Federal Energy Regulatory Commission

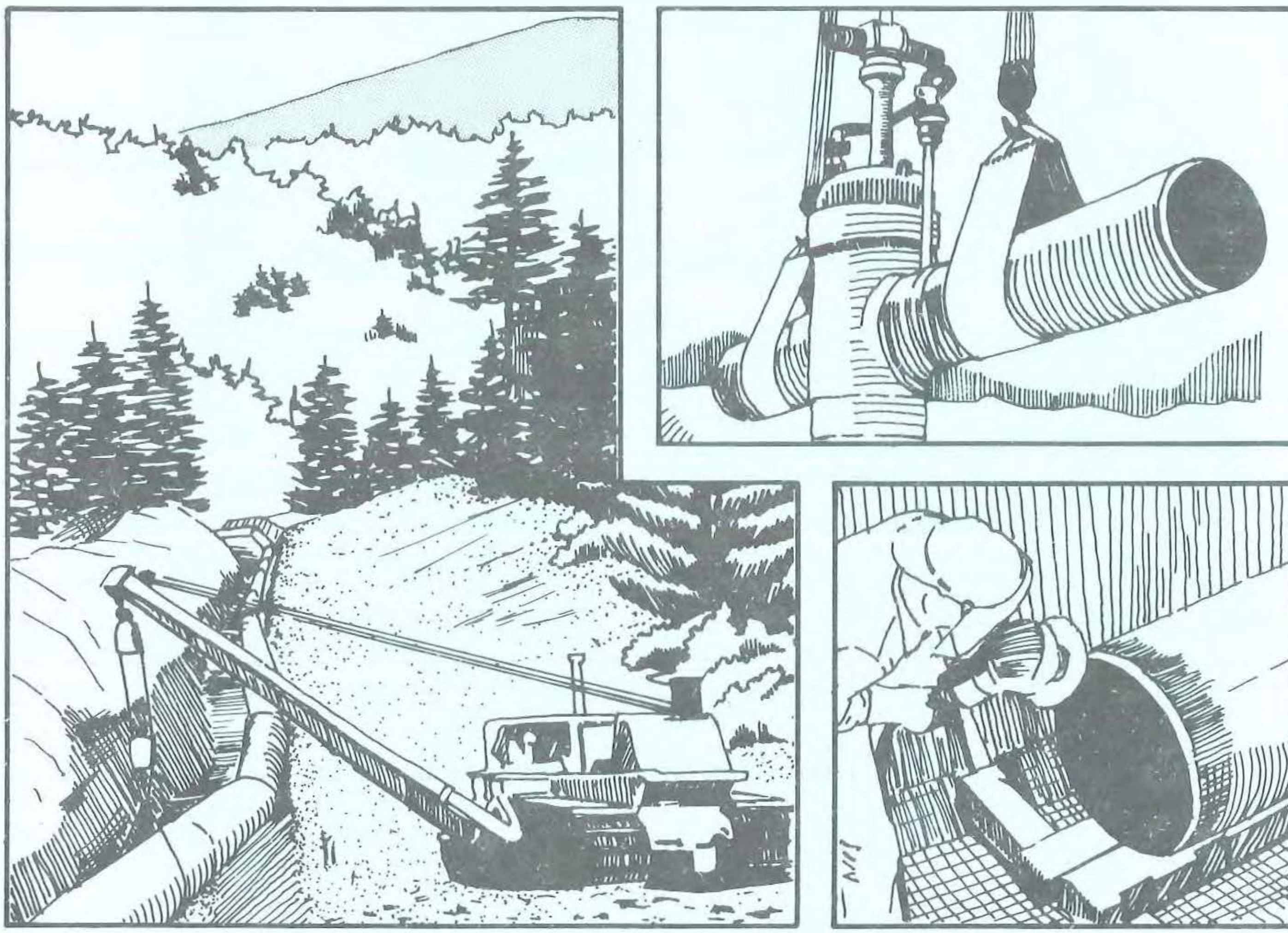
Office of Pipeline and Producer Regulation

June 1990

FERC/EIS-0054
Iroquois Gas Transmission System

Tennessee Gas Pipeline Company

Docket Nos. CP89-634-000
CP89-634-001
CP89-815-000
CP89-629-000
CP89-629-001



IROQUOIS / TENNESSEE PHASE I PIPELINE PROJECT

Final Environmental Impact Statement

Volume I

WASHINGTON, DC 20426

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Final Environmental Impact Statement

Volume I

LEAD AGENCY

FEDERAL ENERGY REGULATORY COMMISSION
OFFICE OF PIPELINE AND PRODUCER REGULATION

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U.S. DEPARTMENT OF ENERGY

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UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Iroquois Gas Transmission System)	Docket Nos.	CP89-634-000 CP89-634-001 and CP89-815-000
Tennessee Gas Pipeline Company)	Docket Nos.	CP89-629-000 and CP89-629-001

IROQUOIS/TENNESSEE PHASE I PIPELINE PROJECT
NOTICE OF AVAILABILITY OF
FINAL ENVIRONMENTAL IMPACT STATEMENT

(June 1, 1990)

Notice is hereby given that the staff of the Federal Energy Regulatory Commission (FERC) has made available a final environmental impact statement (FEIS) on the natural gas pipeline facilities proposed in the above-referenced dockets and related nonjurisdictional facilities.

The FEIS was prepared to satisfy the requirements of the National Environmental Policy Act. The staff concludes that approval of the proposed project, with appropriate mitigating measures, including receipt of necessary permits and approvals, would have limited adverse environmental impact. The FEIS evaluates alternatives to the proposals.

Overall, the Iroquois Gas Transmission System (Iroquois) proposes to construct pipeline facilities capable of transporting up to 575,900 thousand cubic feet per day (Mcfd) of natural gas received from TransCanada PