representatives of the public, the aquaculture industry, and various federal, state, and municipal agencies), which makes recommendations concerning methods to reestablish the shellfish resource base (e.g., the rehabilitation of state shellfish seed beds, the removal of silt, cultivation, planting of shell (cultch), and predator control). Through the implementation of such recommendations by private shellfish farmers and the state, the industry has recently revived, and Connecticut has become a regional leader in seed oyster production and now produces the most valuable oyster in the marketplace (Connecticut Aquaculture Commission 1986).

Connecticut leases or franchises shellfish grounds throughout the nearshore Sound area. In the nearshore area off Milford, the pipeline route traverses 10,000 feet through such leases (see Figure IV-2). There are basically three types of shellfish areas in Connecticut:

- Areas leased by the state to individuals or corporations --these require periodic renewal on the part of the lessee;

- Areas franchised and essentially owned by the shell fisherman and passed from generation to generation--no new franchises have been granted since 1916 (these are designated on shellfish maps by number only); and

- Public (natural) beds--these are areas owned by the state or town and available for public shellfish harvesting. Each coastal town owns submerged lands adjacent to it for some



SHELLFISH LEASE AREAS

FIGURE IV - 2

distance offshore; the boundaries were established in 1881 and vary from place to place. The town ownership of natural beds is identified on maps by a letter of the alphabet -- e.g., "M" refers to Milford.

Oysters currently rank first in landed weight among all commercial marine species harvested in Connecticut, and are the most valuable shellfish taken from state waters. In Connecticut waters, most natural and nearly all commercial oyster beds are located in estuarine river mouths and harbors west of the Connecticut River (e.g., the Housatonic River). High concentration areas, due mainly to the efforts of commercial operations on state-leased beds, are located in New Haven Harbor, off Milford, and in the Bridgeport and Norwalk areas. Over 3,000 bushels per acre have been reported from these beds (Mackenzie 1970).

In addition, seed oysters produced in Connecticut are transported to New York and Massachusetts and have traditionally been the mainstay for the oyster industry in those states (Connecticut Aquaculture Commission 1986). An important source of seed oysters to the aquaculture industry comes from the various state and town (public) natural shellfish beds, including those in the Housatonic River south of Interstate 95. These beds produce a natural shellfish spawn and set. The seed is typically harvested using hand implements such as rakes, tongs, and hand dredges by shellfish farmers who work both public beds and leased grounds.

The hard-shell clam, or quahog, is the second most valuable shellfish product generated by Connecticut's aquaculture industry. The clams are typically harvested using hydraulic dredges on leased or franchised shellfish grounds. A shellfish farmer usually works his leases on a rotational basis, harvesting some, while allowing recruitment and grow-out on others; thus encouraging continued productivity of the grounds (Connecticut Aquaculture Commission 1986).

In some locations in Connecticut, clams and oysters are cultivated and harvested on the same leases. The commercial shellfish grounds in New Haven Harbor as well as off Silver Sands State Park are examples of this. Oysters spawn in Long Island Sound from late June to late August (Loosanoff 1965) at temperatures above 68° F (Galtsoff 1964). Gametes are simultaneously released into the water column where fertilization occurs. The larvae is planktonic for a short time, eventually seeking hard rock or semi-hard mud structure.

Annually, in the late fall or springtime, juvenile oysters are transplanted off the setting beds. Prior to planting cultch (shell) to prepare the substrate for oyster setting, the leaseholder works the beds with hydraulic clam dredges for a period of several weeks or more. The purpose of this is to scour down to the subsoil and remove parasites (Blum 1986).

In anticipation of oyster setting on these same grounds, large quantities of cultch (approximately 2,000 bushel per acre) are planted. This cultch cover, which provides a substrate for oyster larvae to settle upon and attach, also seems to provide some protection from predators for the clam populations in the sediments below. Thus, a shellfish farmer may have two crops from one lease (Connecticut Aquaculture Commission 1986).

Many shellfish production areas, like those along the route east of Charles Island, are located in waters classified as "closed" or "restricted" by the Connecticut Department of Health Services (DOHS) for the taking of shellfish for direct consumption. The closures are due to the proximity of sewage facilities within a six-hour tidal flow range or because the waters exceed guidelines of 70 indicator coliforms per 100 milliliters of water. Prior to harvesting for market, the shellfish grown in closed areas typically are transplanted into waters that are certified for shellfish consumption. According to DOHS regulations, the crop must remain in certified waters for a minimum of 14 consecutive days at water temperatures above 50°F to insure the shellfish are actively filtering and cleansing. After this period of time, the shellfish can be harvested for market.

The areas off of Milford and Norwalk are the best shellfish areas in Connecticut. The shellfish beds off Silver Sands State Park to the west of Charles Island are prime market "grow-out" areas (i.e., the shellfish can be sold directly for consumption). West of Charles Island, the State of Connecticut also has a spawning bed that is stocked with various shellfish species. The hard bottom west of Charles Island is extremely good for getting oyster sets. Farther offshore (directly south of Charles Island) and to the east of the island, a major shellfish producer (Talmadge Brothers--the largest shellfish farming operation in Long Island Sound) owns various beds, which are currently not used as market beds.

The Iroquois landfall (east of Charles Island) is a shellfish closure area -- that is, the shellfish cannot be marketed directly from this area. This is because water quality in the bay has been degraded by discharges from three sewage treatment plants -- at Indian River, Gulf Pond, and Wippowague. The closure line runs from Welsh's point to Charles Island and then north up to the tombolo.

Because of previous problems with market closures, the shellfish farmer's prime concerns are water quality and marketability, either on a temporary or a long-term basis. The main concerns of the shellfish farmer with respect to offshore or nearshore developments are:

- Closure of a market area:
- Loss of resource (clams and oysters);
- Loss of habitat (temporary or permanent);
- Possible obstructions that would hinder clam/oyster dredges;
- Effects on private beds; and
- Effects on public beds (Volk 1986; Ludwig 1986; Blum 1986).

The principal types of shellfish harvesting equipment used in the Connecticut portion of the Sound include:

- Cage dredge. This skims through sediments to a depth of 2 to 4 inches.
- Suction Dredge. This operates by sucking the shellfish through a pipe and depositing them on a sorting conveyor. Only the large boats (100 feet or more) are typically equipped with this type of dredge.
- Hydraulic dredge. This is the largest type of gear and can be used to a water depth of 40 feet. Quahogs are harvested using a hydraulic dredge that is dragged along the bottom; a water jet is pumped through a manifold in front

of the cage and helps to loosen the sediment. This cage weighs 600 pounds, empty.

The DOHS closely monitors activities in Long Island Sound that could affect the shellfish resources. For example, Connecticut prohibits dredging from June 1 to September 30. This is because disturbances of the bottom may chum fish and if the sediments contain pollutants, a "clean" fishery may be impacted. Moreover, DOHS is concerned that dredging may trigger anomalies in the environment, which in turn can cause bacteria blooms in the water column. Thus, there is a 0.5-mile potential shellfish closure area around any dredging site; this closure area would only be instituted if tests conducted by DOHS during dredging show coliforms (Bell 1986).

Hard Shell Clams (Quahogs). Hard clams constitute a long standing fishery of high economic value in Long Island Sound. They typically occur in nearshore water where the substrate is composed of sand or clayey sand. Localized beds of high abundance can be found in nearly all areas. Population migrations do not occur, except for the dispersal of pelagic larvae by currents. Spawning occurs from June through August, depending upon the temperature of the river, bay, or area of the Sound proper in which they are located. Normal spawning temperature must exceed 68° F (Loosanoff 1937a, 1937b). Hard clams become sexually mature in their second summer and continue to produce gametes every summer until death.

Hard clams contribute a moderate percentage to total annual commercial landings, ranking ninth in 1983 (Blake and Smith 1984). Stocks on private commercial beds are enhanced by aquacultural activities of the shellfish companies that own them. However, increased production is constrained by the limited amount of productive ground located in unpolluted water.

IV. 6 LAND USE

The pipeline route will traverse various types of land uses in right Connecticut municipalities (see Table IV-14). Principal land uses are denoted on or illustrated by the maps in Volume 2.

A review of the State Policies Plan for the Conservation and Development of Connecticut (June 1987) shoes that with the exception of the Paugussett State Forest and Silver Sands State Park, the pipeline route does not traverse areas of existing preserved open space. The route does cross areas identified for conservation or preservation (e.g., Means Brook, Housatonic River). Most of the areas along the pipeline route are identified in the plan for long-term urban potential or as rural land.

Of the approximately 47.5 miles traversed by the Connecticut land portion of the route, 29 miles (61%) are through forested lands, 2.7 miles (6%) are through areas currently used for agricultural purposes, and 8.2 miles (17%) are open or reverting fields. Approximately 7.4 miles (16%) of the route cross urban land (e.g., residential, commercial, and industrial development) and rights-of-way.

The aboveground facilities associated with the pipeline (i.e., mainline valves, pig launcher/receiver sites, sales meter stations, and interconnection points) have been sited so as to minimize conflicts with existing land uses. The general land use characteristics at the sites of these facilities are summarized in Table IV-15.

In general, the pipeline route has been aligned wherever possible to be parallel and adjacent to existing rights-of-way (e.g., highway, railroad, pipeline, electric transmission line corridors). Approximately 18.3

Table IV-14

Land Use Characteristics of the Proposed Iroquois Pipeline Route in Connecticut

County	Length Adjacent to Existing ROW a/		LAND USES CROSSED: Woodland b/		Agriculture & Open Space c/		Residential d/		Commercial Industrial e/		Open Water		Number of Homes Within 50 feet of Proposed Right-of-Way
	Miles	%	Miles	%	Miles	%	Miles	%	Miles	%	Miles	%	
Litchfield County	3.2	29	6.1	56	3.5	32	1.0	9	0.3	3	0.0	0	15
Fairfield County	13.3	40	21.8	65	6.2	18	5.3	15	0.1	1	0.1	1	29
New Haven County	1.8	64	1.1	38	1.1	41	0.3	10	0.2	7	0.1	3	2
Total	18.3	38%	29.0	37%	10.8	48%	6.6	6%	0.6	1%	0.2	8%	46

Source: After FERC DEIS 1989, as amended by Iroquois Gas Transmission System 1990.

Notes:

a/ = Pipeline right-of-way adjacent to other existing corridors.
b/ = Includes mature deciduous on coniferous forest stands.
c/ = Includes cropland, pastureland.
d/ = Includes single-and multi-family yards.
e/ = Includes retail/wholesale areas, manufacturing, quarries.

TABLE IV.-15
Land Use at Proposed Ancillary Pipeline Facility Sites
in Connecticut

Facility	Milepost	Municipality	Surrounding Land Use	Topography	Floodplain (Y or N)	Historic Sites within 1.5 miles. (No.)	Proximity to Existing Roads Miles	Roads
MLV	293.10	New Milford	Residential/ Forested	Steep	N	11	0	Light Duty Road
SMS	297.2	New Milford	Shrub	Flat	N	---	0.05	Route 7
MLV	304.2	Brookfield	Right-of-way/ Residential	Steep	N	2	0.05	Vail Road
ICP	305.5	Brookfield	Right-of-way/ Commercial	Flat	N	0	0	High Meadow Drive
MLV	317.3	Monroe	Residential/ Commercial	Moderate slope	N	4	0	State Higway 111
SMS	324.0	Shelton	Forested/ Right-of-way	Moderate slope	N	3	0.2	Road off Willoughby Road
ICP	328.5	Stratford	Right-of-way	Sloping	N	0	0.05	James Farm Road
SMS	330.0	Stratford	Right-of-way/ Residential/ Forested	Moderate slope	N	6	0	Chapel Street
MLV	334.0	Milford	Open Land	Flat	N	N	0.01	Park Access Road

Source: Iroquois Gas Transmission System, 1990.

miles (38%) of the route in Connecticut parallels such corridors (see Table IV-16).

The proposed pipeline will cross near or through various areas used for recreational purposes or identified as land trusts. Table IV-17 identifies recreational areas, land trusts, and other special interest properties along the proposed pipeline route. About 1.4 miles of the route in Connecticut will be across state properties; several parcels of town open space also will be crossed. In addition, the marine portion of the pipeline traverses Long Island Sound, in which subtidal lands are under the jurisdiction of the State of Connecticut. No federal lands, other than the Appalachian Trail, and various highway rights-of-way, will be crossed. In addition, the route will traverse near several solid or hazardous waste sites (see Table IV-17).

The following subsections summarize the land use and recreational resources in the Connecticut municipalities traversed by the route.

Fairfield County

The pipeline route traverses approximately 34 miles and six municipalities in Fairfield County. One (the Town of Sherman) is located in the northwest part of the county near the New York State border. The route crosses about 1.6 miles through the northern portion of this town before passing into the Town of New Milford in Litchfield County. After crossing New Milford, the route reenters Fairfield County and traverses the municipalities of Brookfield, Newtown, Monroe, Shelton and Stratford, which are located in the central and southeastern part of the country.

Overall, in Fairfield County, the route crosses approximately 22 miles (65%) through wooded areas, and 0.7 miles (2%) through

Table IV-16

List of Locations Where The Pipeline Route Parallels Existing Corridors

County	Corridor	Approximate Mileposts
Litchfield	Electric Transmission Line	293.35-294.70 296.97-298.13 298.38-299.10
Fairfield	Electric Transmission Line	299.10-300.46 300.59-300.85
	Railroad	299.55-302.7 303.70-304.10 304.90-305.50
	U.S. Route 7	302.90-303.60
	Pipeline Corridor	305.48-308.25
	Interstate 84	310.27-312.00
	Electric Transmission Line	323.73-324.40 325.00-326.10 328.25-329.00 330.00-330.90
New Haven	Electric Transmission Line	330.90-331.40
	Railroad	332.65-332.85
	Park Access Road	330.00-334.10

Source: Iroquois Gas Transmission System 1990.

TABLE IV-17

Recreation and Public Interest Areas Crossed or Near the Proposed Pipeline

Municipality	Public Interest Area	Milepost	Length of Crossing (miles)	Comments
Sherman	Appalachian Trail	286.7	0.17	National Trail
	Naromi Land Trust/Wimisink Brook	287.7	0.30	Private Land trust
New Milford	Weantinogue Heritage, Inc./ Morrissey Brook	288.0	0.16	Private Land trust
	Stilson Hill Road Scenic Area	289.5	0.01	Town-designated scenic road
	Housatonic Range Trail/ Candlewood Mt./Pine Knob	291.8	0.01	Privately owned
	Kimberly-Clark Corp.	292.2	Nearby	Paper sludge Waste disposal from mfg. plant
	Lynn Deming Park	293.8	Nearby	Swimming beach, picnic grounds
	New Milford Landfill	295.5	Borders	EPA listed municipal waste site
	Hill and Plain School	296.0	0.17	Elementary School
	Candlewood Valley Country Club	297.1	0.50	Public golf course
	Harrybrooke Park	297.3	Nearby	Passive recreation
Brookfield	Still River Preserve	299.5	0.32	Part of Weantinogue Land Trust
	Silvermine Road Open Space		Nearby	Municipal ownership
Newtown	Paugussett State Forest	315.1		ROW would traverse border of forest
Monroe	Boys Halfway River Caves and Pomperaug Blue Dot Trail	318.2	0.60	Natural area, limestone caves, and hiking trail
Monroe/Shelton	Means Brook Valley	320.6	0.45	Partially Town-owned natural area
Shelton	Hill & Harbor Tourist District	320.0-323	2.0	Farms
	Shelton Conservation Land Trust	320.9	0.25	Private Land trust
Stratford	Roosevelt Forest	329.1	0.20	220-acre town forest
Stratford/Milford	Housatonic River	330.8	0.40	River used for recreational boating
Milford	Silver Sands State Park	333.5	0.77	State park proposed for development

Source: FERC DEIS Table 4.1.9-4 and Iroquois Gas Transmission System, 1990.

agricultural or open lands. About 4.5 miles (13%) of the alignment pass near residential areas.

The following describes the pipeline alignment in Sherman; the route in remainder of the Fairfield County towns is described sequentially, after the discussion about the Town of New Milford.

Town of Sherman. In the Town of Sherman, the route crosses residential, forested and wetland areas. The town as a whole, as well as the area in the vicinity of the route, is becoming increasingly developed for low-density residential use (i.e., large lot subdivisions). There are various subdivisions existing or planned within 1.5 miles of the pipeline route, and the pipeline traverses one such development (the Smoke Ridge subdivision) between Anderson Road and Wimisink Brook.

The pipeline route crosses the Appalachian Trail in the Town of Sherman, as well as property owned by the Naromi Land Trust, Inc. The crossing of the Appalachian Trail (milepost 268.7) is directly east of the New York border, just south of the State Route 55.

The Naromi Land Trust property is traversed for approximately 0.3 miles in the vicinity of Wimisink Brook. The land that will be specifically crossed is the Land Trust's Wimisink Valley Sanctuary, a 51-acre area identified by the organization as a wildlife sanctuary. The Land Trust, a private, non-profit organization, also owns nine other properties, totaling 324 acres, within 1.5 mile of the pipeline right-of-way in Sherman (Donohoe 1987).

The town's Zoning Regulations classify all of the land to be crossed by the pipeline as Zone A: farm-residential. The town's Plan of Development (Ciropalovych et.al. January 1978) describes the land use conditions as of the plan publication date, identifies constraints for various types of development, and presents recommended plans for recreation and open space. These plans indicate that the pipeline project traverses primarily areas in which residential development on large lots (one unit per 2 acres) is recommended. However, the route also crosses areas identified as open space and recreation -- particularly the Naromi Land Trust parcel along Wimisink Brook. The plan does not identify any scenic areas in the vicinity of the route, although it notes that State Routes 37 and 39 are scenic in the southern part of town.

Although not specifically defined in the town plan, the route will traverse two areas of specific recreational and scenic concern: the Appalachian Trail and the lands owned by the Naromi Land Trust. The Land Trust owns several different parcels in the vicinity of Wimisink Brook; the pipeline route traverses approximately 0.15 miles through these properties.

Litchfield County, Town of New Milford

The route crosses about 10.9 miles (i.e., mileposts 288.2 to 299.1) through the Town of New Milford, which is located in southwestern Litchfield County. Approximately 30% (3.3 miles) of the route through new Milford will be aligned parallel and adjacent to an existing electric transmission corridor. The right-of-way parallels a CL & P electric transmission corridor between mileposts 293.35 and 294.7, as well as from about milepost 296.9 to 299.1.

Most of the area in the immediate vicinity of the pipeline route is zoned and used for residential purposes, although portions of the pipeline will be located in business and industrial zones (New Milford

Planning Commission 1985). Lands traversed by the right-of-way are used primarily for woodlands (6.1 miles, or 56%), and agriculture/open lands (2.0 miles, or 18%). The route specifically traverses near residential developments along Stilson Hill and Old Stilson Hill Road; Route 37; north of New Milford Bay and south of Kent Road (i.e., U.S. Route 7); and near Maple Road and Sullivan Road.

The pipeline route traverse west of (and upgradient from) a RCRA landfill operated by Kimberly-Clark in the vicinity of Candlewood Mountain/Pine Knob. In addition, north of the Lanesville area, the route also crosses to the west and upgradient of the New Milford Landfill, a regional municipal waste disposal area (which is a CERCLIS site) operated by Waste Management, Inc. The pipeline also passes through part of the Candlewood Valley Country Club golf course.

Although the alignment does not traverse any parks in New Milford, it is within 1.5 miles of various public uses areas. These include Candlewood Lake and the various open space areas along it (e.g., Lynn Deming Park -- a 13-acre quasi-public area; Ferris Park -- a 1 acre town park). In addition, the route traverses about 1.1 miles through parcels of land owned by the Sunny Valley Foundation, Inc. The pipeline route also crosses the Candlewood (or Housatonic Ridge) Trail twice -- once at about milepost 292 on Pine Knob/Candlewood Mountain (on property owned by Kimberly-Clark), and once along Rocky River Road, (milepost 293) between a gravel mining area and the site of an industrial/commercial building. The trail is a footpath on private land that is part of the Connecticut Forest and Park Association's "Blue Dot Trail" system.

In addition, at about milepost 289, the pipeline route crosses about 820 feet through the Weantinogue Heritage Inc.'s Morrissey Brook parcel. This area is wooded and includes a trail and wetlands areas: in addition, there is a scenic waterfall on Morrissey Brook, east of the pipeline route. The proposed Iroquois route, which incorporates the Stilson Hill Road Variation, avoids a second parcel of Weantinogue property in New Milford adjacent to Stilson Hill Road, which is a town-designated scenic road.

New Milford does not have a specific plan concerning recreation or visual resources. However, open space and recreational issues are addressed in the town's 1986 Updating Plan of Development. The pipeline route does traverse across or near various recreational resources, as well as areas of potential aesthetic value. Recreational areas traversed by the pipeline include the Housatonic Range (Candlewood) Trail and the Candlewood Valley County Club Golf Course. Other major open space areas include lands owned by CL&P in the vicinity of the Rocky River, as well as land trust parcels owned by Weantinogue Heritage, Inc. In addition, the route passes within 0.5 miles of most portions of Candlewood Lake, a major recreational resource for western Connecticut as a whole. The town's 1986 plan calls for the acquisition for preservation of the Smyrski tract on Candlewood Mountain.

Fairfield County (milepost 299.1 to 330.95)

Land use along the pipeline route in the five southeastern Fairfield County cities or towns (i.e., Brookfield, Newtown, Monroe, Shelton and

Stratford) consists primarily of woodlands interspersed with low-density (i.e., large lot) residential development and scattered areas of pasture land, wetlands, and open fields. Within the past several years, all of the cities/towns have been experiencing significant development pressure; as a result, there has been a substantial increase in the number of subdivisions approved or pending approval in all of the areas and a concomitant increase in the conversion of land to residential uses. The following describes land uses along the pipeline route in each of the cities and towns traversed.

Town of Brookfield. The pipeline route enters the town from New Milford at about milepost 299.1 parallel to the existing CL&P electric transmission corridor. Overall, most of the 6.8 miles of the pipeline route in Brookfield is aligned to parallel existing rights-of-way. Specifically, the route traverses approximately 4.0 miles (58%) largely parallel and adjacent to the electric transmission corridor, railroad rights-of-way, U.S. Route 7, and an existing Algonquin Gas Transmission Company (Algonquin Gas) pipeline right-of-way.

Most of the land within 1.5 miles of either side of the right-of-way through Brookfield is zoned and developed for residential or commercial uses; scattered industrial uses, including former sand/gravel mining areas, are located primarily adjacent to the railroad that traverses the area (Brookfield Zoning Commission 1987). Major land use features in the area include Candlewood Lake, which is located a minimum of 1.5 miles to the west of the route; U.S. Routes 7 and 202, which are major north-south highways; and the Still River, which also crosses north-south through the town (the pipeline parallels the river to the east).

The Brookfield Plan of Development (1977) sets forth various land use policies for the town, including the recognition of the Still River Valley (through which the pipeline traverses) as the principal area for commercial and industrial development. It also includes an open space and recreation plan, which identifies Candlewood Lake as the single important recreational resource in the area and sets a goal of devoting 10% of the town's land to open space and recreation. Recommendations to achieve this goal included the acquisition by the town of lands along Lake Lillinonah (i.e., the Housatonic River, which forms the northeastern boundary of the town); the protection of stream belts and other waterfront open space; and the development of a linear park along the U.S. Route 7 corridor (Flaherty-Giavara Associates, P.C. 1977).

The pipeline, which is aligned within about 1 mile of the southern portion of Candlewood Lake, does not cross near any of the recreational or aesthetic resources identified in these Brookfield plans. However, the pipeline does traverse for about 0.34 mile through the eastern border of the Weantinogue Heritage, Inc.'s (Weantinogue) Still River Preserve. This area is used for various recreational purposes, including hiking, nature viewing, and hunting. Through this area, the pipeline is aligned between the CL&P transmission line (which traverses the preserve) and the Conrail tracks.

Town of Newtown. Traversing into Newtown at about milepost 305.9, the route crosses approximately 11.1 miles through the town. Approximately 2.5 miles of the right-of-way abuts the existing Algonquin Gas pipeline easement (mileposts 305.9 to 308.4), while approximately 1.7 miles parallel Interstate 84 (mileposts 310.3 to 312.0).

The land crossed by the pipeline in Newtown is zoned for farming and residential use, and land uses within 1.5 miles of either side of the pipeline route are generally characterized by large lot (i.e., 2 acres) suburban residential development within forested areas. The town center and major public uses (i.e., schools, hospitals) are located south of Interstate 84, approximately 0.6 miles from the pipeline alignment.

Principal land use features in the general project area include Interstate 84 (which the route parallels for about 2.2 miles before crossing at milepost 312.5); Rocky Glen State Park (which is located about 0.5 miles north of milepost 311.0 adjacent to the Pootatuck River); Lake Zoar (which is formed by the Housatonic River and is a minimum of 0.7 miles northeast of the route); and the 1853-acre Paugussett State Forest (within which the pipeline traverses for approximately 1.4 miles between mileposts 314.6 and 316.4).

Overall, the land uses crossed by the pipeline right-of-way mirror those in the general vicinity. For example, the route crosses 7 miles through forested areas, and 1.1 miles through residential areas. In addition, the route is within 1.5 miles of 19 existing or proposed subdivisions, and traverses about 3.2 miles through portions of eight separate subdivisions for which plans have been submitted to Newtown. Such subdivisions are crossed in the vicinity of mileposts 308.8, 312.3 to 313.9, 314.4, and 315.9, and 316.9. The route also passes near, but does not cross, various land trusts maintained by the Newtown Forests and Parks Association Inc., and the Shepaug Dam Land Trust, as well as a town park just north of Interstate 84's interchange No. 11 (milepost 312.0).

The pipeline route crosses 0.07 miles of a parcel of town open space land adjacent to the Halfway River at the Newtown-Monroe boundary (milepost 316.9). Between mileposts 318.3 to 319.3 it also traverses about 1 mile through Class 1 lands owned by the Bridgeport Hydraulic Company.

Prepared in 1981, Newtown's Plan of Development includes both a land use and open space/recreation element. According to this plan, land uses in the vicinity of the pipeline route are proposed primarily for low-density residential development (0.5 to 3 acres per unit). Open space and recreation plan objectives generally call for the development of additional lands for such purposes, with particular emphasis on water-oriented opportunities (Newtown Planning and Zoning Commission 1981). The only areas proposed for open space that would be traversed by the pipeline are aligned linearly across local roads.

In the town, the pipeline route is aligned within 1.5 miles of several recreational areas, and crosses 0.7 miles through the Paugussett State Forest. The areas within 1.5 miles of the route include: Rocky Glen State Park, Lake Zoar, and Kettletown State Park (across the Housatonic River from the pipeline route).

Town of Monroe. The pipeline route crosses about 3 miles through the eastern portion of the Town of Monroe. Lands in the vicinity of the route are zoned for residential and farming use, and consist mostly of forested areas, within which low-density residential uses (i.e., 2 to 3 acre lots) either have been developed or are planned. The pipeline route crosses about 0.4 miles of two such subdivisions.

The route through Monroe is aligned approximately 1.5 miles west of, and parallel to, the Housatonic River. Webb Mountain Park, a town recreation area adjacent to the river, is located about 0.7 miles east of the route. In addition, the route crosses about 0.7 miles along the boundary of a town/city open space parcel at the Monroe/Shelton border.

Most of the pipeline right-of-way in the Town of Monroe traverses wooded areas. This land use accounts for 2.5 miles (85%) of the route.

In addition, the pipeline route traverses near a scenic forested area adjacent to the Boys Halfway River. Although located west of the Iroquois route, portions of this area are characterized by a scenic gorge, steep topography, and hemlock glades. In this area the pipeline also traverses the Pomperaug "Blue Dot" Trail which is aligned along the north side of the Boys Halfway River.

City of Shelton. Traversing northwest-southeast across approximately 7.8 miles of the northern part of the city, the pipeline is generally aligned through a mixture of woodlands, open areas, and higher-density suburban residential and commercial developments. The land crossed by the pipeline route is zoned for residential, light industrial, and planned development uses. The uses of the land crossed by the pipeline route also characterize the existing land use patterns within 1.5 miles on either side of the route; exceptions are the various industrial and commercial uses that are concentrated along Route 8 (which the pipeline crosses at milepost 326.6). Specifically, in Shelton, the pipeline right-of-way crosses 4.8 miles of forestlands, and 1.5 miles of residential development.

The pipeline route also crosses a total of about 1.45 miles of two planned subdivisions (0.75 miles) and one parcel of commercially-owned property (0.7 miles). In addition, the route traverses about 0.45 miles of a parcel of land (Lot 13) owned by the Shelton Land

Conservation Trust, Inc. This parcel is located directly north of State Route 110 east of Means Brook (mileposts 320.7 to 321.1). It also traverses about 0.5 miles of municipal open space land in the vicinity of mileposts 324.7 and 325.0.

The City of Shelton does not have any land use, open space, or recreation plans. However, the route does traverse the floodplain of Means Brook, as well as a parcel of property owned by the Shelton Land Conservation Trust; both are considered scenic. In addition, the route passes within 1.5 miles of the Housatonic River, lands adjacent to which are used for a variety of recreational purposes. The river itself also offers various opportunities for recreational activities, and in certain reaches is considered scenic.

Town of Stratford. The southern most part of Fairfield County traversed by the pipeline route, the Town of Stratford is, for the most part, a densely developed urban area. The land that the pipeline will cross is zoned for residential and light industrial uses. The most urbanized portions of the town are located south of Interstate 95, and along the coast of Long Island Sound. The pipeline is aligned across less developed portions of the northern section of the town. However, this area, too, is rapidly developing. The principal land use is large lot residential subdivision development.

For approximately 1.7 of the 3.3 miles through Stratford, the route is aligned generally parallel to a CL & P transmission corridor. Following this corridor between milepost 328.3 and 330.98, the pipeline right-of-way passes near residential areas along James Farm Road, crosses 0.36 miles of the eastern portion of Roosevelt Forest, and traverses the Merritt Parkway before crossing the Housatonic River into the City of Milford.

Along most of this area, the pipeline is generally aligned adjacent to the transmission corridor; the route deviates from the corridor in order to avoid residential developments.

In avoiding these residential areas, the route traverses the eastern boundary of Roosevelt Forest, a 220-acre town recreation area. The forest is managed for a variety of uses, including bicycling, hiking, fishing, and picnicking, among others; it also includes a nature museum.

The pipeline route crosses the Housatonic River approximately 0.04 miles to the north of the CL & P transmission corridor. At the river crossing, it passes about 0.2 miles south of Boothe Memorial Park; the route will not affect this 44.7-acre multiple use town recreational area that is located along the river.

The Town of Stratford is within Connecticut's coastal zone, and the pipeline route traverses the coastal boundary adjacent to the Housatonic River. However, except for a small coastal flood hazard area, the pipeline does not traverse any identified coastal resources within this area. (Environmental Design Associates, P.C. 1988).

New Haven County

City of Milford. The Iroquois route traverses approximately 3.2 miles in New Haven County, all within the City of Milford. The land crossed by the pipeline route is zoned for residential, office, industrial special design, and open space uses. Approximately 0.6 miles (19%) of the route in Milford pass near residential, commercial, or industrial areas. Specifically, upon entering Milford from Stratford, the route traverses a former sand/gravel mining area and then is aligned parallel to a CL&P

transmission line south to Oronoque Road. The route passes behind industrial uses (e.g., the Bic Plant), and then traverses south adjacent to various commercial (office) buildings along Schoolhouse Drive, Interstate 95, and Route 1.

As the route traverses through the city, however, it passes across or near various recreational resources. Although no scenic areas have been officially designated by the city, several areas along the route could be considered scenic.

South of Interstate 95, the route crosses areas that have been slated for general forest management, development, and natural preservation. The Beaverbrook Reservoir, which is located approximately 0.1 miles south of the route and was formerly part of the South Central Connecticut Regional Water Authority's water supply system, was sold to the City of Milford in 1987 and is identified as a recreation area around which development is planned. These lands are within the Beaverbrook watershed, which the Water Authority formerly used as a source of drinking water supplies. In 1982, the Water Authority developed a land use plan for the Beaverbrook properties. This plan is oriented toward the multiple use and development of the watershed lands. The plan specifies areas for uses such as recreation, general forest management, development, water-based recreation, preservation, and agriculture. It should be noted that the Water Authority has no active water supply facilities in the immediate Iroquois project area.

The Milford Conservation Land Trust, Inc. also owns a parcel of land adjacent to the northeastern tip of the Beaverbrook Reservoir; this parcel is located southwest of the pipeline route.

In the City of Milford, the route crosses one parcel of state-owned land--Silver Sands State Park and the 334-foot-wide highway right-of-way leading to it from U.S. Route 1. The pipeline route traverses about 0.7 miles along the highway easement (through which an access road has recently been developed) and 0.6 miles through the undeveloped park proper.

Silver Sands is 293 acres, and includes 3,100 feet of frontage on Long Island Sound. The park is presently undeveloped (i.e., no picnic areas, shelters) and consists of a beach area with an offshore tombolo and a 23-acre island (Charles Island). The beach area is located mainly east of the tombolo; west of this, the high tide extends to a breakwall and low tide reveals a mud flat. Various jetties and groins also extend seaward in the area west of the tombolo. An eroded breakwall and beachfront access road separate the shore and backshore areas.

The backshore area in the park is characterized primarily by a wetland, access roads, and various municipal facilities (e.g., the dog pound, an old sewage treatment plant, a shredder plant, a former landfill). Portions of the wetlands have been filled, and some areas have been used for dumping garbage. In addition, a squatter occupies a portion of the higher ground in the backshore area; the squatter's home consists of a collection of trailers, shacks and chicken coops located immediately across the beachfront road and slightly northwest from the tombolo.

The northwestern part of the park was formerly used a landfill by the City of Milford. A closure plan has been prepared for this area, and the landfill is currently being capped with fly ash. The landfill is listed on the federal CERCLIS list; however, it is anticipated that the ongoing closure/capping activities will serve to remediate the site.

In the near future, the state proposes to develop the park for passive recreation (Clifford 1986; Rocque 1986; Emmerick 1986; 1988; Pac 1986; Clapper 1989, 1990). DEP views this development as a significant addition to its public recreational system since Connecticut as a whole has only 78.5 miles of sand beaches (representing 13.5% of the coastline). The state owns only 7.5 miles of all of these sand beaches (Schneider 1978; U.S. Department of Commerce, NOAA 1980).

Charles Island and its associated tombolo are designated under the Coastal Barrier Resource Act (CBAA), PL-97-348. Both Charles Island and Silver Sands State Park also are within the Connecticut coastal zone management area, as is the entire City of Milford area (U.S. Department of Commerce, NOAA 1980; DEP 1979).

In addition, the area off the coast of the state park (just east of the tombolo and Charles Island) has been designated by the City of Milford as a transient anchorage area for small boats. The location of the anchorage is included in Milford's Harbor Management Plan, which has been approved by the state. The pipeline route will traverse a portion of this anchorage area.

IV.7 CULTURAL RESOURCES

Iroquois recognizes that portions of its proposed route in Connecticut will traverse areas in which prehistoric and historic resources may be located. As a result, Iroquois has conducted site file research to identify the known cultural resources in the vicinity of the proposed pipeline route. In addition, Iroquois has completed surveys of the marine portion of the pipeline route, and initiated surveys of the land portion of the pipeline route in Connecticut on April 3, 1990.

Because of the need to protect the locations of cultural resources, no specific data regarding sites or sensitivities is included herein. Such information will be provided only to the Connecticut Historical Commission (CHC) and the FERC. As a result, the following discussion summarizes the research methods that have been and are being used to conduct the surveys.

Information regarding known cultural resource sites was collected from historical maps, local histories, and state records, as well as from other appropriate sources. To provide the most up-to-date information regarding known cultural resources in Connecticut, a literature and records search was conducted in January to March 1990. This research supplements previous studies regarding the project area conducted from 1986 to 1988.

Cultural resource information is presented in Iroquois' 1986 ER and in its 1988 Resource Report No. 4: Cultural Resources. For those reports, site files were consulted at the Connecticut Historical Commission, the American Indian Archaeological Institute (AIAI), and the University of Connecticut. Sites within 1.5 miles of the route were recorded and plotted on current USGS quadrangle sheets. In addition, local historians and historical societies were contacted by telephone or by mail, and information on potential sites and areas of sensitivity along the route was requested. The 1988 Resource Report includes a table of sites identified, including historic structures and districts, prehistoric and historic archaeological sites, and National and State Registers of Historic Places (NRHP) sites.

The 1990 research effort was undertaken in order to update and expand on the research regarding known cultural resource sites that was conducted from 1986 to 1988. Specifically, site files at the above mentioned agencies were consulted, and any sites that had been added since 1988 were recorded. Any additional information on these sites, or previously recorded ones, that would be of value in the evaluation of resources identified during the field surveys of the proposed route was also recorded. Cultural resources survey reports on file at the University of Connecticut also were consulted for background information on the areas crossed by the proposed route.

Local authorities with the New Milford Historical Society, the New Milford Trust for Historic Preservation, the Brookfield Historical Society, and the Milford Historical Society, as well as the Newtown town historian, and a local private historian in Brookfield were contacted, and their collections reviewed. Efforts to contact individuals or organizations in Sherman, Monroe, Shelton, and Stratford were unsuccessful.

Additional documentary research also was conducted to evaluate the sensitivity of areas along the route for historic sites, particularly historical maps and local histories. This work was completed during the 1990 research effort. Historical maps were consulted at state and local collections, including the Connecticut State Library, the University of Connecticut, the Yale University Library, and the New Haven Colony Historical Society.

Copies or tracings were made wherever possible. Sites and structures on these maps were checked against the proposed pipeline route and all sites found to be within 0.5 mile of either side of the centerline of the route were plotted on current USGS topographic maps as accurately as possible based on natural and man-made features. In areas of dense settlement, where the proposed right-of-way is constrained to a specific location (such that route refinements are unlikely) and where it would be difficult to record all historic occupations within 0.5 mile of the route, only those sites that appeared most likely to be potentially impacted were recorded. This was necessary in parts of Brookfield (Iron Works Village), Newtown (Sandy Hook), and the City of Milford. Local histories were consulted and checked for references to sites or names associated with sites identified from the maps, as well as for general histories to towns through which the pipeline passes. All the information on potential sites was gathered from written and oral sources. No field inspections were conducted to determine the condition of the sites.

IV.8 AIR QUALITY AND NOISE

Ambient air quality is protected by federal and state regulations. The USEPA has developed ambient standards for certain criteria air pollutants. These standards are referred to as the National Ambient Air Quality Standards (NAAQS). Connecticut's air quality standards are the same as the NAAQS.

The noise environment along the proposed route varies as a function of land use. Because the pipeline route in Connecticut traverses areas ranging from undeveloped/rural residential to highly urbanized, ambient noise levels can be expected to vary significantly.

V. ENVIRONMENTAL IMPACTS, INCLUDING CONSTRUCTION PRACTICES AND OTHER MITIGATION MEASURES TO MINIMIZE NEGATIVE EFFECTS.

V.1 PHYSIOGRAPHY, TOPOGRAPHY AND GEOLOGY

The overall effects of construction, operation, and maintenance of the proposed pipeline on topography and geologic resources will be minor, limited primarily to impacts resulting from construction activities. Similarly, the potential for the pipeline to be affected by geologic hazards also is low. These potential impacts are discussed below. The project will not affect physiography.

V.1.1 Construction

The impacts to topography and geology along the land portion of the pipeline as a result of construction activities will be temporary and generally minor. The impacts typically will be mitigated by the use of standard construction techniques and by adherence to applicable regulations. In addition, because the right-of-way will be restored and revegetated after construction, no significant long-term effects on geology and topography should occur.

Impacts on topography will be limited primarily to the construction phase, during which conditions along the right-of-way will be temporarily altered. Steep slopes will be locally recontoured in order to install the pipe. However, after the completion of construction, topographic and drainage conditions along the entire right-of-way will be restored as closely as possible to their preconstruction state.

On some slopes that require cut and fill, the exact preconstruction features will not be restored. This also is true for areas of rock outcrops and slopes considered to be unstable. The impact on topography in these areas will be long-term but generally minor.

Construction of the pipeline in areas where bedrock is relatively close to or at the surface will require both grade and trench blasting. Grade blasting will be required to level off rock outcrops in order to allow the preparation of a relatively level surface along the right-of-way for construction equipment. Trench blasting will be limited to the placement of subsurface charges to create a trench area of sufficient depth for the pipe.

To minimize the effects of blasting, various standard procedures will be employed. The handling, transportation, storage, and use of explosives will be in accordance with all applicable regulatory requirements. Explosives will not be primed or fused until immediately before use, and nearby residents will be given appropriate advance notice of the blasting activities. Warning signs, fences, or barricades will be erected as needed. In addition, procedures for controlling vibration and fly-rock will be employed in the vicinity of populated areas, as well as where the proposed pipeline follows existing pipeline rights-of-way or is near existing power transmission lines. Precautions will be taken to avoid impacts to landowners' domestic animals, structures, wildlife, and existing utility lines.

The overall impact of blasting activities will be short-term, lasting only for the duration of construction activities. To minimize the impact of blasting on noise receptors, all blasting will occur during daylight hours (after 9 a.m. near residences and other sensitive areas), and controlled blasting techniques will be used. Excess rock will be windrowed or otherwise disposed of in appropriate areas, in accordance with applicable regulatory requirements and good engineering practices. A blasting consultant will be employed for each construction spread.

V.1.2 Operation and Maintenance

The operation and maintenance of the pipeline will not affect topography or geology. However, the geological conditions along the route could affect the pipeline, although the probability of this is extremely low.

For example, concerns with respect to seismic hazards along portions of the route relate principally to the secondary effects produced by intense and prolonged ground shaking -- that is, soil liquefaction or landslides. However, the probability of an occurrence of an earthquake near the pipeline that would produce these secondary effects in sufficient magnitude to damage the pipeline is extremely low. Earthquakes that have occurred within 50 miles of the pipeline route in the past have all been of low intensity. Moreover, there is no historical evidence of fault movement or ground displacement from seismic activity in the area. The potential for rupture of the pipeline due to earthquake movement is therefore considered to be very low.

The potential for landslides triggered by earthquake events along the route also is extremely low, since the pipeline has been aligned to avoid landslide-prone soils and slopes. This also is due to the low magnitude of intensity of historical seismic events in the project area, as well as the relative absence of unstable soils on steep slopes within earthquake-prone regions along the route.

Moreover, the pipeline is designed in consideration of the maximum expected earthquake in the area; this typically has a probability of 0.005% (i.e., a 1 in 200 years event). Pipeline design (and pipe wall thickness) will specifically take into account potential seismic loadings, in combination with the operation and other supplemental loads acting on the pipeline. In addition, because strain concentrations may occur on overbends and sagbends, Iroquois will ensure that pipe bends are not made in saturated wetlands where soil strength is low, will use thicker pipe, or will anchor such bends (see Iroquois Resource Report No. 6, p.6-38).

Because the overall impacts of pipeline construction, operation, and maintenance will be minor, no significant cumulative effects to geologic resources are expected to occur.

V.1.3 Mitigation Measures

Topographical and geological conditions were among the primary engineering and environmental considerations when identifying the pipeline route. Construction through mountainous terrain and areas with excessively steep slopes or other irregularities, such as escarpments, may be precluded from an engineering standpoint. Pipeline construction along steep side slopes is difficult from an engineering standpoint because more excavation is required to create a level work space, and damage to the in-place pipeline (e.g., from landslides) is more likely to occur if the pipeline traverses side slopes than if it is constructed directly up-slope. In addition, adequate long-term, stable restoration of the right-of-way may be difficult in areas of severe topography. This could result in erosion or landslides along the right-of-way which could affect the structural integrity of the pipeline and cause impacts to water, soil, and visual resources.

Geologic considerations of importance in pipeline routing include: the potential for geologic hazards, such as in areas of high seismic activity or potential landslides; the depth to the underlying bedrock, which, if shallow, would require extensive blasting; the nature of the underlying bedrock itself; and the presence of unique geologic features and mineral resources.

These alignment considerations have played a major role in the routing process. For example, steep slopes, erosion prone areas, and areas of potential subsidence, slumping and landsliding have been avoided or minimized. The consideration and avoidance of severe topography and geologic hazards during the routing process not only serves to protect the integrity of the pipe from an engineering standpoint, but in turn lessens or eliminates associated environmental impacts brought on by construction, and minimizes right-of-way restoration and maintenance efforts and costs.

Iroquois will use various measures during construction to minimize or avert impacts. Such impacts will be primarily related to the drilling and controlled blasting that will be required to dig the trench in areas of solid rock. The principal mitigation measures that will be used include:

- Performance of all blasting activities under the direction of special blasting consultants (there will be one for the mainline spread in Connecticut).
- Use of standard safeguards, such as matting, to control fly-rock and to minimize vibrations and air-blast, which could not potentially affect the integrity of nearby structures.
- Monitoring of activities in any wetlands where blasting is required, to ensure that drainage patterns are not

affected by blasting-induced fissures. If necessary, Iroquois will consider the use of bentonite or other suitable material to seal the trench.

Iroquois will perform various types of geotechnical investigations before construction, and will conduct geotechnical monitoring in selected areas as necessary subsequent to construction. These studies are conducted both to identify specific geological and physical information concerning the pipeline route and to ensure that project construction will not adversely affect local environmental conditions such as wetlands, springs, and watersheds. Iroquois has conducted geotechnical investigations of the land portion of the pipeline route (H&A 1987), as well as the marine portion of the alignment. The basic objectives of these studies are summarized below.

Prior to construction, an evaluation and analysis of existing data are performed to determine the distribution and characteristics of the surficial materials along the pipeline route. USGS topographic maps and soils maps were used in combination with aerial photo interpretation to identify surface materials. More specific information was provided through review of published journals from government and private agencies. From these source materials, and selected field verification visits, the geotechnical properties of the surface materials along the pipeline route can be established with a reasonable level of confidence. For areas requiring more detail (e.g., major water crossings), geotechnical drilling programs were initiated to gather the required subsurface data (H&A 1987). The results of the geological and geotechnical evaluations provide the benchmark for final pipeline design and construction planning.

During construction, the locations requiring special design as identified by the results of the geotechnical evaluations are reflected in the construction drawings and must be adhered to under the terms of the contract. This is ensured through on-site inspection and, if certain specific sites require a more complex geotechnical design, inspectors with specialized soil and geotechnical backgrounds will be assigned. After construction, all aspects of the design will be reviewed during routine right-of-way inspections and surveillance.

In addition, Iroquois will take special precautions to ensure that blasting does not affect the quality or quantity (yield) of groundwater wells in the vicinity of the pipeline. When landowners are contacted during the preconstruction line location survey, information will be obtained concerning the specific sites and depths of any wells within 300 feet of either side of the right-of-way in areas in which blasting is required. If blasting is required in the vicinity of any such wells, prior to construction, Iroquois will take measurements of water quality and yield. If any concerns about well quality or yield arise subsequent to construction, Iroquois will remeasure the wells and, as necessary, implement appropriate remedial actions. This is in accordance with FERC's recommendations.

V.2 SOIL RESOURCES

This section describes the potential impacts to soil resources as a result of the construction, operation, and maintenance of the project. The project's potential cumulative effects on soil resources also are discussed, as are measures to avoid or minimize impacts.

The construction of the project will principally involve short-term or minor impacts to soil resources. These will result from the excavation of the trench area, as well as the potential for compaction of soil along the right-of-way caused by the movement of heavy construction equipment. There also is the potential for erosion and sedimentation to occur during construction in areas of steep slopes (for purposes of pipeline construction, these are considered generally to be those greater than 15°) or in sloped areas characterized by highly or potentially highly erodible soils.

However, these impacts are expected to be minor and to be limited primarily to the construction period, because Iroquois will adhere to strict procedures for minimizing potential effects to soil resources. These include adherence to the project-specific Soil Erosion and Sedimentation Control Plan (as contained in the D&M Plan); implementation of special techniques to segregate topsoil from subsoil, mitigate the effects of compaction during construction, and restore compacted areas after construction; and use (during construction) of environmental inspectors with authority to enforce all environmental stipulations, including those related to soils.

Construction of permanent aboveground facilities and access roads to such facilities will result in long-term impacts to soils only in those areas where aboveground facilities are located. Iroquois will adhere to the same strict procedures as developed for the construction of the pipeline for minimizing potential soil resource impacts in these areas.

The operation of the pipeline will not adversely affect soil resources because once the pipeline is in place, no disturbances to soil will be required, with the exception of infrequent, non-routine maintenance activities (which may involve pipe excavation). However, such activities, if required, will be performed using the same procedures to minimize impacts to soils as discussed for construction.

V.2.1 Construction

Construction will cause minor impacts to soils, resulting primarily from the disturbance to the soil horizon in the trench area, the possible compaction of soils on the right-of-way, and the increased potential for soil erosion.

Soil erosion is a potential hazard along certain areas of the route. Two types of erosion are of concern: water erosion and wind erosion. The potential for soil loss due to water erosion in unprotected areas along the route is a function of various factors, including the soil's inherent properties (i.e., erosion factor (K)), the percentage and length of slope, and the duration and intensity of rainfall. Many of these soils are found on the steep side slopes of kames, eskers, drumlins, and stream terraces. Certain areas of slopes of 15° or greater are located along portions of the route in Connecticut (see the maps in Volume 2).

Soil erosion impacts along the right-of-way could potentially occur during all phases of construction, ranging from clearing to restoration and revegetation. However, various procedures will be used to insure that these impacts either do not occur or are minor.

For example, the potential for wind and water erosion during construction will be minimized by the use of standard erosion control techniques. These methods will be specified in the D&M Plan, and will be in accordance with general FERC recommendations and with Connecticut soil erosion control guidelines.

Another potential soil impact from pipeline construction is the temporary disturbance to farmland. The degree of disturbance depends on such factors as soil type and condition, weather (soil moisture) conditions, type of construction equipment, and the preventive or mitigative measures employed.

In areas that are presently farmed or have the potential for farming, topsoil and subsurface soils can become mixed during the construction process; this can significantly decrease the fertility of the soil and hence the long-term productivity of the land. In addition, if the right-of-way is not revegetated, productive soil may be lost by erosion. The passage of heavy equipment over the right-of-way may cause soil compaction, rutting, and, as a result, loss of organic matter, which will also adversely affect long-term farmland productivity if not properly mitigated.

Some of the agricultural land crossed by the route also is artificially drained, or the terrain has been altered to increase surface drainage. Disruption of the drainage patterns can result in the soil becoming anaerobic if saturated with water for long periods. The lack of air will render the soil non-productive.

Agricultural production also can be affected in other ways as a result of project construction. For example, construction debris (e.g., portions of welding rods), spills of fuels during the movement or operation of equipment on the right-of-way, and the introduction of stones to surface soil layers may interfere with agricultural practices and result in the reduction of productivity. Similarly, the introduction of weeds into the revegetated right-of-way may result in their spread into the adjacent cropland where the weeds will compete with the desired crops for soil moisture and fertility which results in a lower crop yield.

Landsliding is a potential impact related to soils along some areas of the route. Landslides occur when the gravitational forces which tend to move earth materials down a slope are greater than resisting forces which tend to oppose such movement. The most common restricting force is the shear strength of the soil material. Areas with a high probability of landsliding generally have the following characteristics: steep slope, low shear strength, potential for water seepage, and high pore water pressure.

The pipeline route crosses several soil areas or associations that are characteristically corrosive to steel. Areas of these soils occur in most of the counties crossed by the route and some may be traversed by the right-of-way. However, the alignment of the pipeline through these areas will not result in damage to the integrity of the pipe because of the use of standard corrosion prevention procedures and pipe coating procedures. The include coating the pipe with a protective material (i.e., fusion bond epoxy) and the provision of cathodic protection.

V.2.2 Operation and Maintenance

The operation of the project will not result in adverse impacts to soil resources. Immediately after construction, the entire right-of-way will be restored and revegetated in low grass or shrub cover, or in the case of cultivated land or pasturelands, returned to agricultural use. Soil compaction and rutting will be relieved as part of the overall right-of-way restoration process. This will be performed immediately after the completion of construction. Iroquois will monitor crop productivity on the right-of-way for at least two years after construction to ensure that full productivity is restored. In addition, because Iroquois will conduct weekly aerial surveys of the route, any evidence of activities that could lead to erosion or slope instability (e.g., use of the right-of-way by off-road vehicles which could cause rutting and lead to erosion; evidence of inadequate vegetative cover) will be immediately noted and rectified.

In the unlikely event that pipeline maintenance activities require excavating, the same methods to ensure the minimization of impacts to soil resources, including erosion and sedimentation controls instituted for pipeline construction, will be applied.

Unauthorized use of the right-of-way by all-terrain vehicles (ATVs) may disrupt or prevent the restoration effort. The passage of unauthorized ATVs can severely damage right-of-way revegetation efforts or agricultural crops, resulting in the exposure of soils to the forces of wind and water erosion. Erosion of the soils, especially on steep slopes, may effect the integrity of the pipe itself. In addition, unauthorized access may result in the opening of gates and fences, resulting in the escape and/or loss of livestock. Iroquois will work with the individual landowner to determine appropriate techniques to prevent unauthorized ATV use of the right-of-way and will monitor the effectiveness of these techniques during routine aerial inspection of the right-of-way.

Construction of the proposed Iroquois pipeline and associated facilities will result in limited, temporary soil erosion and deposition, increased potential for soil slumping on steep slopes, and a temporary decrease in productivity on agricultural land due to soil compaction and soil horizon mixing. The proposed project would be expected to cause some soil erosion during construction as a result of site preparation, loss of vegetative cover, and soil stockpiling. Limited long-term impacts to soil will occur at aboveground facility locations where soils are displaced by the facilities or access roads to them.

No further cumulative impacts to soils would occur once the project began operation and the pipeline right-of-way was revegetated. Overall impacts to soils in Connecticut would be insignificant over the long-term.

V.2.3 Mitigation Measures

Restoration and erosion control measures will be implemented to mitigate potential impacts on soils resulting from pipeline construction, operation, and maintenance activities. The mitigation measures will generally be in accordance with FERC recommendations (as presented in the DEIS, except as otherwise noted in Iroquois' February 1990 comments thereto: see Appendix C). Soils identified as occupying steep slopes, and having high susceptibility to erosion, will receive particular attention. For the design and implementation of restoration measures, steep slopes will be considered to be those with a greater than 15° slope. Depending on degree of slope, type of soil, and other site factors, methods such as use of excelsior or straw mulch with plastic netting, geotextile fabrics, mats, hydromulching or hydroseeding, and construction of berms or terraces may be required to control erosion, preserve natural drainage patterns, and improve vegetation establishment in these areas. Other measures that will be used to stabilize disturbed soil material, reduce soil loss due to erosion, revegetate the right-of-way and restore soil productivity are:

- o Removal (stripping) and replacement of topsoil (A horizon) on agricultural lands and on lands for which the landowner requests topsoil conservation.

- Construction or placement of both temporary and permanent erosion control features to limit steepness and length of slope (e.g., water bars, collection ditches, terraces, riprap, or sand bags or straw bales for temporary control).

- Construction of surface or subsurface drainage control measures to increase steep slope stability (e.g., drainage gutters or gravel filled cut-off trenches).

- Seedbed preparation of the disturbed areas on the right-of-way including, if necessary, surface roughening and tilling across slope.

- Application of seed mixture (adapted grass or other plant species) which have been approved by the surface management agency and/or landowner.

- Addition of soil amendments, such as fertilizer, if necessary, and the use of appropriate seeding methods (e.g., drill seeding and broadcast seeding) to enhance the degree of germination and rooting.

- Mulching with hay, straw, or wood fibers, as and if necessary.

- Crimping of mulch on the contour into the soil or tacking netting over an organic mulch to hold the mulch, soil, and soil mixture.

- Monitoring of disturbed areas to identify potential soil instability or eroded areas and to implement the required revegetation measures to restablize the soils.

Controls will be applied to limit the potential for erosion both during construction and immediately after construction (i.e., until vegetation along the right-of-way is reestablished). Temporary soil erosion controls will be applied until revegetation measures can be properly applied. The USDA SCS has developed standards and specifications for temporary erosion/sedimentation control, specifically for those regions of Connecticut traversed by the proposed pipeline. FERC has similarly recommended standard procedures for soil and erosion control. Soil erosion control structures will be designed to temporarily control run-off until disturbed areas have become stabilized. Various temporary structures, such as diversion dikes, interceptor dikes, perimeter dikes, straw bail dikes, interceptor swales, stone outlet structures, sediment basins, and sediment traps, are proven effective measures when correctly implemented and maintained. Other methods may involve the use of hay mulch, jute netting, or other suitable matting.

Within six working days of final grading (i.e., following replacement of topsoil), in areas of the right-of-way subject to erosion, Iroquois will seed or seed and mulch the right-of-way. Only where seasonal weather conditions would render reseeding futile will Iroquois postpone reseeding. In such cases, other appropriate methods (e.g., mulching, matting, berming) will be employed to ensure that erosion is minimized.

In developing plans for revegetating the right-of-way, Iroquois will consult with landowners as well as the appropriate regulatory agencies to determine appropriate seed mixtures and application rates.

V.3 WATER USE AND QUALITY

V.3.1 Surface Water Resources

The construction and operation of the proposed pipeline across streams and rivers will generally result in minor and short-term impacts. These will occur as a result of in-stream construction activities, or construction on slopes adjacent to streams. Potential impacts as a result of these and other construction-related activities could affect both surface water/sediment quality and surface water use.

General Construction

The principal impact on surface water quality will result from in-stream construction, which will generate a localized increase in suspended sediment. This will result in increased turbidity levels and downstream sedimentation. In addition to in-stream construction, the introduction or resuspension of sediment in watercourses along the route may result from streamside construction, trench dewatering operations, and soil erosion along the right-of-way. (Small staging areas will be required adjacent to the certain crossing locations, such as the Still, Pootatuck, and Farmill rivers. In addition, an 8-acre staging area is required for the crossing of the Housatonic River; this staging area is planned on the Milford side of the river.)

However, because of the relatively short period of time required for construction activities in or near bodies of water, and the small area of impact, the overall effect on regional water quality will be minor and short-term. These impacts will be further minimized by the use of special construction procedures and erosion and sediment control techniques. These construction techniques are discussed in detail in Iroquois' Resource

Report No. 1; 1986 ER (Section 5.3, Volume; Appendix A, Volume 2); and in Iroquois' application to the COE.

Standard water crossing procedures have been established to install the pipe safely and efficiently while maintaining downstream water flow, use, and quality. To insure this, temporary erosion and sedimentation control measures will be used to minimize potential impacts to streams and rivers during construction. Such measures may include limitation of the duration of in-stream construction activities during "wet" crossings; placement or installation of runoff barriers along stream banks; installation, where appropriate, of culverts, flume pipes, or temporary bridges for access across streams; use of the "dry" crossing method at certain streams by the installation of flume pipes to isolate the water column or the use of sand bag dikes and pumping the water around the work area; and post-construction restoration and revegetation of stream banks, staging areas, and the right-of-way. If necessary, and where appropriate, sediment control devices such as silt curtains will be used to further limit the areal extent of downstream sedimentation and turbidity by confining the impact zone to the immediate construction area.

The selection of a suitable water crossing procedure (either "wet" or "dry") is influenced both by the environmental sensitivity of the water body, and by engineering feasibility (for example, the use of the dry crossing technique is precluded by certain physical stream characteristics related to stream width, depth, and bottom type). Water bodies may be considered sensitive to pipeline construction for a number of reasons, including but not limited to: downstream municipal water supplies; critical habitat; presence of threatened or endangered species; migratory fish passage; or recreation/high quality visual resource value.

At each environmentally sensitive water crossing, preconstruction studies will be conducted to determine the most suitable crossing procedure and mitigative measures. However, when installed quickly, efficiently, and with due consideration for these sensitivities, wet crossings have normally been found to cause only a short-term impact, limited to sedimentation. For water bodies highly sensitive to sedimentation, dry crossings may be considered preferable, providing they are practical. When employed at suitable locations, dry crossing procedures can reduce the duration of sediment-generating in-stream activities. Where dry crossings are impractical, quick and efficient wet crossings within a suitable construction window and employment of suitable mitigative measures are the usual alternative. This would limit the sedimentation to the immediate construction area.

In general, construction through surface water resources will be conducted during low-flow periods. In Connecticut, low-flow conditions may exist into December. In addition to such timing restrictions, critical biological periods (e.g., fish spawning and migration periods) also will be avoided; this is discussed further in Iroquois' Resource Report No. 3 (and was described in the 1986 ER, Volume 1, Section 5.6).

The specific construction measures that Iroquois will follow at water crossings are presented in detail in Section III.3 of this document; in Iroquois' 1988 Resource Report No. 1 and in the 1986 ER, Volume 1, Section 5.3 and Volume 2, Appendix A. Iroquois will require its construction contractors to comply with these and other relevant procedures recommended by FERC during pipeline construction and right-of-way restoration.

To avert contamination of surface waters during construction, Iroquois will require that construction-related activities (such as vehicle refueling and equipment maintenance) will be conducted at an appropriate distance from surface waters, and that the contractor not permit liquid or solid wastes or fuels to be deposited upon the ground or into bodies of water contrary to applicable laws, regulations, and guidelines. When servicing requires the drainage or pumping of lubricating oils or other fluids from the equipment, a groundsheet of suitable material and size should be spread on the ground to catch the fluid in the event of a leak or spill. An adequate supply of suitable absorbent material and any other supplies and equipment necessary to immediately clean-up inadvertent waste or fuel spills also must be available. Storage and disposal of liquid wastes and filters from equipment maintenance and any residual material from spill clean-up must be in accordance with procedures discussed above.

Iroquois will insure that any reportable spills or incidents involving waste oils, fuels, or hazardous wastes are handled appropriately, in compliance with applicable federal requirements. These measures will limit the potential for any accidental spills that may occur from reaching the water and causing impacts to water quality and aquatic resources.

During construction, water obtained for hydrostatic testing will be acquired from sources of ample supply, so as not to interfere with normal stream flow or supply volumes. The release of the hydrostatic test water and discharges from trench dewatering will not impact surface water resources. No chemical additives will be used to test the pipeline, and the discharge quality and flow rates will be in compliance with all applicable requirements. The quality of the trench dewatering discharges will be a reflection of the existing surface water/groundwater, as well as that of the disturbed material.

Rivers and Streams

The potential impacts of pipeline construction and operation on watercourses are a function of the existing characteristics of the stream or river (e.g., streambed condition, stream type, water quality and use), as well as the type and duration of construction across the watercourse.

Impacts to Substrate. Impacts of pipeline construction activities on substrate at watercrossings are expected to be short-term, localized, and minor. Temporary stockpiling or sidecasting of material excavated from the trench will alter the elevation of the substrate in the immediate vicinity of the trench. However, the material will be returned to the trench immediately following placement of the pipe and the bottom contours (and thus elevation of the substrate) returned to grade. In addition, provisions will be made to ensure that normal water circulation patterns, current patterns, and water flows and fluctuations are maintained during construction, while the dredged material is temporarily stockpiled.

Trench excavation and temporary spoil stockpiling will adversely affect bottom-dwelling organisms on a localized basis; however, benthic forms should readily recolonize the areas after construction, since the construction sites will be restored and the fill material will be similar in physical and chemical nature to the site. Impacts to substrate and substrate biota will also be minimized to the extent possible by scheduling construction activities in low-flow periods to minimize the downstream transport of sediment.

Suspended Particulates/Turbidity. Construction activities in watercourses will result in a short-term increase in the level of suspended particulates, resulting in higher turbidity levels. However, the increase in suspended particulates will be short-term, lasting only during the period of in-water construction activity. In most streams, increased turbidity may occur downstream for a short distance.

Some additional sediment transport may occur during the first high flows following construction, as particulates which settled during low-flow conditions are resuspended by higher flows. Studies have shown that about 50% of the sediment suspended as a result of construction across streams generally settles out of the water column within 150 feet of the construction site. At 0.5 miles downstream, no deposition is typically evident (Michigan Public Service Commission 1978). However, the transport of sediments downstream necessarily is a function of the type of sediments at the crossing point, as well as water flow and channel configuration. For example, coarse sediments (sand and gravel) will be redeposited a limited distance from the construction site, whereas fine sediments (fine sand, silt, clay) can remain in suspension longer. Studies also have shown that while suspended solids concentrations increase during construction, levels decrease to near normal conditions within 12 hours after trenching (Schubert et al. 1985).

Increases in levels of suspended particulates with a high content of organic matter may result temporarily in reduced levels of dissolved oxygen in the water column. This is most likely to occur in wetlands and slow-moving streams. However, these impacts will be highly localized since the low water flow and velocity which allow the accumulation of organic sediment also would limit downstream sediment transport.

Temporary increases in suspended sediment levels in streams will alter the chemical and physical characteristics of the water column at the construction sites on a short-term basis. Those characteristics most likely to be affected include color and clarity. However, overall impacts to water quality are expected to be short-term and minor because construction in streams will proceed as rapidly as possible, and disturbed sites will be restored as near as practicable to preconstruction conditions.

Current Patterns and Water Circulation. Instream pipeline construction activities will have no major adverse effects on water circulation, current patterns, or normal water fluctuations in rivers and streams, since Iroquois will take care to ensure that normal flow patterns are maintained. No significant permanent changes in bottom topography or stream channel configuration will occur.

Housatonic River Crossing. The installation of the pipeline at the Housatonic River crossing will require approximately two months. To ensure that impacts to the use of the Housatonic River will minimized, Iroquois will use special construction techniques. Because of the maximum depth and width at the proposed crossing of this river (the Housatonic River is about 9 feet deep and 750 feet wide), conventional stream crossing procedures cannot be used. A special construction spread will be established at the crossing and floating dredges will be used to drill, blast, and dig the trench and install the pipeline.

A rock drilling assembly, mounted on a barge, will be used to drill -- and explosive charges will be placed to open -- the pipe trench since tests at the crossing have indicated that rock will be encountered on the Stratford side of the river. The pipe will be welded onshore and pulled into place. Once installed, the river bottom contours and slope will be reestablished. The navigability of the river will not be affected by construction activities, since stream flow will be maintained throughout the construction period.

To minimize the potential for erosion and sedimentation, the staging area will be located well back from the river bank within an area formerly used for sand/gravel mining. Precautions also will be taken to protect against bank erosion during construction.

Construction activities in the river will be conducted to insure that commercial vessel movements, recreational activities, and fish passage will not be adversely affected. For example, construction across the navigable channel will be in accordance with Corps of Engineers permit requirements and the applicable regulations of the U.S. Coast Guard and the Siting Council.

Operation and Maintenance.

The operation and maintenance of the pipeline will not affect the water quality of the streams traversed. Routine inspection activities associated with the operation of the pipeline system will have no effect on surface water, since most inspections will be conducted by aerial observation.

The only potential impacts on water quality associated with the (non-routine) operation of the system would be if a pipe segment requires repair or replacement beneath a watercourse. The repair or replacement of a segment of the pipe within a watercourse will result in the same types of impact as described for the initial construction; that is, short-term, localized, and minor impacts to water quality. These impacts will be mitigated by the use of appropriate sedimentation and siltation controls.

In the event of an underwater leak in a pipe, natural gas will be released into the aquatic system. However, natural gas, which is primarily methane, is highly insoluble in water and not toxic to acquatic biota. The gas would merely bubble to the surface and disperse into the atmosphere, and would have no impact on the aquatic system or on water quality.

Municipal Surface Water Supplies

In Connecticut, the route crosses upstream of two reservoirs in the City of Shelton -- Means Brook Reservoir and the Shelton Reservoir No. 2. The Shelton Reservoir is inactive with no immediate plans for use. Means Brook Reservoir is not used directly as a drinking water source; instead, surface waters flow from Means Brook Reservoir into Trap Falls Reservoir. Since the pipeline will cross Means Brook upstream of the Means Brook Reservoir, no significant impacts on water quality are expected. In the City of Milford, the pipeline will traverse within 0.3 miles of the watershed of the Beaverbrook Reservoir (also referred to as the Milford Reservoir), which was part of the South Central Connecticut Regional Water Authority. This reservoir has been deactivated as a water supply source and will serve mainly as a recreational facility in the future.

Impacts to drinking water supplies downstream of the pipeline will be minor and short-term because of the temporary duration of construction activities and the mitigation measures that Iroquois will employ to limit effects on surface water quality and quantity. Potential impacts to surface water supplies will be minimized by the use of standard sedimentation controls, which will limit downstream sedimentation.

Water-Related Recreation

The pipeline will traverse areas used for water-related recreational activities. However, neither the construction nor the operation of the pipeline will result in the long-term impairment or destruction of the resources that support these activities. Impacts to water-related recreation will involve mainly short-term inconveniences associated with construction across streams and rivers. For example, construction across the Housatonic River may limit recreational boating, swimming, and fishing in the immediate vicinity of the construction site. However, this impact will be highly localized and limited to the period of in-water construction activity.

The construction of the pipeline also will result in short-term and highly localized aesthetic impacts associated with aquatic ecosystems. These impacts will stem from the disruption of riparian vegetation along the right-of-way and the localized and short-term degradation of water quality at the pipeline stream crossing locations. However, these impacts will be limited to the construction phase. The operation of the project will not cause adverse effects on water resource-related aesthetics (i.e., the pipeline will not result in persistent or permanent water quality degradation, the denial of access to or visibility of the resource, or changes in noise, odor, or air quality).

Similarly, the implementation of the project will not involve the discharge of dredged or fill material at any preserves, federal parks, wilderness areas, or national seashores. The construction and operation of the project through Silver Sands State Park will not result in adverse modifications to the recreational use or aesthetic value of the area and will not result in a reduction in the use of the currently undeveloped park.

Construction and operation of the proposed pipeline will generally not impact or be affected by flood hazard areas. Although floodplains are associated with most of the rivers and streams crossed, the potential for impacts associated with construction and operation of the pipeline is minimal. Significant flooding during construction of the pipeline through a floodplain could result in various impacts. For example, floodwaters could potentially transport sediment, slash, construction debris, and construction materials into the stream, resulting in water quality impacts. Similarly, current or ice scour during floods could expose the installed pipeline and cause damage to it.

However, by using special construction techniques in flood hazard areas and by generally avoiding the placement of aboveground facilities in 100-year floodplains, these impacts will be avoided. For example, construction of the pipeline will be conducted during low-flow periods (i.e., late spring, summer, fall). The pipe will be placed at sufficient depth below the streambed to be a minimum of 5 feet below any slurried organic muck and potential current or ice scour. The pipeline will be weighted to provide negative buoyancy. This will prevent flotation during flood conditions. Pipe weighting will be achieved either by using concrete saddle weights or by installing pipe pre-coated with concrete. In addition, slash and other construction debris will not be stored along portions of the right-of-way within flood hazard areas; this will insure that such materials will not become waterborne in the event of a flood.

V.3.2 Groundwater Resources

The pipeline route traverses within 1.5 miles or less of municipal and private groundwater wells that provide sources for drinking water (refer to

Section IV.3). It is possible that under certain circumstances, grade or trench blasting along the right-of-way in the vicinity of such wells could potentially alter localized groundwater flow patterns and thus adversely affect well water pressure or quantity. This in turn could result in major inconveniences to residents using the affected groundwater supplies. Specifically, it is possible that the yield of the existing wells could be so significantly affected that new wells would have to be dug with potable water supplied from other sources in the interim. Alternatively, if the groundwater table rises as a result of construction activities, localized basement flooding could occur.

To ensure that such impacts do not occur, Iroquois will hire a qualified consultant who will inventory all public and private wells within 300 feet of the route in areas where blasting is required. This procedure is in accordance with FERC recommendations. Iroquois will specifically inventory water quality, water level, and water pressure in each well both prior to and after construction. In the event that any adverse impacts to groundwater drinking supplies are reported subsequent to construction, Iroquois will investigate such reports. If appropriate, Iroquois will compensate the affected individuals or municipalities for the development of new wells, and will provide interim sources of potable water.

No impacts will occur to the groundwater as a result of the operation or maintenance of the project. Natural gas is not soluble in water. Thus, even in the unlikely event of a leak, the gas that would escape would quickly migrate to the ground surface, and disperse to the atmosphere. Because the gas would temporarily replace oxygen in the soil, and thus discolor immediately adjacent vegetation, the leak would be detected during routine aerial reconnaissance of the route.

V.3.3 Wetlands

The activities associated with pipeline construction will not result in any permanent loss of wetlands. Following construction activities, spoil will be returned to the trench; all natural contours will be restored to ensure that the wetland hydrology is not altered; provisions will be made to ensure natural flow patterns are maintained to prevent excessive flooding or draining of wetland areas; natural vegetation will be allowed to reestablish over the entire right-of-way; and trench breakers will be used to ensure that the trench does not act as a conduit, draining the wetland.

The construction procedures that will be used to cross wetlands will depend on site-specific conditions. For example, if required due to soil moisture, work pads will be used. Clearing will not be required except in wooded wetlands. In such areas, trees will be cut by chain saw; stumps will be left in place except in the area immediately over the pipeline trench.

The typical alternative methods that may be used to construct the pipe in wetlands are described in Iroquois' 1988 Resource Report No. 1, 1987 (as amended in 1989) Corps of Engineers application, and in Section III.3. These include:

- Temporary placement of mats in flooded wetlands to provide a working surface for the movement of excavation equipment across the wetland and for the excavation of the trench. Prefabricated pipe sections will then be either pulled or walked across the wetland, depending on the water table. Weighting of pipe may be required, depending on excavated material. The temporary mats will be removed after construction.

- Use of the "yo-yo" ditch method may be used to cross small distances through wetlands characterized by soils of low cohesiveness. This method involves the use of a wireline/double winch system to which a bucket is attached. The bucket is pulled back and forth across the wetland until the desired ditch depth is achieved. This process can only be used for short distances through wetlands, where clamshell dredges can be used to cast excavated material back into the trench after the pipe is installed.

- In non-flooded wetlands, the installation of a log riprap road (where the wetland is wooded) and/or the installation of filter cloth with a gravel overlay may be used to provide a working base for construction equipment. Logs for the road would be from trees cleared along the right-of-way. Trenching and pipe installation equipment would use this as an accessway across the wetland. As necessary, culverts will be installed to maintain water flow across the right-of-way during construction. The filter cloth and gravel, if used, would be removed from the wetland after the completion of construction. The logs may be left in place to decompose naturally. Topographic and hydrologic conditions will be restored.

In general, the installation of the pipe across small distances of wetlands will involve the use of techniques similar to dry land construction. Dry land construction techniques also may be used in wetland areas with soils that are only seasonally saturated. However, if the trench entering the wetland contains water, ditch plugs will be left in the trench prior to crossing the wetland. This procedure will minimize silt discharges into the wetland and will generally maintain the water level in the wetland during construction. Topographic and hydrological conditions will be restored after the completion of construction.

Pipeline construction activities will result in short-term, localized, minor impacts to wetland hydrology and water quality, as vegetation is cleared from the trench areas, dredged material is temporarily stored in the wetland adjacent to the trench, and temporary roads are constructed for access, where appropriate. These activities will increase suspended sediment levels in the wetlands, particularly in the immediate vicinity of the pipe trench, on a short-term basis. The water quality characteristics most likely to be affected are color and clarity. In addition, the suspension of particulate organic matter may reduce temporarily dissolved oxygen levels in the water column. This impact could occur as a result of construction in wetlands because of the low water flow and velocity that typically characterizes such areas. However, any such impacts would be highly localized (because the low water flow which allows the accumulation of organic sediment also would tend to limit downstream sediment transport) and limited to the duration of the construction period.

In addition, if the route crosses a wetland located on a perched water table, it is possible that construction activities could breach the impermeable layer that maintains the water in a perched condition. This could effectively "drain" the wetland. Iroquois' environmental inspectors will be trained to look for such conditions during construction. If a perched water table in a wetland is breached, Iroquois will consider the installation of bentonite or other suitable material in the trench to reestablish water levels.

V.3.4 Hydrostatic Testing

After the completion of construction and prior to operation of the pipeline, hydrostatic testing will be conducted. The specific procedures used to hydrostatically test the pipeline are discussed in detail in Section III.3 and in Iroquois' 1988 Resource Report No. 1.

Water for the tests will be withdrawn from various freshwater watercourses along the pipeline route as well as from Long Island Sound (to test the marine pipeline). In Connecticut, Iroquois has tentatively identified the Still, Pootatuck, and Housatonic rivers as potential sources of hydrostatic test water. These sources were selected based on instream flow rates, as well as on a line profile of the topography along the project route (indicating locations where topographic conditions would prevent the effective transfer of water between pipe sections).

Test water will be withdrawn from and discharged to the same source: the maximum rate of withdrawal will be 1,800 gpm. Iroquois will conduct all hydrostatic testing operations in accordance with applicable SPDES permit requirements. For example, water intakes will be screened to prevent the entrainment of fish and organic materials such as sticks and leaves. Energy absorbing diffusers will be attached at all hydrostatic discharge points.

Hydrostatic testing may be conducted any time from mid- to late-summer through late fall; the exact timing of the test at a particular location will be tied to the construction schedule along the spread. However, all testing will be conducted so as to avoid critical periods for fisheries in the streams from which or into which test water will be withdrawn or discharged. In addition, Iroquois will not withdraw water during periods of extreme low flow such that significant adverse impacts would result to aquatic resources or water quality.

V.3.5 Cumulative Effects

The cumulative effects of construction of the Iroquois pipeline on water use and quality will be minimal. A short-term increase in sedimentation is expected during the construction of most stream crossings. If all stream crossings in any one basin occurred simultaneously, the additive effects could create a large slug of suspended solids. However, because construction across streams in the basin will occur sequentially over a period of time, this will not occur, and the individual watercourses will be able to assimilate the sedimentation. Only the crossings of the major streams will incur larger quantities of in-stream sediment loading. However, such loading will be individual events; no accumulation of sediment should occur; and the amount of sediment involved, in most cases, should be no worse than during major rainfall events, authorized maintenance dredging, or--in the case of the Housatonic River--in-stream sand and gravel mining.

Cumulative groundwater effects associated with the pipeline also should be minimal or absent. This is because the pipeline is not expected to adversely affect groundwater quality or quantity except possibly in isolated cases where individual wells could be affected by construction-related blasting. If such effects occur, however, Iroquois would implement mitigation so that no long-term cumulative impacts result. In summary, then, any effects due to pipeline construction would be confined largely to the area of occurrence, and no accumulation of effects is expected.

V.4 VEGETATION AND WILDLIFE

V.4.1 Vegetation

Construction, operation, and maintenance of the proposed pipeline will result in both long- and short-term, minor impacts to terrestrial vegetation. Construction of the pipeline will result in the temporary disturbance of existing terrestrial vegetation within the construction area, which in Connecticut will generally be 75 feet wide or less. Following construction, this entire area will be restored and reseeded. Generally, a permanent 50-to 60-foot-wide easement will be maintained as non-woody vegetation, while the remaining 40 to 50 feet will be allowed to revert to its preexisting natural vegetation. The permanent easement will be maintained in non-woody vegetation (e.g., shrubs, grasses, open field, vegetation). Within this area all agricultural-type vegetation, openfield and other low-growing vegetation (e.g., lawn grasses, orchards) will be allowed.

In forested areas, a 50-foot-wide portion of the 60-foot easement will be maintained in a cleared condition. The remaining 10 feet of the 60-foot easement and the 40-foot temporary construction area, will be allowed to revert to preconstruction conditions.

Construction and operation of the permanent aboveground facilities and the access roads leading to such facilities will result in long-term impacts to vegetation. The existing vegetation will be displaced by these facilities for the life of the project. It is estimated that the meter stations will result in removal of about 1.8 acres of vegetation (assuming an average site size of 100'x200' for each), and the valve sites will require 0.07 acres (assuming a 18'x40' site foreach). Although long-term, these impacts will be minor due to the small amount of vegetation to be lost.

Forestland

Construction of the pipeline through forested areas will result in the removal of forest vegetation from approximately 9 to 12 acres for each mile of pipeline (based on the use of a 75- and 100 foot-wide right-of-way, respectively). Of this, all but 6 acres per mile (i.e., a 50-foot-wide area) will be allowed to revert to natural vegetation following construction. This 6 acres per mile will be permanently maintained in non-woody vegetation, representing a net loss of forestland. Where the right-of-way parallels existing highway, railroad, power transmission lines, or utility rights-of-way, vegetation removal will increase the width of the existing permanently maintained right-of-way. However, where the route parallels existing transmission lines, Iroquois proposes to use part of the existing easement for temporary work space. To the extent that forest vegetation has already been removed from these areas, this will serve to limit the need for additional clearing of woody vegetation.

Approximately 60% of the route in Connecticut will traverse forestlands. Construction through these areas will result in the removal of forest vegetation from a maximum of approximately 350 acres. Following construction, forest vegetation will be allowed to become reestablished on approximately 175 acres, while the remaining 175 acres will be maintained in a non-woody vegetation type.

Agricultural and Open Lands.

Construction of the pipeline will also have minor, short-term impacts on agricultural (i.e., cropland, pastureland, cultivated/improved areas) and open lands. The long-term maintenance and operation of the pipeline will not have any adverse impacts on agricultural areas because, following construction through agricultural lands, the pipeline right-of-way will be returned to its preconstruction use.

The route traverses approximately 2.7 miles through existing agricultural land. Construction of the pipeline will result in temporary disturbances to existing agricultural activities on approximately 33 acres; following construction, all agricultural activities will be permitted to reestablish within the entire permanent easement. Potential impacts associated with construction through agricultural lands include: erosion; impacts to soil structure and fertility as the result of compaction, rutting, topsoil/subsoil mixing, and loss of organic matter; bringing rocks and stones to the upper soil layers where they could interfere with farm equipment or other established farm practices; disruption of either natural or tile drain systems; long-term decrease of productivity on croplands; and temporary loss of productivity from the right-of-way and temporary work space for the duration of construction.

However, special construction and right-of-way restoration procedures will be employed during pipeline construction through cultivated and improved agricultural lands to minimize these potential impacts. In addition, landowners will be compensated for any loss of crops or damages.

Pipeline construction through other open lands, such as abandoned agricultural areas, old field, and early successional forest areas, will result in temporary disturbance to existing vegetation within the construction right-of-way, and long-term modification of vegetation within the permanent 60-foot right-of-way. Along the route, approximately 100 acres (75 acres if a 75-foot-wide right-of-way can be used in all areas) of open land will be temporarily disturbed during construction, after which 40 acres will be allowed to revert to its previous condition, while 60 acres will be maintained in non-woody vegetation. Because the vegetation communities found on open land are generally common in the areas through which the pipeline route will traverse, and because these communities are already in an early stage of succession, the impacts of pipeline construction are expected to be minor. In addition, the amount of open, early successional vegetation communities will increase along the route as a result of pipeline construction through forested areas.

During operation and maintenance of the pipeline, the extent to which woody vegetation is allowed to reinvade the permanent 50-to-60-foot right-of-way will be limited by mechanical clearing operations. The 25-to-40-foot temporary work space, on the other hand, will be allowed to revert through secondary succession to naturally occurring vegetation communities.

Wetlands

Construction of the pipeline will result in disturbance to existing vegetation in the wetlands traversed. Following construction and restoration of the pipeline right-of-way, wetland vegetation, including trees, will be allowed to become reestablished within the entire construction right-of-way excepted in forested wetlands in which soils are not permanently saturated. As a result, impacts to wetlands are expected to be minor, although the removal of wooded wetland vegetation will represent a long-term effect, stemming from the duration of time that will be required for the type of vegetation to become reestablished along the right-of-way.

During construction, wetland vegetation will be temporarily disturbed on approximately 71 acres in Connecticut (assuming the use of a 75-foot-wide construction right-of-way and an alignment across a total of 7.8 miles of hydric soils). The disturbance to wetland vegetation will only last for the duration of the construction activities, and following restoration of the right-of-way, wetlands will be allowed to revegetate completely, except for those wooded wetlands with non-saturated soils (allowing woody vegetation to grow directly over the pipe in such areas could pose safety concerns).

For forested wetlands, the impacts would be long-term, as it may take several decades for trees to reach their previous size. However, tree stumps will be left during clearing activities through forested wetlands and the regeneration of stump sprouts will help to speed the restoration of forest vegetation in the wetland. The long-term operation and maintenance of the pipeline will not have any adverse effects on wetland vegetation, once it becomes reestablished, since natural wetland vegetation will be allowed to remain within the permanent right-of-way.

Iroquois has been committed to minimizing impacts to wetland throughout the routing process and will use techniques for wetlands crossings and restoration consistent with the Corps of Engineers' nationwide permit. During the initial environmental review for the Iroquois project in 1986, Iroquois representatives met with federal and state agencies with jurisdiction or review responsibilities over wetland resources. The agencies included the U.S. Army Corps of Engineers (New York District and New England Division), U.S. EPA (Regions 1 and 2), the U.S. Fish and Wildlife Service (Region 5 office in Newton Corners, Massachusetts and field offices in Concord, New Hampshire) and DEP. During these consultations, measures to avoid or minimize impacts of pipeline construction through wetlands were discussed, and Iroquois has adopted procedures recommended by these agencies into its construction and restoration procedures.

In pipeline routing studies, the locations of wetlands based on existing wetland resource maps and aerial photographs were evaluated, and to the extent possible wetlands were avoided by alignment modifications. Because there are limitations to the accuracy of the existing wetland resource maps, Iroquois has always been committed to performing on-the-ground wetland delineations to further identify routing variations to minimize wetland impacts. In 1989, when the Federal Manual for Identifying and Delineating Jurisidictional Wetlands was published, Iroquois committed to delineate wetlands along the entire pipeline route using the federal uniform procedures. In addition, since wetlands in Connecticut are defined solely on the presence of hydric or alluvial/floodplain soils, Iroquois also committed to delineate state regulated wetlands in Connecticut.

Each federal and state jurisdictional wetland will be identified in the field (to the extent that access permission can be obtained)) and depicted on 1" = 500' or 1" = 200' scale aerial photographic alignment sheets. Iroquois will delineate, using field procedures, those wetlands within the pipeline right-of-way. Wetland areas adjacent and hydrologically connected to the right-of-way and contiguous with the wetlands in the right-of-way will be delineated to the extent possible using off-site techniques, since Iroquois does not and will not have access to offsite areas.

With respect to evaluating wetland functional value and quality, the construction of the Iroquois pipeline will have no effect on most of the functional values of wetlands. Pipeline construction will not affect wetland hydrology, all contours will be restored, and following construction, wetlands will all be allowed to revert to their preconstruction vegetation. As a result, pipeline construction will not affect wetland values such as flood storage, nutrient retention, sediment trapping, and groundwater recharge potential; and will have only a minor short-term (or in the case of forested wetlands, potentially long-term) affect on wildlife habitat values. Iroquois will identify potential changes in wetland values that are expected to result from construction after the detailed field studies are performed.

With respect to revegetation of wetlands, Iroquois will rely primarily on natural revegetation to restore wetland habitats to preconstruction conditions, although quick-seeding annual or perennial grasses will be seeded on the exposed areas. The primary purpose for using conservation grasses will be to stabilize the soil and prevent erosion prior to the native vegetation becoming reestablished, as well as to develop a more valuable vegetation cover in areas presently covered with either Phragmites or purple loosestrife. To enhance the natural revegetation process in forested wetlands with saturated soils, Iroquois is committed to cut tree stumps flush at the ground and allow them to resprout following construction. The only exception to this is immediately over the pipeline trench where the tree stumps will have to be removed for pipeline installation.

In shrub and herbaceous wetlands, where soil conditions allow, over the pipeline ditch, Iroquois will strip and stockpile the uppermost organic mat which contains roots and seeds from the wetland plants. This organic mat will be replaced following construction, and the plant material in the organic mat will resprout, enhancing recovery of the wetland. The exception to this is in wetlands dominated by loosestrife or Phragmites, in which the undesirable wetland plants will be buried, and the area reseeded. Allowing wetlands to revegetate naturally will quickly restore the wetlands to their preconstruction conditions.

With a few exceptions, the revegetation procedures described above will be applied to wetlands along the entire pipeline route. Where special revegetation methods are required, specific revegetation plans will be prepared and submitted as part of the D&M Plan .

Iroquois has been aware that certain wetlands along or near the route have been identified as significant wetlands, or are otherwise considered to have unique values associated with their ecological characteristics or ownership. In Connecticut, these include the wetlands along Wimisink Brook which are part of the Naromi Land Trust's Wimisink Sanctuary, wetlands along a tributary to Morrissey Brook which are part of the Weantinogue Land Trust's Morrissey Brook parcel, wetlands along the Still River which are part of the Weantinogue's Still River Preserve, wetlands along Means Brook which are part of the Bridgeport Hydraulic Company's watershed, and Cranberry Pond in the Town of Stratford, a locally unique wetland area that is adjacent to the pipeline route. Iroquois has committed to develop special plans for construction and restoration of wetlands in these areas to insure that hydrologic conditions and ecological values are not adversely affected by pipeline construction. These plans will be presented in the D&M Plan.

V.4.2 Wildlife Resources

Construction of the pipeline will have minor, long-term impacts on wildlife habitat, causing, in turn, localized but long-term impacts on wildlife populations. Since the right-of-way will be maintained in a cleared condition and the associated facility sites will be converted to developed uses for the life of the project, the principal impact will be a shift in wildlife populations using the right-of-way from those species favoring forest habitats to those utilizing more open areas. However, because a substantial portion of the area through which the pipeline traverses is forested, creation and maintenance of a 50-foot right-of-way will increase habitat diversity; this could have both beneficial and adverse effects.

During construction, the clearing and grading of the right-of-way and temporary work space will result in a loss of vegetation cover and could result in limited mortality to less mobile forms of wildlife, such as small rodents, that are unable to escape the construction area. In addition, the general disturbance associated with construction activities will likely cause the temporary displacement of most wildlife from the immediate vicinity of the construction zone and adjacent areas.

Edge Effect

Maintenance of a permanent right-of-way in an early successional stage (i.e., in low grasses) will, in most cases, permanently alter the wildlife habitat along the right-of-way. However, the creation and maintenance of this right-of-way will increase wildlife habitat diversity in many areas. For example, where forest habitat abuts the pipeline right-of-way, an ecotone or transition zone between the two habitat types will be created. The diversity of wildlife is often greater in transition zones because they are generally inhabited by species of both adjacent habitat types, as well as those that prefer the edge.

The potential effects of the creation of a forest edge on wildlife species was evaluated by both Iroquois and the FERC (refer to DEIS Section 5.1.4.2.1 pp 5-37 to 5-39). These evaluations generally indicate that the changes in wildlife populations resulting from construction of a right-of-way or edge habitat results from a change in the vegetative community structure, and that the species which are favored are those that prefer open or early second growth forest vegetation. In areas of otherwise unbroken forest vegetation, the addition of these species to the wildlife community can result in an increase in overall species diversity in the areas traversed by the right-of-way. This effect will be most pronounced within the temporary work space and portion of the permanent easement (50 feet) that will be reseeded and allowed to revert to native vegetation after the completion of construction. Thus, the forest habitat removed by construction will be replaced with a different habitat type, increasing the overall habitat diversity of the area. In addition, the vegetation that will be planted to control erosion will provide seeds and foliage as food for mammals and birds as well as habitat for ground nesting birds, and small mammals characteristic of meadow or old field habitats.

The creation of a right-of-way could provide travel corridors for mammalian predators such as fox, coyote, and raccoon, which have been shown to utilize habitat edges for this purpose. An increase in the occurrence of predators could result in an increase in predation rates for wildlife species found along the right-of-way.

Creation of a right-of-way through forested areas is not expected to result in forest fragmentation because the width of the opening created by the right-of-way is small relative to the size of the forested areas traversed. Forest fragmentation has been identified as a potential factor contributing to the recent decline in the populations of some species of birds that are typically found in forested habitats. Studies have been conducted which demonstrate that certain bird species are less abundant in forest tracts that are relatively small and isolated from adjacent larger forest tracts. However, most of these studies have been conducted in areas in which remnant forest vegetation is surrounded by large open areas such as agricultural land or residential developments. No studies have documented the decline of a forest interior bird species as a result of construction of a utility right-of-way through an otherwise unbroken forest tract. The edge effect described above may result in a decline of forest bird species for a short distance into the forest interior, as these species are replaced by species preferring open or edge habitats. However, the right-of-way itself should not create a cleared area of sufficient size so as to result in forest fragmentation. Moreover, it should be noted that all of the areas traversed by the pipeline already are crossed by various highways, access roads, and large-lot residential subdivisions, or are being developed for residential purposes to some extent. Those existing developments already have provided opportunities for the encroachment of species favoring more open habitat.

Moreover, Iroquois is not aware of any evidence that a pipeline right-of-way of 75 to 100 feet wide has been found to cause forest fragmentation. In fact, in a recent Wildlife Monograph on the subject, (Habitat Area Requirements of Breeding Forest Birds of the Middle Atlantic States, Robbins et al. 1989 Wildlife Mongraphs No. 103), the authors state that utility corridors of less than 100 meters (over three times as wide as the proposed Iroquois right-of-way) have not been found to cause fragmentation. Although fragmentation of forest habitats may be caused by rights-of-way as narrow as 75 to 100 feet, there is no evidence to that effect, in spite of a considerable amount of research on the subject of forest fragmentation over the past several years.

Wetlands

Tidal flats, marshes, and other wetlands provide excellent habitat for wildlife. Pipeline construction through wetlands will temporarily alter these habitats and limit wildlife usage of them during construction and until they are fully restored. However, as discussed in Sections V.3.3 and V.4.1 of this report and in the DEIS Section 5.1.7 (pp 5-54 to 5-59), impacts to wetlands will be mitigated by avoiding or minimizing construction in these areas to the extent practicable through pipeline route selection, and by implementing special construction and restoration practices. These practices will insure that wetland hydrology is not affected, and that the wetland vegetation is rapidly restored to its previous condition. Because wetlands will be allowed to revert to previous vegetation types, impacts to wildlife in wetlands will generally be short term. Construction of the right-of-way through forested wetlands will result in the clearing of forest vegetation. Although forest vegetation will be allowed to reestablish in these areas, the complete recovery of these areas may require several decades. Thus, the impact to wildlife which prefer forested wetland habitat will be long-term.

Endangered or Threatened Wildlife Species

Construction and operation of the pipeline will not affect any federally endangered or threatened wildlife species or other state-listed species of special concern. Although there are several federally or state-listed species of concern which are reported to occur in the general vicinity of the pipeline route, only one species (bog turtle) is reported to occur in the immediate vicinity of the areas which will be disturbed during construction.

If, during the course of the wildlife surveys that will be conducted in areas where there is a high probability that wildlife species of concern could exist, additional information becomes available indicating that species of concern may be present in the areas to be affected during pipeline construction, either the alignment of the right-of-way will be slightly modified, or special construction or restoration procedures will be adopted to mitigate potential impacts to these species. These procedures, which will be implemented in accordance with federal or state regulations (and with the reasonable agreement of the landowner), will be site-specific, but would generally include avoiding important habitats and timing construction activities to avoid critical periods.

V.4.3 Freshwater Fisheries

Construction and operation of the pipeline will have minor, short-term impacts on fishery resources; these impacts will occur as a result of pipeline installation activities. Pipeline construction will involve the crossing of various streams containing self-sustaining fish populations, as well as streams or rivers which are stocked. Of particular concern are the cold-water salmonid fisheries, which are of high recreational importance.

Because of the importance of the fisheries resources along the preferred pipeline route, special construction techniques will be implemented at stream crossings in order to mitigate potential adverse impacts. As a result of the use of these construction techniques, the limited stream areas that will be affected by construction techniques, the limited stream areas that will be affected by construction activities, and the natural recovery abilities of the streams traversed, the overall impact on fisheries resources should be minor, localized, and short-term.

The potential impacts of greatest concern to the aquatic environment are those stemming from siltation due to construction activities. If in-stream construction occurs during migration or spawning, siltation in streams and related turbidity and downstream sediment deposition can affect fish populations by smothering eggs and larvae, impairing respiration, and affecting food supply. In-stream construction activities may also alter or impede passage of adult fish during spawning migrations.

In areas of bedrock where in-stream blasting is required, fish mortality resulting from blasting-induced shock waves could occur. However, the disturbance caused by drilling operations and other blasting preparations will probably cause most fish to vacate the area, thereby reducing the potential mortality. If necessary and in consultation with the appropriate regulatory agencies, reduced charges could be set off to scare fish away from the area prior to the initiation of bedrock blasting. The use of these mitigation and restoration techniques, and the minimal amount of aquatic habitat affected in relation to that available in the project area as a whole, should minimize potential impacts.

After the completion of construction, the withdrawal and discharge of water for the hydrostatic testing of the pipeline could result in minor, short-term, and localized impacts on fish populations. Juvenile and larval fish may be injured or killed by entrapment during water intake operations, and following hydrostatic testing, water discharge could result in erosion and siltation in surface waters. Both the Pootatuck and the Housatonic rivers, which support important fishery resources, have been identified as sources of hydrostatic test water.

However, test water intake and discharge will be conducted in accordance with all applicable state water regulations and federal and/or state discharge requirements. Intake structures will be screened with 1/4 to 1/2-inch mesh to reduce entrapment of juvenile fish during surface water withdrawal. When possible, withdrawal will occur during higher flow periods when in-stream biota will not be as concentrated, and the probability of fish entrapment will consequently be low.

An energy diffusing device will be installed on the discharge pipe to reduce the potential for bank erosion into surface waters during hydrostatic test water discharge. If necessary, screening devices (such as hay bales and settling ponds) will also be used. Water quality will be monitored in accordance with State Pollution Discharge elimination System (SPDES) permit requirements.

V.4.4 Mitigation Measures

Terrestrial Vegetation

The potential impacts to terrestrial vegetation in general will be minimized through the use of special procedures during the clearing and grading of the right-of-way, by strict adherence to the D&M Plan, and by careful restoration and revegetation of the right-of-way following construction. In addition, special procedures will be followed in the major vegetation types traversed to minimize impacts, as described below.

Adverse effects on forest resources will be minimized by implementing the following measures:

- o Identifying specimen trees, and snags within close proximity to the right-of-way edge during preconstruction surveys, and protecting them from damage;
- o Use of experienced woodcutters only;
- o Minimizing clearing and subsequent maintenance to the extent practicable;

- Felling trees and brush parallel to the right-of-way to prevent damage to adjacent vegetation;
- Repairing damage to or replacing with suitable nursery stock and/or compensation any trees that are inadvertently damaged off the right-of-way;
- Salvaging merchantable timber (i.e., logs, cordwood);
- Chipping or other disposal of unmerchantable vegetation at approved sites;
- Adhering strictly to soil erosion control guidelines to minimize impacts to soil productivity;
- Initiating right-of-way restoration as soon as possible following pipe installation (generally within six days of final grading); and
- Careful revegetation of the right-of-way.

To minimize potential impacts to agricultural lands, special construction and right-of-way restoration procedures will be employed during pipeline construction through cultivated and improved agricultural lands. These special procedures (which are discussed in detail in the FERC DEIS and in Iroquois' 1988 Resource Report No. 1: General Project Description and in Resource Report No. 7: Soils.) include:

- Close coordination with affected landowners prior to construction to identify specific concerns and measures to minimize inconvenience;
- Special pretrenching operations to remove topsoil and stockpile the topsoil separately from the subsoil, and to subsequently replace the topsoil with a minimum of handling;
- When possible, scheduling construction during dry periods to minimize soil compaction, rutting, and erosion;
- Restricting vehicle access and vehicle loads, and use of lower ground-pressure equipment to minimize compaction when soils are wet;

- Use of subsoiling techniques to relieve soil compaction where it can be demonstrated;
- Restoration of land contours to maintain drainage patterns;
- Careful repair of existing drain tile systems to prevent subsequent flooding problems;
- Attempts to control the spread of weeds onto the exposed right-of-way;
- Control of fly-rock during blasting, and collection and removal of rock from the right-of-way through agricultural areas;
- Mechanical or manual collection and removal of large rocks and stones (over 4 inches in any dimension) brought to the surface in agricultural lands as a result of construction activities;
- Application of fertilizer to the right-of-way during revegetation;
- Incorporation of legumes into revegetation seed mixtures, as appropriate, to aid in the restoration of soil structure and fertility;
- Implementation of standard erosion control practices during construction and restoration; and
- Timely restoration and revegetation of the right-of-way as soon as practicable following construction.

In addition, landowners will be compensated for any loss of crops or damages. Implementation of these special procedures will insure that potential impacts resulting from construction through agricultural areas will be minimized, and that any impacts will be short-term and minor.

The potential impacts to vegetation in open lands will be minimized by implementing numerous procedures during construction, restoration, and maintenance of the pipeline. Although there are no specific procedures to minimize impacts to vegetation resources on open lands, many of the procedures related to clearing, trenching, restoration and revegetation, and long-term maintenance of the right-of-way as discussed for the other major vegetation types will be employed and also will serve to minimize impacts to these early successional vegetation communities.

Wetlands

Construction of the pipeline will result in disturbance to existing vegetation in wetlands traversed by the route. Following construction and restoration of the right-of-way, wetland vegetation, including trees (except in areas of non-saturated wetland soils), will be allowed to become reestablished in the entire construction right-of-way. As a result, impacts to wetlands are expected to be short-term and minor.

The primary means by which impacts to wetlands will be reduced is through avoidance of wetland areas in routing the pipeline. Avoidance of wetlands is a primary routing criteria, both for environmental and engineering reasons. An initial routing criteria, the avoidance of wetlands to the extent possible also is a key element of Iroquois' biological field programs. As a result of these programs, wetlands along the right-of-way are being delineated using both the uniform federal procedures and hydric soils. This information is being used to refine the route in order to further avoid -- or if avoidance is not possible -- to minimize wetlands crossings.

In addition to avoidance of wetlands to the extent practicable in siting the pipeline, several measures will be implemented to minimize the effects of pipeline construction on wetlands. All construction through wetlands will be in accordance with state and federal regulatory requirements (e.g., Corps of Engineers nationwide permit criteria and FERC recommended measures), and will be performed to minimize both the amount of disturbance to the wetland vegetation and the extent to which construction equipment must be present in wetland areas. In addition, special construction and restoration techniques, as discussed in detail in Iroquois 1988 Resource Report No. 1: General Project Description, will be employed to further minimize potential impacts. These techniques are as follows:

- Prior to construction, Iroquois will prepare a description of each wetland to be traversed, identifying specific construction methods that will be employed to protect wetland drainage patterns and plant and wildlife species of concern; and providing a schedule for conducting and reporting post-construction monitoring;

- Continue during preconstruction survey to pursue minor routing modifications to avoid wetlands, providing other environmentally sensitive areas would not be affected to such changes;

- If wetlands must be crossed, crossing will occur at the narrowest point practical;

- Where possible, all temporary access roads will be constructed outside wetland boundaries;

- Temporary access roads that must be constructed in wetlands will be constructed of log rip-rap work pads or filter fabric with granular material;

- During clearing operations in forested wetlands, trees will be cut flush to the ground and the stumps left in place except where trenching will occur (rapid sprouting from the remaining stumps will enhance the recovery of forest vegetation in wetlands);

- Construction activities will be performed from swamp mats or other fabric or rip-rap;

- Topsoil separation will be used where feasible to segregate and preserve the vegetation mat and organic soils, and the horizons restored during backfilling;

- Spoil from construction activities will not be placed so as to interrupt natural drainage;

- Staging activities will be performed on adjacent upland areas;

- Ditch blocks or trench breakers will be used in the trench where necessary during and after construction to prevent draining the wetland and all predisturbance flow will be restored;

- If trench dewatering is necessary for construction through wetlands, trench water will be discharged according to applicable regulatory requirements;)

- Trench water will be discharged to minimize potential impacts due to erosion or sedimentation in receiving waters; and

- Trench water will not be discharged directly into watercourses if it will result in the degradation of water quality in the receiving stream.

Revegetation of most wetland areas disturbed during construction should occur naturally. However, if necessary, special revegetation techniques, such as planting, will be utilized in order to insure rapid recovery. Implementing these special construction and restoration practices will insure that the potential impacts to wetland resources will be short-term and minor.

Wildlife

Construction of the proposed project will have minor, long-term impacts on wildlife habitat, causing, in turn, localized but long-term impacts on wildlife populations. Since the right-of-way will be maintained in a cleared condition, the principal impact will be a shift in wildlife populations using the right-of-way from those species favoring forest habitats to those utilizing more open areas. In addition, at the sites of the aboveground facilities, most wildlife utilization will be precluded for the life of the project. For the most part, the minor impacts to wildlife associate with displacement from these sites cannot be mitigated except by planting screening-type vegetation outside the fenceline. As a result, the following discussion focuses on the pipeline right-of-way.

Impacts to wildlife will be mitigated by implementing measures designed to minimize impacts to vegetation and to enhance the restoration and revegetation of the construction work space. Implementation of these measures will insure that wildlife habitat disturbance is minimized, and that the right-of-way is rapidly restored to a condition which will provide habitat for wildlife.

In addition, impacts to wildlife have been minimized by coordinating with state and federal resource wildlife specialists to identify known locations where wildlife species of concern are reported to occur so that these areas could be avoided during pipeline routing. Additional surveys may be conducted in areas where there is a high probability of encountering threatened or endangered species. If these species are preset, additional mitigation measures, such as time of year restriction or minor realignments, may be implemented.

Freshwater Fisheries

The potential impacts of greatest concern to freshwater aquatic environments are those stemming from siltation due to construction activities. If in-stream construction occurs during migration or spawning, siltation in streams and related turbidity and downstream sediment deposition can affect fish populations by smothering eggs and larvae, impairing respiration, and affecting food supply. In-stream construction activities may also alter or impede passage of adult fish during spawning migrations.

To mitigate the potential adverse impacts due to in-stream construction activities, a number of mitigation measures will be implemented. The primary means of minimizing impacts to fishery resources include avoiding those areas in which valuable habitats are known to occur, and scheduling construction activities during periods of low stream flow and when fish spawning or migrations are not occurring.

In addition, based on recommendations from the FERC, the NMFS and the USFWS, pipeline construction activities in streams and rivers will be scheduled to avoid critical periods. In streams with important cold-water fisheries, construction will generally be restricted to the period July 15 to September 30. In streams with warm-water fisheries, construction will be delayed until after July 15 and completed before the end of winter low flows or April 1 to avoid periods of spawning activity. The Housatonic River crossing is planned for installation between October 15 and February 15 to avoid conflicts with various species, including the spawning of winter flounder.

In addition to avoiding critical habitats and critical life history periods, standard stream crossing procedures have been established to install the pipeline safely and efficiently while maintaining downstream populations of aquatic life, minimizing the extent and duration of sedimentation from construction activities, and maintaining an unimpeded flow of water. Implementation of these standard procedures will insure that impacts to downstream aquatic life will be both short-term and minor. These procedures include:

- Strict observance of all permit requirements and schedule restrictions;
- Confining work to delineated right-of-way and temporary work space;
- Minimizing disturbance to slopes, shorelines, and stream bank vegetation; implementing temporary stabilization measures where necessary; and maintaining the stream bank vegetation undisturbed, with the exception of cutting large trees, until seven days prior to construction, where possible;
- Minimizing the duration of in-stream work;
- Providing a minimum of 5 feet of cover over the pipe;
- Providing for fish passage if construction is permitted during migration;
- Removal of all debris, piling, and flumes, or any other obstructions from the stream;
- Use of standard soil erosion and sedimentation control practices such as hay bales or silt curtains where appropriate;
- Timely regrading, stabilization, and reseeding of stream banks, including protection with rip-rap if needed; and

- o Use of screening or alignment modifications at stream crossings of high aesthetic value to minimize visual impacts.

In addition to standard stream crossing procedures identified above, for those streams identified as being of particular significance, detailed preconstruction studies may be conducted to determine site-specific modifications or procedures which would be implemented to minimize impacts at a particular stream. Prior to construction, each stream will be surveyed to determine the appropriate stream crossing method. Information will be provided on the depth of the trench and the depth of fill between the top of the pipe and the restored bed; the location of temporary storage areas for spoil or material to be used as backfill; the location of staging areas, if required; measures to minimize sedimentation and damage to banks and shorelines; the type and description of water diversion devices, if used; method for bank restoration and provisions for monitoring and inspection; techniques for withdrawing hydrostatic test water; and techniques for diffusing the outlet stream of any pipe which may be installed as a diversion device. In addition, no equipment washing will be allowed in streams, and runoff from washing of equipment will not be discharged directly to any watercourse. No fuel storage or refueling of equipment will be allowed within 100 feet of any watercourse.

The use of these mitigation and restoration techniques, and the minimal amount of aquatic habitat affected in relation to that available in the project area as a whole, should minimize potential impacts.

V.5 MARINE RESOURCES

This section describes the potential impacts of the marine pipeline on Long Island Sound's physical characteristics (i.e., bathymetry, geology, and sediments; water use and quality) and biological resources. Potential impacts are discussed both for the nearshore (landfall) and offshore portions of the marine route.

In general, the construction, operation, and maintenance of the marine pipeline will result in short-term, localized impacts as a result of laying the pipeline on the sea bottom, and the nearshore trenching into the seabed. However, the area affected by these activities will be limited and, once restored, will be recolonized by marine organisms shortly after the completion of construction. Long-term, minor impacts could occur as a result of potential conflicts with bottom fishing gear along the offshore portion of the marine route, where the pipe will be laid on the bottom. However, studies and operational experience in the North Sea indicate that a 24-inch concrete-coated pipeline will not be affected by or impact the bottom fishing gear used in Long Island Sound. Overall, the marine pipeline will have a negligible impact on the structure, productivity, and use of the marine resources in Long Island Sound.

V.5.1 Physical Characteristics

The installation and operation of the marine pipeline will impact the physical characteristics of Long Island Sound on a short-term basis. Those characteristics most likely to be affected include color and clarity. Dredge and fill activities will result in the short-term increase in the level of suspended particulates, resulting in higher turbidity in aquatic ecosystems. However, the increase in suspended particulates will be short-term, lasting only during the period of in-water construction activity. The marine pipeline will be constructed using proven conventional technology, as discussed in Section III.3, and will be buried at least 3 to 5 feet below the seabed in the landfall and nearshore areas. Along the offshore portion of the marine route (from the 50-foot isobath at Milford), the pipeline will be laid on the bottom with minimum (if any) seabed preparation.

During construction, the approximate nearshore area affected at both landfalls will be 0.38 square miles (244 acres). After burial and backfilling of the pipe, the seabed will return to its preconstruction condition largely through wave and current action. In the open waters of the Sound, the placement of the pipe on the sea bottom will affect less than 0.01 square miles (approximately 4.0 acres) of the seabed.

Current Patterns and Water Circulation

Dredge and fill activities associated with pipeline construction will have no major adverse effects on water circulation or current patterns in Long Island Sound, rivers and streams, or wetlands, since Iroquois will take care to ensure that normal flow patterns are maintained. No significant permanent changes in bottom topography, stream channels, or wetland drainage patterns/hydrology will occur.

Normal Water Fluctuations

Dredge and fill activities associated with pipeline construction will have no adverse effect on normal water fluctuations, as no major long-term changes in bottom contours, stream channel configuration, or wetland drainage patterns will occur. The temporary movement of sediment in nearshore tidal areas associated with the trenching of the marine pipeline will not restrict normal tidal flushing, and no areas subject to periodic inundation will be isolated from tidal action as a result of the construction activities.

Salinity Gradients

As discussed above, dredge and fill activities will not affect normal water circulation patterns or fluctuations, and so there will be no changes in salinity gradients resulting from construction.

Similarly, the operation of the pipeline will not cause impacts to physical marine characteristics. The entire length of the pipeline will be concrete-coated to provide stabilization on and within the seabed. As such, the limited area affected by Iroquois' marine pipeline will not result in the modification of the Sound's physical features, tidal and current movements, or chemical regime.

Bathymetry, Geology, and Sediments

The construction and operation of the pipeline will have a minor effect on bathymetry, marine surficial geology, and physical geography. Minor impacts will occur as a result of sediment and bottom material movement associated with pipe-laying and anchor-handling, specifically during seabed preparation and pipeline stabilization activities at the landfalls. For example, sediment and rocks will be displaced during trenching activities at the landfall and in the nearshore area. Generally, the large materials, such as boulders and gravel, will be deposited close to the trench, while the finer materials will be suspended and displaced a greater distance. However, after pipe installation, original nearshore bottom contours will be reestablished out to the 30-foot water depth to ensure that suitable shellfish habitat is reestablished.

During construction, the operation of the layvessel will have an effect on local bottom sediments. Anchors will be continually deployed and recovered around the vessel as it moves forward. Eight to 10 anchors will be deployed around the layvessel at any one time. Each time an anchor is repositioned, several cubic yards of bottom material will be displaced, creating a short-term disturbance of benthic sediments. However, as discussed above, natural reworking of the sediment and recolonization from adjacent areas will result in complete recovery to preconstruction conditions.

Along the offshore portion of the route, special consideration has been given to locating the pipeline largely away from areas of slumping; seafloor erosion; megaripples; potential boulders and rock outcroppings; and sediments containing dissolved gas. Such careful attention to pipeline routing has minimized difficulties associated with these potential geological constraints (J.P. Kenney 1986).

Water Quality and Use

Impacts to water quality and use associated with the installation of the pipeline will be minor and short-term. These impacts will result from the localized resuspension of bottom sediments as a result of trenching and jetting activities in the nearshore and landfall areas. Resuspension of bottom sediments is not expected to have an impact on the concentration of toxic contaminants in the water column. Analyses have shown that the sediments sampled along the pipeline route are of good quality.

Nearshore (landfall) trenching will be conducted using bucket and clamshell type dredges in which dredged materials will be side-cast adjacent to the trench. Sedimentation levels may exceed background for a distance less than 0.25 miles downcurrent (Cameron 1986). Normally, the principal turbid zone will likely occur 100 to 500 feet from the trench; within this zone, the amount of turbidity will vary as a function of distance from the trenching activity. Beyond 500 feet from the trench, sediments will be dispersed and turbidity should approach background conditions. The overall effect of the trenching operation is expected to be localized, short-term, and minor, since the sediments in the areas where trenching will be employed are relatively coarse and can be expected to rapidly settle out of the water column.

To predict the turbidity effects associated with the post-jetting technique (which will be used to lower the pipeline into the seabed between the 30- and 50-foot isobaths at Milford), sediment plume modeling was performed. Because a higher percentage of silt and clay was found along this segment of the marine route, the objective of the modeling was to evaluate the maximum potential dispersion of the suspended turbidity plume, assuming "worst-case" conditions involving very fine sediments. The results of this modeling showed that after discharge from the jet at a concentration of about 30 g/l, most of the sediment will settle out within about 150 feet of the trench on the downstream side of the jet sled and within about 60 feet on the upstream side. The suspended turbidity plume, which will remain below the water surface, may extend downcurrent for about 0.75 miles; however, the suspended solids concentration is expected to be below 100 mg/l at about 0.5 miles from the post-jetting operation. Moreover, the plume will dissipate rapidly following the cessation of post-jetting activities; within 3 hours, the highest concentration of solids in the plume will be reduced to 23% and after 6 hours to 9% of its original value. Thus, even under such "worst-case" conditions, post-jetting will result in turbidity impacts that are neither persistent nor extensive.

Any suspended material in the water column around Milford will be further diluted and dispersed by the strong westerly longshore drift and tidal current existing in that area. The Charles Island tombolo, which is located to the west of the proposed route, will thus assist in trapping sediments and in minimizing the transport of sediments toward the productive shellfish grow-out areas located to the west of it.

Water quality impacts also will be minor because of the short duration of construction. In-water trenching activity is expected to require five work weeks at the Milford landfall (J.P. Kenney 1986). Since the sediments are generally of good quality, no chemical degradation of water quality is anticipated.

Negligible impacts will occur from the discharge of hydrostatic test water used to pressure-test the marine pipeline (see also Section V.3). Filtered seawater will be used to test the pipe; segments will be tested continuously as they are assembled, and the same test water will be used. Test water will be discharged into the LILCO cooling water return and will be in accordance with all applicable requirements. No chemicals will be used in the hydrostatic test water.

During construction, oil spills could occur as a result of equipment failure or human error during layvessel fuel transfer operations, improper storage and disposal of spent lube oil, or pumping untreated bilge water overboard. Specified procedures will be employed to insure that fuel losses are minimized, and that spent lube oil and bilge water are managed properly. However, despite these precautions, some minor equipment failures or human error could result in small spills. The principal fuel involved in transfer operations will be marine diesel fuel, which is highly toxic to fish and invertebrates because of the high aromatic content.

However, if a spill occurs, the volumes are likely to be relatively small, and once released on the sea surface, the oil will evaporate and disperse relatively quickly. Any effects will be confined to the area immediately around the spill site, and spill containment and countermeasures will be implemented. Hence, any impact would be negligible. A spill prevention, containment, and countermeasures plan will be developed for implementation during construction, in accordance with FERC recommendations..

No impact will occur from routine operation and maintenance of the marine route. To control corrosion of the pipeline, sacrificial zinc/magnesium anodes will be placed every 150 to 500 feet apart and will degrade over time releasing zinc/magnesium oxides into the adjacent water column and the immediate sediments. The marine pipeline will be annually inspected using electronic pigs to monitor pipeline integrity. Should a gas leak occur, the gas wold rise to the surface and would not be retained in the aqueous environment. (Natural gas, which is primarily methane, is highly insoluble in water and non-toxic to marine life.) Impacts associated with repair or replacement of a pipeline segment would be similar to the minor short-term effects associated with the installation of the marine pipeline as a whole.

The construction of the proposed pipeline will generally result in only minor, short-term impacts to marine communities. These impacts will result from short-term disturbances to the nearshore areas as a result of trenching and jetting activities and to the bottom substrate along the offshore pipeline right-of-way as a result of pipe-laying activities and anchor movement from support vessels.

The short-term impacts associated with these types of activity are: temporary loss of bottom habitats and communities in the nearshore areas; smothering of benthic communities near trenching operations in the nearshore areas; minor, short-term changes in fish movements; and localized interference with shellfish resources. Placement of the pipeline on the seabed along the offshore route will result in a long-term but minor loss of approximately 4.0 acres of benthic habitat. The relatively small loss of seabed habitat indicates that the effect on existing benthic communities would be negligible.

Furthermore, the existence of the pipe on the sea floor will diversify the substrate, providing a hard surface for the colonization of other species which currently do not inhabit the area. For example, such substrate will be favorable to lobster communities (LILCO 1973).

After all construction and restoration activities have been completed, natural biological communities will reestablish themselves to preconstruction conditions. Operation and maintenance of the pipeline will have negligible impact upon the ecology of the nearshore and offshore communities.

As stated above, the short-term impact will primarily be to the benthic habitats and associated benthic communities. The remaining biological communities encountered along the route will be temporarily displaced, but the overall impact will be negligible. A more detailed discussion of the effects on marine communities as a result of construction, operation, and maintenance is presented below.

V.5.2 Marine Biological Resources

The construction of the marine pipeline will generally result in only minor, short-term impacts to marine communities. These impacts will result from disturbances to the nearshore areas as a result of trenching activities and to the bottom substrate in the offshore area as a result of pipe-laying activities and anchor movement from support vessels.

The short-term impacts associated with these types of activity are: temporary loss of bottom habitats and communities in the nearshore areas and long-term but minor loss of habitat in the offshore areas where the pipe is laid on the bottom; smothering of benthic communities near trenching operations in the nearshore areas; minor, short-term changes in fish movement; and localized interference with shellfish resources.

Marine pipeline installation is planned to be completed by May 31 because of the prohibition of construction activities in Long Island Sound from June 1 to September 30 (in Connecticut) and from June 30 through September 30 (in New York). As such, the construction schedule is planned over a five-month time frame between January 1 and May 31; extensive preplanning will insure rapid mobilization and the efficient installation of the pipeline. Scheduling the construction period during the winter months will reduce the extent of impacts, since most biological communities are at their lowest level of activity during the winter.

After the completion of pipe installation, areas disturbed at the landfalls will be restored by backfilling the trench and recontouring the seabed to preconstruction bathymetry to create the same habitat that was present before construction. Along the offshore marine route, existing bottom habitats will be lost beneath the 24-inch diameter pipeline.

However, the total area of affected habitat covers approximately 0.006 square miles (approximately 4.0 acres) of seabed, of which approximately 0.003 square miles (2.1 acres) will be in Connecticut waters. No restoration of the offshore seabed will be required, since the pipeline will simply be laid on the sea bottom.

After all construction and restoration activities have been completed, natural biological communities will reestablish themselves to preconstruction conditions. Operation and maintenance of the pipeline will have negligible impact upon the ecology of the nearshore and offshore communities. The natural gas carried by the pipeline is primarily methane, which is highly insoluble in water and non-toxic to marine life. Should a leak occur, gas would rise to the surface and disperse into the atmosphere.

Seaweed Communities

Impacts on submergent marine algae communities along the pipeline route will result from seabed preparation (dredging, trenching, and possibly blasting) at the landfalls, which will cause the physical destruction of the algae as well as the disruption of the substrate around the trench. These activities will cause localized increases in turbidity and light attenuation, and a corresponding decrease in water column transparency, which also could affect algae. However, these impacts will be short-term, and algae will recolonize the disturbed area following construction and restoration activities. The brown and red algae normally exist in fairly stable subtidal habitats, and as a result of this disturbance in their environments, their intrinsic growth and recovery rates may be slower than for other algae, which have higher intrinsic growth rates.

The installation of the offshore pipeline will not affect seaweed communities. Similarly, because no long-term maintenance activities are required for the marine pipeline, there will be no adverse impacts to marine algae resulting from pipeline operation and maintenance.

Planktonic Communities

Impacts to planktonic communities will be negligible. After construction, the plankton populations will be transported by currents back into the construction area. In the winter (when pipeline construction will occur), concentrations of meroplankton (i.e., fish eggs, shellfish larvae) are low or non-existent. Thus, the installation of the pipeline will not affect the recruitment of the local species with planktonic larvae. During pipeline operation and maintenance, no adverse impacts will occur.

Benthic Communities

Construction of the proposed pipeline will have short-term adverse impacts on benthic communities, resulting from direct physical disruption of substrate and organisms, as well as from sediment plumes generated by dredging operations and the associated sedimentation. Total loss of habitat at the Milford landfall will occur along an area approximately 45,400 feet long by 200 feet wide (210 acres).

At Milford, the benthic habitat is composed of sand and gravel from shoreline to the 30-foot water depth. Clayey silt has been observed from this point to approximately the 50-foot contour, where fine to medium sand is encountered. Along this course, a diverse community of organisms exists. With the exception of the shellfish beds at the Milford landfall, none of the benthic assemblages along the pipeline route are unique; they occur throughout the Sound.

In the immediate area of trenching and side-casting activities, i.e., within 100 feet, 100% of the benthos will typically be lost (Chaney 1986). Beyond this, benthos may be buried up to 12 inches and approximately 25% of the benthos killed. The effect of sedimentation will diminish as a function of distance from the trenching activities. Beyond a distance of about 150 feet from the trench, effects on benthos are expected to be transient and will resemble impacts of turbidity and sediment levels which occur during a storm. For example, suspension-feeding bivalves can tolerate fairly high suspended sediment loads over short periods and many acclimate to high concentrations over more extended periods (Robinson et al 1984).

No long-term impacts will occur from the construction activity. The successful reestablishment of the disturbed area will occur after construction is completed via recruitment from adjacent areas. Bathymetry will be returned to preconstruction contours and the bottom substrate will be replaced with materials that were excavated. The natural reworking of the sediments will provide a suitable habitat for the natural recruitment of marine benthic communities.

Placement of the pipeline on the seabed along the offshore route will directly affect approximately 4.0 acres. The relatively small loss of benthic habitat indicates that any effect on the existing benthic communities would be negligible. Moreover, the type of substrate encountered will be primarily equal portions of silt and sand/silt. Thus, within a short time period, it is anticipated that the pipeline will be buried partially by natural sediment movement.

Within the central basin of the Sound, sediment movement is very high. With every tidal cycle, a layer of sediment 1 or 2 millimeters thick is eroded and redistributed within the central basin (DEP 1977). Furthermore, the existence of the pipe on the sea floor will diversify the substrate, providing a hard surface for the colonization of other species which currently do not inhabit the area. For example, such substrate will be favorable to lobster communities (LILCO 1973).

Similarly, during construction, the operation of the layvessel will have an effect on local bottom habitat. Anchors will be continually deployed and recovered around the vessel as it moves forward. Eight to 10 anchors will be deployed around the layvessel at any one time. Each time an anchor is repositioned, several cubic yards of bottom material will be displaced, creating a short-term disturbance of benthic habitat. However, as discussed above, natural reworking of the sediment and recolonization from adjacent areas will result in complete recovery to preconstruction conditions. Long-term impact upon the benthic communities will not occur.

Commercial Resources

The construction and operation of the marine pipeline will affect commercial marine resources (finfish and shellfish) in Long Island Sound. However, as discussed below, most of these impacts are expected to be minor, of short duration, and localized in the immediate vicinity of the pipeline.

Some specific concerns were raised regarding the potential impacts of the marine pipeline on lobster and flounder movements in those deep areas of the Sound where the pipeline will be laid on the bottom. In particular, there was some concern that these species might simply move along, rather than over, the pipeline. Iroquois notes that this is highly unlikely for several reasons. First, the entire marine pipeline will be encased in two inches of concrete. (** Note: encasing the entire marine pipeline in two inches of concrete will necessarily result in an outer pipe diameter of 28 inches.) Thus, the weight of the pipe itself, combined with the downward force of gravity as the pipe is lowered into the seabed from the layvessel, will act to settle the pipe into the seabed initially. Given the type of sediments that exist in the offshore area, and the movement of sediments by the current, the pipeline can also be expected to settle further into the sediments over time. As a result, the pipeline will never present a 28-inch-high barrier. Second, there is no evidence to suggest that lobster and winter flounder would not move over the pipe, or that a lateral movement along a portion of the pipeline would constitute a negative impact. This is because the concrete coating will provide a surface not unlike the bouldery substrate that exists elsewhere in the Sound.

Finfish. The overall impacts on finfish will be negligible. The finfish that are present can easily avoid the construction areas. In addition, construction activity will occur during the winter, when the fish populations and diversity are low and seasonal (summer) migrants are absent and spawning activity is minimal. Moreover, the installation and operation of the pipeline will not affect any environmental factors (e.g., habitat, food sources) that could limit finfish resources in Long Island Sound.

The winter flounder (Pseudopleuronectes americanus) is a permanent resident of Long Island Sound and migrates seasonally, moving into deeper waters in the summer and fall and to shallow water estuaries in the winter and spring. It spawns in the estuaries between January and May.

The Milford landfall site lies about 2 miles east of the mouth of the Housatonic River, a prime area for flounder migration and spawning. However, since flounder exhibit good swimming ability and the duration and extent of construction will be limited, pipe installation activities on this species are expected to be minimal.

Pipeline construction activities will have temporary, minor, and highly localized impacts on commercial finfishing activities in Long Island Sound. This is because only six trawlers routinely fish the Sound, and most of this activity occurs in the summer. Minor impacts will result, primarily the exclusion of fishing activities (e.g., trawling) from the immediate construction area. Fishing will be excluded from any particular area for two to three days in the vicinity of the pipe-laying vessel and trenching barge. However, this temporary exclusion is not expected to have any discernible impact on the fishing effort, although minor inconveniences to some fishermen may occur. This is because commercial fishing activities in Long Island Sound are low during the winter months when pipeline construction will occur. Moreover, the exclusion will be very short-term, and the area that will be excluded from fishing is small compared to the total area typically fished in the Sound. Thus, the impacts of pipeline installation (e.g., the establishment of exclusion zones around the laybarge) will have negligible effects on commercial fishing operations.

On a long-term basis, the presence of the pipeline on the sea bottom in the offshore water may pose problems for some fishing gear, such as otter trawls. Otter trawls and offshore pipelines have been the subject of a series of field investigations in the North Sea (Carstens 1980; Kiltau et al. 1981). These studies have shown that a pipeline is exposed to three separate forces when hit by an otter trawl (Carstens 1980). These are:

- A bending force imposed when the towing warp contacts the top of the pipe as the trawl approaches;

- An impact force as the otter board strikes the pipe; and

- A pullover force as the otter board is dragged over the pipeline.

The major concern was that an otter board would hook the pipeline and either become permanently lodged or unhook and "fly" through the water and dive into the bottom, imparting a load that would snap the trawl warp. The following conclusions were reached (Carstens 1980) as a result of the studies:

- Hooking does occur on smaller pipelines, but is not a problem with large-diameter (i.e., greater than 16 inches) pipelines;

- The concrete coating on large-diameter pipelines appears to bear the impacts of otter boards; and

- The trawl gear itself does not suffer any damage as it is dragged over the pipeline.

The results of these studies, as well as evaluations of the type of gear used by Long Island Sound commercial fisherman (Allardice and Associates, Ltd. 1986; E & E 1987), indicate that even though the pipeline will not be trenched through most of the heavily fished areas along the route, no damage to fishing gear or to the offshore pipeline should occur as a result of interactions between the two.

Shellfish. The construction and operation of the marine pipeline will result in different impacts to shellfish resources. These are discussed separately below.

Lobster. The effects of pipeline construction and seabed preparation on lobsters existing along the pipeline route will mainly involve the extremely localized disturbance of physical substrate and organisms north of Stratford Shoals. This is an area of rocky outcropping filled with holes and crevices that are well-suited for lobster habitat. However, pipe-laying activities along the north boundary of the Shoals will avoid rocky areas and, as such, will involve minimal habitat disturbance, since the pipeline will simply be placed on the bottom. Although this could remove some habitat for lobsters on a long-term basis, the overall effect will be negligible, given the total available habitat in Long Island Sound. Few lobsters would be directly affected by pipeline construction.

There will be minimal adverse effects between lobster potlines and the pipeline during operation and maintenance. Care will be taken during annual pipeline inspections to insure that lobster pots do not become tangled with the survey boats.

Clams/Oysters. The pipeline route will have localized, short-term impacts on clam and oyster resources These impacts will be restricted to the nearshore area off Milford. At Milford, the pipeline will cross about 10,000 feet of shellfish beds. In this area, any shellfish not previously harvested will be destroyed by pipeline trenching and burial. A total of about 46 acres of shellfish areas will be affected by trenching and sedimentation, since a 100-

foot-wide area on either side of the trench can be expected to be affected by sediment.

However, Iroquois will mitigate these effects by allowing lease-holders to harvest the commercial shellfish species in the affected area prior to construction, and by compensating the lease-holders for the lost resources. Also, oysters located outside of the determined impact areas will not be affected by construction, since this activity will take place during the winter months when water temperatures are low and oyster activity is low, requiring a minimal level of pumping. Moreover, after the completion of pipeline installation, the disturbed sea bottom will be restored as closely as possible to its preconstruction condition. The bottom will be replaced and recontoured, after which cultch (oyster shells) will be placed along the area to insure that a suitable substrate for spat is reestablished. It is expected that the sandy marine sediments will compact quickly.

In addition to direct disturbance, shellfish resources may be impacted by the resuspension of coliforms contained in the sediments. The Connecticut Department of Health Services (DOHS) will monitor the pipeline construction activities, testing for unacceptable coliform counts. If coliforms are present above 70 counts per 100 milliliters, DOHS regulations prevent the harvest of shellfish for two weeks after the completion of dredging activities and when water temperatures exceed 50°F. This water temperature is not typically reached in Long Island Sound until late April. Thus, if the pipeline is installed in the Milford area in January or February, shellfish harvesting could be precluded for several months. If this occurs, Iroquois will financially compensate shellfishermen for the full market value of their lost harvests.

Threatened or Endangered Fish Species

There are two fish species of special concern in the areas traversed by the pipeline route in Long Island Sound. These species are the shortnose sturgeon (Acipenser brevirostrum) and the Atlantic sturgeon (Acipenser oxyrhynchus). However, the construction of the marine pipeline will not affect these species since they do not occur in the vicinity of the pipeline route in the winter, when construction will largely occur. The operation of the marine pipeline will similarly have no effect on these species.

V.6 LAND USE AND VISUAL RESOURCES

V.6.1 LAND USE

In most areas of Connecticut, Iroquois proposes to install the pipeline using a construction right-of-way of 75 feet (see Table II-2 in Section II). Because of the nature of construction activities, all land uses within the construction right-of-way will be temporarily affected. Such land use disturbances will typically last only for about two to four months -- the duration of time between clearing/grading and restoration/revegetation activities. Moreover, during construction, Iroquois will take all necessary precautions to insure that lands off the right-of-way are not disturbed. For example, the right-of-way itself will provide vehicular access to and from the work area, and environmental inspectors will monitor construction activities to insure conformance with both permit requirements and landowner stipulations.

Upon completion of construction, a permanent 50-to-60-foot easement will generally be maintained. In forested areas, 50 feet of the easement will be maintained in non-woody vegetation. Generally, the remaining 10 feet of the permanent easement as well as the other temporary construction work space will be allowed to revert to its previous use. In addition, through agricultural lands and other open areas (i.e., croplands, pasturelands, lawns, wetlands, open fields), the right-of-way as well as the temporary work space will revert to their previous use after the completion of construction.

Through forest lands, the maintenance of a 50-foot wide area in non-woody vegetation is required to ensure adequate aerial surveillance of the right-of-way and to permit access in the event of an emergency. As a result, construction and operation of the pipeline will cause a long-term impact due to the creation of a new open-space corridor. Impacts resulting from the conversion of woodlands to open space will be minimized by the adherence of all applicable construction activities to FERC guidelines, as well as the specifications of state agencies.

Table V-1 presents information concerning the land uses that will be disturbed as a result of both the construction and operation of the pipeline route. The following subsections discuss the potential impacts of the construction and operation of the project on the various land uses traversed.

Forests

The construction of the pipeline in Connecticut will involve the removal of a maximum of approximately 350 acres of forestlands. Approximately 175 acres of the forestland affected by the construction of the pipeline right-of-way will be allowed to revert to woodlands after the completion of construction. Forest uses will be precluded from the remaining 175 acres along the pipeline route and the areas of ancillary facilities for the life of the project.

The loss of forest resources will represent a long-term impact. Although this impact is minor when considered in light of the forest resources remaining in the project region, the creation of an open space corridor through generally undisturbed woodlands could have discernible local effects. This will be especially true for the wooded areas traversed by portion of the route in Connecticut, portions of which are characterized by extensive woodlands on rolling terrain. In these areas, if the cleared easement is visible from highways, a further adverse aesthetic impact will result.

TABLE V-1

Land Uses Disturbed During Construction and Operation of The Iroquois Pipeline in Connecticut

County	LAND USES AFFECTED (ACRES)									
	WOODLAND		AG & OPEN		RESIDENTIAL		OTHER		TOTAL	TOTAL
	CONST.	PERM. a/	CONST.	PERM.	CONST.	PERM.	CONST.	PERM	CONSTRUCTION b/	PERMANENT b/
Litchfield	73.9	37.0	42.4	25.4	12.1	7.3	3.6	2.2	132.0	71.9
Fairfield	264.2	132.1	75.1	45.0	64.2	38.5	2.4	1.5	405.9	217.1
New Haven	13.3	6.7	13.3	8.0	3.6	2.2	3.6	2.2	33.8	19.1
	351.4	175.8	130.8	78.4	79.9	48.0	9.6	5.9	571.7	308.1

a/ Permanent right-of-way acreage is calculated based on a 60-foot right-of-way for all except forested areas. Iroquois has committed to maintain only 50 feet of the right-of-way through forested areas.

b/ The rights-of-way may be increased or decreased to avoid obstacles or to accomodate special construction techniques.

SOURCE: After FERC DEIS Table 5.1.9-1, 1989.

Agricultural Uses

The pipeline will cross few agricultural areas in Connecticut, although agricultural and open areas constitute the most common types of land uses traversed by the pipeline route as a whole. In Connecticut, 2.7 miles (6%) of the route will cross agricultural land.

Construction through agricultural areas will result in the loss of crop production or pastureland directly along the right-of-way and temporary work space for the duration of the construction period. After the completion of construction, however, the entire area disturbed during pipeline construction will be allowed to revert to agricultural use. In addition, landowners will be compensated for crop losses or damages caused by construction activities, as well as for temporary declines in productivity (if any).

Long-term agricultural productivity losses could occur along the right-of-way if subsoil and topsoil are mixed, or as a result of soil disturbance due to compaction and rutting. The improper replacement/restoration of tile drains also could cause long-term impacts to agricultural productivity. Moreover, the alignment of the pipeline through agricultural areas could affect a farm owner's future plans for drainage system installation, etc.

However, as a routine matter, Iroquois has committed to implement procedures to insure that such impacts either do not occur or are minimized. These mitigation measures include:

- o Consultation with landowners to determine the locations of existing and (if applicable) proposed drainage systems and land management plans, and the consideration of these locations in installing the pipe to an appropriate depth;

- Scheduling of construction in the late spring, summer, and fall to avoid periods when the soil is wet, and thus most susceptible to compaction and rutting;

- Topsoil stripping of the trench area and the area on which the subsoil will be placed;

- Installation of temporary drains or other drainage systems during construction, if necessary;

- Replacement and repair of cut tile as well as any tile damaged by construction;

- Subsoiling to relieve compaction where it is demonstrated;

- Removal of stones larger than 4 inches in diameter to at least plow depth;

- Use of controlled blasting procedures to minimize dispersion of rock fragments where blasting is required; and

- Revegetation of the right-of-way as soon as possible after construction, preferably with legumes or grasses that will help restore the right-of-way to its previous productivity.

Pipeline construction can also result in short-term impacts in terms of the disruption of livestock production and general inconveniences to farm activities. For example, the construction of the pipeline will require the cutting of existing livestock fences along the right-of-way; the open trench could also pose hazards to livestock. Although this could create inconveniences, Iroquois will mitigate the overall impact by building temporary fences (including gates) as necessary to contain livestock and to prevent animals from getting near the trench. The time that the trench will be open also will be minimized, since all construction activities will be conducted sequentially, with the least amount of time between each task. Moreover, Iroquois will maintain temporary accessways across the trench as necessary to allow the passage of livestock, farm equipment, or people. After the completion of construction, all fences and gates will be immediately rebuilt. This will be performed as part of the restoration phase.

To minimize potential impacts to livestock, Iroquois will employ standard procedures for the cleanup of all debris (including welding rod stubs) from the right-of-way.

The operation of the Iroquois pipeline through cropland and pastureland will not cause any adverse impacts, since all farm activities will be allowed on the pipeline easement.

Water Resources and Wetlands

The pipeline route traverses numerous rivers and streams, including some with wooded floodplains, as well as various types of wetlands. The maintenance of a cleared right-of-way through floodplains could cause long-term aesthetic impacts, but will be performed in accordance with applicable federal and state requirements. Where a stream has high aesthetic value, mitigation measures, such as minor alignment refinements or screen plantings to reduce line-of-sight visibility, may be utilized.

Residential, Commercial, and Industrial Uses

About 7.4 miles of the route will be aligned through more developed areas where residential, commercial, and industrial uses predominate. Through these areas, the construction of the pipeline will generaly be impact due to the creation of a new open-space corridor. Impacts resulting from the conversion of woodlands to open space will be minimized by the adherence of all applicable construction activities to FERC guidelines, as well as the specifications of state agencies.

Table V-1 presents information concerning the land uses that will be disturbed as a result of both the construction and operation of the pipeline route. The following subsections discuss the potential impacts of the construction and operation of the project on the various land uses traversed.

Forests

The construction of the pipeline in Connecticut will involve the removal of a maximum of approximately 350 acres of forestlands. Approximately 175 acres of the forestland affected by the construction of the pipeline right-of-way will be allowed to revert to woodlands after the completion of construction. Forest uses will be precluded from the remaining 175 acres along the pipeline route and the areas of ancillary facilities for the life of the project.

The loss of forest resources will represent a long-term impact. Although this impact is minor when considered in light of the forest resources remaining in the project region, the creation of an open space corridor through generally undisturbed woodlands could have discernible local effects. This will be especially true for the wooded areas traversed by portion of the route in Connecticut, portions of which are characterized by extensive woodlands on rolling terrain. In these areas, if the cleared easement is visible from highways, a further adverse aesthetic impact will result.

Agricultural Uses

The pipeline will cross few agricultural areas in Connecticut, although agricultural and open areas constitute the most common types of land uses traversed by the pipeline route as a whole. In Connecticut, 2.7 miles (6%) of the route will cross agricultural land.

Construction through agricultural areas will result in the loss of crop production or pastureland directly along the right-of-way and temporary work space for the duration of the construction period. After the completion of construction, however, the entire area disturbed during pipeline construction will be allowed to revert to agricultural use. In addition, landowners will be compensated for crop losses or damages caused by construction activities, as well as for temporary declines in productivity (if any).

Long-term agricultural productivity losses could occur along the right-of-way if subsoil and topsoil are mixed, or as a result of soil disturbance due to compaction and rutting. The improper replacement/restoration of tile drains also could cause long-term impacts to agricultural productivity. Moreover, the alignment of the pipeline through agricultural areas could affect a farm owner's future plans for drainage system installation, etc.

However, as a routine matter, Iroquois has committed to implement procedures to insure that such impacts either do not occur or are minimized. These mitigation measures include:

- Consultation with landowners to determine the locations of existing and (if applicable) proposed drainage systems and land management plans, and the consideration of these locations in installing the pipe to an appropriate depth;

- Scheduling of construction in the late spring, summer, and fall to avoid periods when the soil is wet, and thus most susceptible to compaction and rutting;

- Topsoil stripping of the trench area and the area on which the subsoil will be placed;

- Installation of temporary drains or other drainage systems during construction, if necessary;

- Replacement and repair of cut tile as well as any tile damaged by construction;

- Subsoiling to relieve compaction where it is demonstrated;

- Removal of stones larger than 4 inches in diameter to at least plow depth;

- Use of controlled blasting procedures to minimize dispersion of rock fragments where blasting is required; and

- Revegetation of the right-of-way as soon as possible after construction, preferably with legumes or grasses that will help restore the right-of-way to its previous productivity.

Pipeline construction can also result in short-term impacts in terms of the disruption of livestock production and general inconveniences to farm activities. For example, the construction of the pipeline will require the cutting of existing livestock fences along the right-of-way; the open trench could also pose hazards to livestock. Although this could create inconveniences, Iroquois will mitigate the overall impact by building temporary fences (including gates) as necessary to contain livestock and to prevent animals from getting near the trench. The time that the trench will be open also will be minimized, since all construction activities will be conducted sequentially, with the least amount of time between each task. Moreover, Iroquois will maintain temporary accessways across the trench as necessary to allow the passage of livestock, farm equipment, or people. After the completion of construction, all fences and gates will be immediately rebuilt. This will be performed as part of the restoration phase.

To minimize potential impacts to livestock, Iroquois will employ standard procedures for the cleanup of all debris (including welding rod stubs) from the right-of-way.

The operation of the Iroquois pipeline through cropland and pastureland will not cause any adverse impacts, since all farm activities will be allowed on the pipeline easement.

Water Resources and Wetlands

The pipeline route traverses numerous rivers and streams, including some with wooded floodplains, as well as various types of wetlands. The maintenance of a cleared right-of-way through floodplains could cause long-term aesthetic impacts, but will be performed in accordance with applicable federal and state requirements. Where a stream has high aesthetic value, mitigation measures, such as minor alignment refinements or screen plantings to reduce line-of-sight visibility, may be utilized.

Residential, Commercial, and Industrial Uses

About 7.4 miles of the route will be aligned through more developed areas where residential, commercial, and industrial uses predominate. Through these areas, the construction of the pipeline will generaly be accomplished on a right-of-way of 75 feet or less. For example, in the City of Milford, a special construction crew will be assigned to install the pipe.

Construction through these areas will result in the temporary disturbance of 67.3 acres of land along the right-of-way (based on the use of a 75-foot-wide right-of-way). Temporary nuisance impacts (e.g., land disturbances, noise, dust) that could inconvenience residents also will result. The construction of the pipeline will not involve the removal of any structures or the relocation of any families. Moreover, any fences (including stone walls) and ornamental vegetation that are removed to construct the pipeline will be replaced immediately after the completion of final grading. Historic stone walls will be carefully dismantled and replaced.

The operation of the pipeline will preclude the development of the right-of-way (as well as the sites of the aboveground facilities) for alternate built-up uses for the life of the project. The pipeline easement also could affect future land use development.

In these areas, and where the pipeline route traverses close to residences, construction of the project will create significant, localized impacts stemming primarily from nuisances associated with construction-generated noise, dust, and land disturbance. While such nuisance effects will be temporary (i.e., limited to the construction phase), the operation of the pipeline and the maintenance of the permanent easement will pose constraints to certain existing and future land uses (e.g., garages and inground pools can not be built on the easement). Such constraints will represent long-term impacts.

Hazardous and Solid Waste Sites

The construction and operation of the pipeline could result in two types of impacts to waste sites. First, the construction of the pipeline could intersect areas of contamination. Such contamination could affect the safety of pipeline workers. Second, the pipe trench could potentially serve as a conduit for the migration of contamination off-site, while the actual construction activities could serve to mix contaminated and uncontaminated materials that ultimately will have to be treated and disposed of.

The Iroquois route has been specifically aligned to avoid directly crossing hazardous and solid waste sites. However, the route will pass in the vicinity of several sites in Connecticut. Iroquois has specifically aligned the pipeline to cross upland of these sites, and thus should not traverse areas of contaminated groundwater. In addition, Iroquois will use standard techniques, such as the installation of trench breakers or impervious materials to seal the trench, to insure that the pipeline does not act as a conduit for contaminant migration.

The pipeline will traverse near the landfill in Silver Sands State Park. Iroquois will consult with DEP regarding the development of a contingency plan to be implemented in the event that hazardous wastes are uncovered during construction through this area.

Solid Waste Disposal

The construction of the pipeline will create various solid wastes in the form of vegetation (slash and stumps) and general construction-type debris. Clean fill (i.e., excess rock) also will result. Various types of impacts could occur if construction contractors do not properly dispose of such materials. For example, trash and debris left on the right-of-way could create potential health problems as well as visual impacts. Moreover, the waste materials generated during the construction process could exacerbate existing shortages of landfill space.

To minimize or avert these potential impacts, Iroquois will use several standard techniques. For instance, the disposal of debris will be strictly controlled during construction. All construction vehicles (e.g., heavy machinery, buses used to transport workers to the construction sites) will be equipped with trash disposal bags, into which all smaller types of debris will be placed. The right-of-way also will be policed continuously for litter. It will be the responsibility of the environmental inspectors to ensure that Iroquois' policies and the FERC recommended measures regarding solid waste disposal are enforced.

The non-bulky solid waste generated during the construction process will be disposed of at approved solid waste landfills or other types of municipal solid waste facilities in the vicinity of the route. The overall impact of the disposal of these wastes on landfill capacity should be relatively minor since the amounts of waste generated should be comparatively small.

Bulky solid wastes and clean fill generated during the construction process will be disposed of in various manners. These materials will not be disposed of in municipal solid waste landfills. Non-merchantable timber (i.e., slash and stumps) will be chipped on the right-of-way, hauled to suitable off-right-of-way storage yards for later chipping, or, potentially, sold to existing facilities that burn wood for fuel or manufacture wood chips. As appropriate, excess rock and other types of clean fill (i.e., surplus soil) will be hauled to areas off the right-of-way where such clean fill is wanted.

Public Recreation Areas

The pipeline route traverses along (and within) the boundary of the Paugussett State Forest. In this area, construction activities will require the removal of forest vegetation and the creation of an open-space corridor. Although the amount of forest acreage affected is small (17 acres), the long-term creation of maintained right-of-way could have effects on both visual and recreational resources. However, since the forest is managed for multiple use (e.g., various types of recreational activities), the creation of the right-of-way would not necessarily be incompatible, since it could serve as a route for hikers, hunters, or cross-country skiers, or as an accessway for forest personnel in performing activities associated with forest production.

The construction of the pipeline within the publicly owned accessway leading to and coastal area at Silver Sands State Park will result in short-term and generally minor impacts. Iroquois has consulted with DEP concerning the most appropriate alignment of the right-of-way through the park in order to insure that the pipeline does not result in potential conflicts with the agency's planned development of the area (Clifford 1986; Rocque 1986; Emmerick 1986, 1988-1990; Clapper 1990; Souza 1986). The route reflects these discussions, and is aligned parallel and adjacent to an area in which an access road from U.S. Route 1 to the beach has recently been developed. The pipeline will be aligned generally within the eastern part of the park, in an area in which park maintenance buildings are planned. As a result, the project will be compatible with the future recreational use of the park.

The actual construction of the project will not conflict with the existing recreational use of the park, which is primarily beach-oriented. This is because the construction of the pipeline will be timed to coincide with DEP's planned development of the park. In addition, construction through the park will occur as part of the installation of the marine pipeline and will be performed largely in the winter when recreational use of the park is low.

The operation of the project next to the future access road in the park will similarly cause no adverse effects to recreational uses. With the exception of a mainline valve (to be sited in the park imaintenance area), no aboveground pipeline facilities will be located in the park. Through the park, the right-of-way will be maintained in vegetation consistent with DEP's plans for landscaping the park. Moreover, beneath the beach, the pipeline will be buried to provide a minimum of 5 feet of cover, and thus will not affect recreational activities. It should be noted that other pipelines have operated for years through similar types of beach areas, posing no conflicts to recreational use (New England River Basin Committee 1981).

Other Uses

The proposed route traverses various watercourses used for recreational fishing, boating, canoeing, etc. The construction and operation of the proposed route across such areas that are used but not designated for recreational purposes also will cause impacts. However, these impacts will generally be minor and short-term, since flow will be maintained in all streams and appropriate sedimentation controls to preserve water quality will be implemented.

Since the individual property owners will retain title to the land along the right-of-way, public access along the pipeline easement will be prohibited. However, a potential exists for the use of the right-of-way by unauthorized individuals for recreational activities such as riding all-terrain vehicles (ATVs), hiking, hunting, and cross country skiing; this could cause adverse impacts to individual landowners' use and enjoyment of their property. If unmitigated, this impact could be locally significant and long-term. However, Iroquois will, as appropriate, seek to avert such unauthorized uses by using vegetation to screen the view of the right-of-way from public highways (particularly at scenic highways); by offsetting the pipeline easement to reduce line-of-sight; or by erecting fences with locked gates at highway crossings. In addition, all existing fences along the right-of-way that are removed as a result of construction will be replaced.

V.6.2 VISUAL RESOURCES

There are no Connecticut or federal standards that specify what constitutes a significant visual impact. Moreover, the determination of the significance of a visual impact is largely subjective, based on the degree of acceptability of a given landscape alteration to the affected viewer. Under the Bureau of Land Management system of visual impact assessment, a high visual contrast must occur for the impact to be considered potentially significant. A high visual contrast is defined as one in which the landscape alteration demands attention and will not be overlooked by the average observer.

The degree of perceived acceptability of a given landscape alteration also depends on the relation of that alteration to visual changes that already have occurred in the environment. For example, a proposed landscape alteration such as the pipeline right-of-way in an area that is essentially "natural" and is a visible part of the landscape will likely present a high degree of contrast. However, in other natural landscapes, a high degree of contrast may be acceptable because the visual alteration would be seldom seen or is unimportant to viewers.

In areas where some unnatural landscape modifications already exist (i.e., housing developments, roads, commercial use), an additional visual alteration can be expected to have a comparatively minor incremental effect. This appears to be the case in most portions of the Iroquois project area in Connecticut, where the pipeline route generally traverses areas that have been subject to varying types of development, including roads, transmission lines, structures, and other urban features with high levels of visibility. Moreover, most of the Iroquois route has been aligned through areas where the existing topography and vegetation will combine to minimize extensive views of the pipeline right-of-way or aboveground facilities.

As a result, a majority of the Iroquois route in Connecticut crosses areas in which the pipeline right-of-way and aboveground facilities will create low to moderate levels of contrast to the surrounding landscape. Low levels of contrast would occur specifically in areas where the pipeline right-of-way crosses flat or hilly terrain with numerous roads, transmission lines, and other structures; areas of flat terrain or cultivated/open fields; or areas where the right-of-way is adjacent to an existing electric transmission corridor (EDR 1987).

Moderate levels of visual contrast would occur where the route crosses unaltered hilly or gently sloping terrain in which there are nearby cultural modifications such as roads, transmission lines, and structures; through hilly open or cultivated areas; or near urbanized or residential areas. High levels of contrast will occur where the pipeline right-of-way traverses wooded slopes with relatively unaltered "natural" scenery. Moderate or high levels of contrast can be expected to occur as a result of the construction and operation of the pipeline across wooded slopes, especially areas visible from public roads or recreation areas.

The extent to which the landscape contrast created by the Iroquois pipeline right-of-way and aboveground facilities results in visual impact will be a function not only of the degree of contrast (i.e., high, medium, or low), but also the aesthetic sensitivity of the affected environment, the number of people who will be potentially exposed to the project-modified views, and the duration of the viewer exposure. The following sections summarize the expected impacts to visual resources as a result of both the construction and operation/maintenance of the Iroquois project.

Construction

With the exception of the creation of the right-of-way through forested areas and the development of the aboveground facilities, the visual impacts resulting from the construction of the project will be short-term. After the completion of construction, the right-of-way will be recontoured and revegetated in accordance with the D & M Plan, which will reflect FERC requirements as well as requests resulting from consultation with individual landowners.

The visual impact of the construction of the right-of-way through forested areas will be long-term since woody vegetation will not be allowed to become reestablished along 50 feet of the 60-foot-wide permanent easement in most areas. Likewise, the impact of the construction of aboveground ancillary facilities (e.g., mainline valves, meter stations, interconnection points) will be long-term, lasting for the life of the project.

The following identifies potential visual impacts associated with construction of the project in Connecticut.

- In the Town of Sherman, between Anderson Road and Route 39, the route crosses the Smoke Ridge subdivision; the route crosses this subdivision at the top of a wooded slope where the right-of-way will be visible from portions of the subdivision. Deflections in the right-of-way may serve to limit long views of the right-of-way.

- West of Route 39 and adjacent to the Smoke Ridge subdivision in Sherman, the pipeline crosses a portion of the Naromi Land Trust's Wimisinki Sanctuary. Traversing northwest - southeast through this area, the route comes off a wooded footslope (in the subdivision discussed above). The right-of-way across this slope will be visible from parts of Route 39. The right-of-way within the land trust has been aligned to traverse primarly wet meadow vegetation. Following construction, Iroquois will ensure that in this area, the right-of-way returns to its preconstruction vegetation. A special mitigation plan has been drafted for the crossing of the Sanctuary.

- At about milepost 289 in the Town of New Milford, the pipeline traverses 820 feet through a portion of the Weantinogue Heritage, Inc.'s forested Morrissey Brook parcel. Alignment of the pipeline through this parcel will result in long-term visual impacts.

- Between mileposts 289.5 and 291.5 in New Milford, the Iroquois route is aligned generally parallel to Stilson Hill Road, which is a town-designated scenic area. In this area, Iroquois has realigned its alignment farther from homes along Stilson Hill Road, and through more open areas.

- In the Town of New Milford the route also crosses two segments of the Housatonic Range Trail (identified on the USGS maps as the Candlewood Trail). The pipeline first crosses the trail (which is on privately owned land and is maintained by the Connecticut Parks and Forest Associations, Inc.) on a densely wooded ridge top (Pine Knob), at about milepost 292. The pipeline will cross the trail perpendicularly and will open up views to both the east (i.e., to the Housatonic River and Route 7) and the west. In the vicinity of the pipeline crossing, the trail is through mature forest consisting of hardwoods.

The second crossing of the trail is along Rocky River Road, at milepost 293. At this point, the trail is actually a dirt road that leads to a lookout point above Candlewood Lake. Although the pipeline crosses the trail through a wooded area, the crossing is adjacent to an area in which gravel is being mined (prior to development for industrial purposes) and an area in which a commercial building is being developed.

A mainline valve is located near the second Housatonic Range Trail crossing (milepost 293), but should not be visible from it because of the new commercial building.

- Lynn Deming Park is a Town of New Milford recreation area owned by CL & P adjacent to Candlewood Lake (near milepost 294). Although the pipeline route is near the park, it is on the opposite side of an existing powerline. Since the park is completely surrounded by trees, there are no views of either the power line or the pipeline from the park.

- In the Town of New Milford, the pipeline route is within several hundred feet of the Hill and Plain School (elementary) at milepost 296.6. Limited views of the right-of-way may be possible looking north from the school (where the right-of-way will exit from a wooded area). However, in the immediate vicinity of the school, the pipeline right-of-way will be in open areas; thus there will be no long-term visual impacts.

- In the Town of Brookfield, the route crosses the Weantinogue Heritage Inc.'s Still River Preserve. Through this area, the pipeline is aligned between a railroad and a CL&P transmission line which form the eastern border of the preserve. Iroquois has committed to avoid a screen of mature hardwoods immediately adjacent to the railroad easement. The vegetation that will be affected in this area consists of wetlands, herbaceous groundcover, cedars, and shrubs. Iroquois has prepared a draft mitigation plan for this area.

- A mainline valve and interconnection point in the Town of Brookfield (at milespost 304.15 and 305.5, respectively) are both located in areas with minimal visual sensitivity. The MLV is adjacent to a road near a gravel pit, while the ICP is adjacent to an existing Algonquin Gas Transmission Company right-of-way near another sand and gravel mining area.

- At the intersection of Route 25 and Currituck Road, the pipeline route parallels two Algonquin Gas pipelines near a small historic structure (about milepost 306.55). The route will serve to widen this existing easement. The large trees near the historic structure will be preserved.

- Just west of Schoolhouse Hill Road in Newtown, the route crosses a wooded slope (milepost 310). There will be views from Schoolhouse Hill Road, but not from I-84, because I-84 is below grade at this point and bordered by mature trees.

- The pipeline crossing of I-84 will create visual impacts, particularly on the south side of the highway. Although the crossing is through wooded areas on both sides of the highway, a fairly steep wooded slope will be traversed on the south side (adjacent to Pole Bridge Road).

- The pipeline traverses the western border of the lower block of the Paugussett State Forest in the Town of Newtown (mileposts

314.6 to 316.4). In this area, the state forest borders single-family residential development; however, there is no vehicular access from the residential areas to the forest. Through this forested area, the construction of the pipeline will create an open space corridor which will be visible from portions of the state forest and may be visible from some of the residences.

- In Monroe a mainline valve is proposed for location adjacent to Old Zoar Road, near residential and commercial developments. Because of the flat topography, views of this facility will be limited.

- The pipeline crosses the Pomperaug "blue dot" Trail adjacent to Boys Halfway River at milepost 318.4. In this area vegetation consists largely of pole-size hardwoods. The right-of-way will be visible in this area, and a special mitigation plan will be developed.

- The pipeline crosses Shelton municipal open space lands in the vicinity of milepost 320. This open space, which includes active and inactive sand pits, is adjacent to a new subdivision on one side and to the Means Brook floodplain on the other.

- The Shelton Land Trust parcel that the route crosses adjacent to State Route 110 (milepost 321.1) consists of forests, wetlands and an old gravel pit haul road. The route in the southern part of the land trust will be aligned down the gravel pit/haul road. However, in the northern part of the parcel, forest vegetation will have to be cut and this will create a visible contrast.

- A sales meter station is proposed for location in Shelton at approximately milepost 324.4. This site is adjacent to two CL&P transmission lines and Route 108.

- In the Town of Stratford, a sales meter station (milepost 328.5) is located downslope and across a CL&P transmission corridor from James Farm Road. This facility will be visible from James Farm Road and from nearby residential areas.

- Booth Memorial Park, located in Stratford adjacent the Housatonic River about 0.2 miles north of the Iroquois river crossing, is listed on the National Register of Historic Places and consists of a collection of unusual buildings (circa 1840), museums, and beach area. Because of vegetation and intervening structures, there will be no long-term views of the route from this park. During construction, however, park users may be able to see the right-of-way on the Milford side of the river.

- On the Milford side of the Housatonic River, the route is located through a former sand/gravel mining operation and open field vegetation in a mostly industrial-commercial area. The Housatonic Wastewater Treatment Facility is located along the river directly south of the crossing. South of this treatment plant, condominiums have been developed adjacent to the river. The alignment of the route through this area will have minimal visual effects.

- The pipeline traverses along a newly constructed access road in the eastern portion of Silver Sands State Park. The route will not result in long-term visual impacts to the park area since the right-of-way will not be visible after the completion of construction activities.

Operation and Maintenance

The operation of the project will not have an additional impact on visual resources once the project facilities have been built; however, the impacts of some construction activities will last over the lifetime of the project.

Mitigation Measures

The mitigation measures that have been or will be implemented to reduce or minimize visual contrasts associated with the pipeline right-of-way and ancillary facilities are identified in the DEIS and in Iroquois' 1988 Resource Report No.8. These are summarized below.

The strategic location of the pipeline route to minimize visual impacts was considered as part of the route selection process. Wherever possible, the alignment takes into account factors such as:

- Avoidance, where possible, of forested ridgelines and steep slopes;
- Utilization of alignment offsets to minimize long views of the pipeline right-of-way through forested areas; and
- Location of aboveground facilities in least conspicuous areas with short viewing distances, off ridgelines, and out of viewsheds of sensitive use areas.

In certain sensitive visual environments (i.e., the Appalachian Trail, "blue dot" trails, land trusts, public recreation areas), special construction procedures will be used to minimize disturbance including:

- Minimization, to the extent possible, of the width of the right-of-way in limited areas of high user sensitivity and visibility;
- Reestablishment of the right-of-way to preconstruction topography to the extent possible; and
- Use of vegetative screening.

The following options will be applied in a case-by-case basis as needed or to mitigate disturbances to the physical environment using repetition of basic landscape elements. The options should complement other mitigative measures made during the project planning and construction stages:

- Plant screens and buffers, using indigenous materials, in strategic locations to block/buffer views of the right-of-way and aboveground pipeline facilities.

- Where consistent with agency and/or landowner objectives, revegetate non-forested areas with materials that replicate the color, texture, and pattern of vegetation prior to construction, where possible.

- In forested areas, landscape as appropriate to screen the view of the right-of-way from visually sensitive highways, trails, historic structures, and water bodies.

V.7 Socioeconomics and Transportation

V.7.1 Socioeconomics

Iroquois submits the following data, summarized from the FERC DEIS (see Section 5.1.10, pp. 5-102 to 5-104) regarding potential socioeconomic impacts. Socioeconomic impacts associated with the construction and operation of the project are expected to be minimal. This is primarily due to the relatively short construction period and the relatively rapid rate that construction crews will pass through any one area. Increased population due to construction workers will occur for short periods of time over the length of the proposed pipeline route. However, because workers will not be concentrated in any one place for an extended period, the potential for localized impacts (e.g., to housing, infrastructure services (fire, medical, education, police), and transportation) will be limited. Beneficial economic impacts will be realized through local and nonlocal construction payroll expenditures, purchases of construction goods and materials, and the increased property tax base generated by the project.

Iroquois proposes to use one mainline construction spread for the construction of the pipeline in Connecticut; in addition, a small work crew will be assigned to install the pipeline in Milford and a separate spread will install the Housatonic River crossing. Iroquois estimates that its mainline construction spread will typically require about 550 workers, and that 150 workers will be required for the special Housatonic River crossing spread. The special crew in Milford also will consist of approximately 150 personnel. Construction of the marine pipeline across Long Island Sound would require 200 workers.

An estimated 25% of the pipeline construction workers will be specialists and supervisory personnel brought in from outside the local areas. The remaining workforce,are expected to be hired locally through the appropriate unions. The hiring of the pipeline construction workforce will be the responsibility of the contractor.

Generally, nonlocal workers prefer temporary quarters (hotel/motels, housing rental units), in the more populated, service-oriented areas. Since nonlocal workers would be distributed over many miles, sufficient housing should be available within the larger urban areas at convenient commuting distances from the pipeline so that no adverse impacts would be imposed on the tourist trade or other sources of local income.

The proposed project will have a long-term beneficial effect on local tax revenues. Iroquois estimates that its entire proposed pipeline will generate a total of approximately $9 million annually in state and local taxes.

Decrease in Property Value.

According to the FERC DEIS, studies of the effects of electric transmission lines on property values indicate that there is no statistically significant correlation between proximity to a transmission line right-of-way and a decrease in property value (i.e., other market factors may be greater or lesser determinants of the property value). Proximity to utility rights-of-way does not necessarily equate to decreased property value. Property owners would receive full compensation for the use of their land based on market value of the land affected.

Homeowner Property Insurance Liability Resulting From Pipeline Easements.

Casualty losses to land, structures or other property, and personal injuries caused directly by the pipeline are the responsibility of the pipeline company, or its insurance underwriter, to resolve with the affected persons or governing body according to the liability laws of the state. The landowners should not incur additional costs resulting from pipeline easements.

Impacts to Public Services

Considering the transient nature of the construction effort, the limited size of the construction crews and the proposed rapid rate of progression, socioeconomic impacts of pipeline construction would be minimal. Any effects on the local economy, housing and community service would be temporary.

Whenever available, local workers would be employed for construction. Additional construction personnel hired from outside the project area would place little, if any, additional demand on services. The housing supply and public services, such as educational facilities, would not be affected since pipeline construction personnel tend to occupy transient housing (i.e., hotels/motels, rental housing, campgrounds). In most cases, expenditures by the construction workers for temporary housing and food would provide short-term local benefits. Although difficult to quantify, the anticipated short-term impacts to community services would be minimal.

No additional demand would be placed on town infrastructure services except possibly during the construction period. There would not be any significant long-term impacts to public services. Local fire departments should not face any additional burdens since their role would be limited to secondary fires, if any, caused by pipeline rupture or break.

V.7.2 Transportation

Impacts to the transportation network would result from the proposed pipeline crossings of roads and highways, and the movement of construction equipment and materials from the storage/laydown areas to the pipeline work area. The installation of the pipeline beneath high volume roadways and rail crossings will typically be performed by boring or tunneling techniques: as a result, traffic flow would not be impeded. On other road crossings the preferred method for pipe installation will be slipboring. Where this method cannot be used, and the open cut (trench) method is implemented, traffic flow will be maintained either by installing a portion of the road at a time (leaving the other portions passable) or by using a temporary bypass and--in some cases--a short detour.

V.8 CULTURAL RESOURCES

Construction and operation of the proposed pipeline could potentially affect historic, archaeological, and/or architectural properties in, or eligible for, the NRHP. Project impacts could include: the physical disturbance during construction of archaeological sites located within the right-of-way, areas of pipeline staging/storage and temporary access (e.g., roads); and the introduction of visual elements that could alter the setting associated with historic properties (sales meter stations; views of the right-of-way through forested areas). Mitigative measures could include: minor alignment refinements to avoid sites; data recovery in the form of scientific excavation of archaeological sites; and, for indirect aesthetic effects to historic structures, use of vegetative screens or other landscaping devices to reduce or eliminate adverse visual effects.

Iroquois is committed to the performance of cultural resource surveys in full accordance with national and state cultural resource protection legislation. To this end, Iroquois prepared a Cultural Resources Work Plan that describes in detail the methods to be followed in the implementation of field investigations along the entire pipeline route. This plan, which is included as Appendix A of Iroquois' 1988 Resource Report No. 4, Cultural Resources, was approved by the Connecticut Historical Commission (CHC), the FERC staff archaeologist, and the New York State Historic Preservation Officer (SHPO).

Overall, Iroquois generally concurs with the FERC's recommendations regarding the implementation of measures to avert or minimize impacts to cultural resources. These are listed in Section 5.1.11 of the DEIS and include:

- Iroquois shall complete all Phase 1 and Phase 2 reports and forward copes to FERC and the appropriate SHPOs. (i.e., in Connecticut, the CHC).

- In all cases where a property eligible for the NRHP is found within the proposed project right-of-way, applicants shall make every effort to avoid those properties through rerouting.

- Where cultural resources, including archaeological sites that meet the criteria for NRHP eligibility but cannot be avoided, applicants shall prepare Phase 3 mitigation or data recovery plans and submit those plans to the SHPO and FERC for review and approval.

- Iroquois shall not construct in those portions of the right-of-way or any other areas that would be disturbed (e.g., staging areas, access roads) that contain significant cultural resources, including archaeological sites or nearby standing NRHP structures, until the Director of OPPR has reviewed all cultural resources surveys and mitigation plans, and has considered any comments by the appropriate SHPO's and the ACHP.

- Wherever significant standing structures would be visually affected by the proposed project, applicants shall be required to eliminate or minimize adverse effects, to the extent feasible, by planting visual screens, or through use of other landscaping techniques.

Land Pipeline

Iroquois initiated field studies of the Connecticut land portion of the pipeline on April 3, 1989. These field investigations will include surveys of the entire proposed Iroquois right-of-way and ancillary facility sites (e.g., sales meter stations, valves, access roads, material storage sites). The field investigations are designed to identify as yet unrecorded sites that may exist within the pipeline right-of-way, as well as to verify the locations of known sites identified as being potentially located within the pipeline right-of-way.

Iroquois will prepare a Phase 1 report documenting the sites that are discovered during the field investigation. Because of concerns for the protection of cultural resource locations, this report will not be for public disclosure, and will be submitted only to the reviewing agencies with jurisdiction over cultural resources (e.g., the CHC, FERC). Iroquois will consult with these reviewing agencies regarding the sites that will require Phase 2 testing and, as necessary, mitigation. Iroquois notes that its preference is for the mitigation of impacts to significant cultural resources through site avoidance (using minor route refinements) to the extent possible, rather than data recovery. However, data recovery (in accordance with cultural resource protection requirements) will be undertaken at significant sites that cannot otherwise be avoided.

Marine Pipeline

Iroquois completed a report documenting the results of the cultural resources review of the marine pipeline in 1987. This report was submitted to the FERC and other reviewing agencies in 1988. When installing the marine pipeline, Iroquois will avoid all sonar targets and anomalies identified during the marine survey. If, for some reason, the pipeline route or layvessel anchors cannot be aligned to avoid these targets and anomalies as planned, the CHC and FERC will be notified and an appropriate course of action will be discussed.

V.9 RELIABILITY AND SAFETY

General

Iroquois conducted detailed analyses of pipeline safety, and presented the results of these analyses as part of its 1986 ER and 1988 Resource Report No. 11, Reliability and Safety. The FERC DEIS also addressed this issue (see DEIS Section 5.1.12). Both Iroquois' Resource Report No. 11 and DEIS Section 5.1.12 are included as Appendix E. Iroquois summarizes the information contained in those reports as follows:

Iroquois' 1988 Resource Report No. 11, Reliability and Safety, concluded in part that:

- o Over the years, pipelines have had an excellent public safety record when compared to other modes of transportation.
- o Iroquois will meet or exceed the government regulations and enforcement procedures.
- o Based on historic pipeline operating data, the estimated recurrence interval for a reportable incident (defined according to DOT; See Appendix E, page E-21) anywhere along the 369 mile length of the Iroquois route is once every 24.6 years. Iroquois expects to better this.
- o The probability of a pipeline incident for the portion of Iroquois beneath Long Island Sound is much less than the below ground portion. A reportable service incident would not be expected in this location during the operating life of Iroquois.
- o Iroquois will present a much lower transportation risk than that commonly encountered by the public, due to the modern technology that will be used in the design, construction and operation of the project.
- o The public risk presented by Iroquois is extremely small and is acceptable based on commonly used criteria.

The following summarizes information relating to pipe class, grade, etc as it relates to the portion of the pipeline route in Connecticut:

Location Class	Outside Diameter (inches)	Wall Thickness (inches)	Pipe Grade API 5L	Design Factor*	Charpy V-notch Energy Absorbed -full size- (min. ft lb)
1	24	0.370	x65	0.72	50
2	24	0.412	x70	0.60	50
3	24	0.494	x70	0.50	50
4	24	0.618	x70	0.40	50
Marine	24	0.576	x60	0.50	50

* Based on a design pressure of 1440 psig.

Pipe with these values of wall thickness is very difficult to penetrate with all but the larger pieces of construction equipment, thus decreasing the probability of breaching the pipeline. By selecting stress and fracture toughness conditions, the pipeline is designed to maximize the leak before break condition, thus reducing the probability of ignition and the extent of interaction.

Other Issues

In addition to the safety and reliability issues described above, several concerns have been raised regarding the risks posed by hazardous waste site interaction with the pipeline, and by seismic events. The following address these issues.

Risks to the Public from Construction Near Waste Sites

Iroquois has no intention of constructing the pipeline so as to directly or indirectly affect hazardous waste sites or the contaminants that may be migrating from such sites. The location and avoidance of hazardous waste sites has been a major routing criteria for the pipeline and has been the impetus for proposed route variations.

Iroquois has reviewed available information concerning the location of known waste sites, has consulted with the regulatory agencies with jurisdiction over such sites, and has aligned its pipeline to avoid directly traversing such sites and to be upgradient of any sites in the immediate vicinity of the pipeline route (e.g., the New Milford Waste Management, Inc. solid waste and Kimberly-Clark sites). In addition, Iroquois has committed to conduct site-specific surveys, if necessary, to confirm the presence or absence of waste along the pipeline right-of-way in the immediate vicinity of hazardous waste sites. Iroquois will provide the results of such surveys, if required, to the FERC and other regulatory agencies as appropriate. If waste is discovered, Iroquois will consult with FERC and other involved agencies to develop an appropriate course of action.

The implementation of these measures will ensure that any risks to the public that already exist from these waste sites are not affected by the pipeline. Iroquois also notes that the existing risk to public safety that is currently posed by the unlined hazardous and solid waste disposal areas and by the leaking underground storage tanks in Connecticut is likely to be far more significant than any risk posed by the remote possibility of an emergency event involving the pipeline in the vicinity of such sites.

Risks from Earthquakes. A discussion of the risks to public safety associated with an earthquake is included in Sections IV.1 and V.1.

V. 10 AIR QUALITY AND NOISE

Construction of the proposed pipeline will result in temporary impacts to air and noise quality on a localized basis. These impacts will be temporary in nature, lasting only for the duration of the construction period. Since there are no compressor stations associated with the project, no long-term adverse impacts will occur as a result of the operation of the Iroquois pipeline. The proposed project will result in long-term beneficial impacts on air quality stemming from the use of incremental supplies of natural gas, rather than less clean burning types of fossil fuels.

VI. STATUS OF PERMITS AND APPROVALS

As an interstate natural gas pipeline, the Iroquois project is subject to regulation by the FERC. As discussed previously, the FERC issued a DEIS in November 1989, and is scheduled to publish a final EIS in the late May - early June 1990. A FERC certificate is anticipated in late June or early July, 1990.

The following summarizes the status of other federal and state permits and approvals for the project.

Federal

The following are relevant federal permits and approvals for the project.

1.) U.S. Department of Energy. Sixteen of Iroquois' LDC shippers have received import permits from the DOE Office of Fossil Energy. These permits were received in January 1990.

2.) In conjunction with the crossing of the Appalachian Trail, Iroquois has consulted with the U.S. National Park Service (NPS), resulting in agreement on an acceptable Trail crossing. As required for the crossing of NPS lands owned in fee, Iroquois will obtain an easement as part of a land exchange with the NPS.

3). In March 1987, Iroquois submitted to the U.S. Army Corps of Engineers an application for a Department of the Army permit (Sections 10/404). This application was amended in July 1989 to reflect updated information submitted to the FERC in 1988 and early 1989. As part of that application, Iroquois completed a separate 404 (b) (1) analysis. The Corps of Engineers held joint hearings with the FERC concerning the project and is currently evaluating Iroquois' application.

Connecticut

In connection with its applications to FERC and the Corps of Engineers, in November 1989 Iroquois applied to the Connecticut Department of Environmental Protection (DEP) for appropriate consistency determinations or concurrences pursuant to Section 401 of the Clean Water Act and the Coastal Zone Management Act and the Connecticut Coastal Area Management Act.

New York

On December 8, 1989, the New York Public Service Commission (PSC) issued a Certificate of Environmental Compatibility and Public Need for the New York portion of the Iroquois pipeline, pursuant to Article VII of the New York Public Service Law. The PSC must also review and approve Environmental Management and Construction Plans, which are similar to the Council's Development and Management Plans, for each construction spread.

VII. CONSULTATION AND COORDINATION WITH OTHERS

The Iroquois project has been the subject of various federal, state, and local review for over four years. Within this period, the various government review processes have offered ample opportunities for public input; moreover, Iroquois has taken a proactive approach toward meeting with representatives of regulatory agencies and attending public meetings in the various affected municipalities. The Bibliography (Section VIII) identifies the various agencies and groups that have been contacted regarding the project. In addition, in accordance with the Siting Council's pre-application review process, Iroquois filed technical reports and documents concerning the project with each of the affected muncipalities. The materials filed with each city or town included:

- The Iroquois application to FERC;
- The DEIS;
- The Iroquois application for a Department of the Army permit;
- The nine Iroquois resource reports submitted to FERC in September 1988;
- Data summaries concerning the portion of the project within each municipality;
- LPEP materials;
- Town maps depicting the pipeline route; and

- Aerial photography at a scale of 1"=500' showing the proposed and alternative Iroquois routes.

In addition, Iroquois provided its coastal zone consistency certification to the City of Milford and the Town of Stratford -- the two municipalities in which the pipeline route will traverse the coastal management boundary.

These materials, which were filed with the municipalities between December 8 and 15, 1989, were submitted to local government officials and made available for public review. Iroquois timed the initiation of the Siting Council pre-application review period to coincide with the FERC DEIS review period so that public comments could be considered under both processes to the extent possible.

At the request of the various municipalities, Iroquois also has participated in public meetings or hearings. The following summarizes the various public meetings and hearings that have been held concerning the project in Connecticut. Table VII-1 provides a list of the meetings and hearings related to the project.

Spring 1986	Meetings held with various federal agencies, including COE, USFWS, EPA, NMFS, and state agencies, including CTDEP, OPM, and regional planning agencies.
Summer 1986	Public meetings held in Connecticut towns
Fall 1986	FERC scoping meeting held in Connecticut

1989-1990	Public meetings and hearings held in the CT towns along the Iroquois route. Overall public participation effort has involved direct contact with key public officials of each town, town meetings and hearings as requested by local officials, and various follow-up informational meetings with local commissions, private interest groups, etc. At the request of the public, Iroquois also has conducted route reconnaissance of select portions of the route with landowners and local officials.

Table VII-1

LIST OF PUBLIC MEETINGS AND HEARINGS
IN CONNECTICUT

Location	Date	Type of Meeting
	1986	
Town of Monroe	July 10	Public Meeting
City of Milford	July 14	Public Meeting
Town of Stratford	July 15	Town presentation
City of Shelton	July 16	Public Meeting
	1989	
Town of New Milford	December 14	Public Informational Meeting
Town of Brookfield	March 8	Public Informational Meeting
	December 11	Public Informational Meeting
Town of Stratford	March 28	Public Informationa Meeting
	December 19	Public Works Committee Meeting
City of Shelton	February 22	Meeting with City residents
	March 22	Meeting with City residents and city officials
	1990	
Town of New Milford	January 20	Informational route tour with Stilson Hill Road residents
	January 25-26	Public hearing
	February 3	Informational route tour with Stilson Hill Road residents
Town of Brookfield	January 22	Brookfield Inland/Wetlands Commission
	January 27	Brookfield Inland/Wetlands Commission

Table VII-1 (con't)

	January 31	Public Hearing
Town of Newtown	January 19	Meeting with First Selectman, head of NOPE, and Conservation Officer
Town of Monroe	January 3	Public Hearing
	January 4	Meeting with Conservation Commission Chairman
	January 31	Tour of Conrail Variation with First Selectman, and Conservation Commission Chairman, HVA
City of Shelton	January 23	Meeting with Shelton officials, landowners, Maguire Group
	January 31	Tour of Conrail Variation with Shelton officials, STOP, HVA
Town of Stratford	January 18	Meeting with Statford Task Force/ Public Hearing
	February 1	Meeting with Conservation Officer, Conservation Commission Chairman to discuss wetland issues
	February 6	Meeting with Stratford Task Force Public Hearing
City of Milford	January 3	Meeting with local citizens to discuss pipeline route
	January 4	Public Hearing
	January 18	Meeting with Milford Harbour Commission

Source: Iroquois Gas Transmission System 1990.

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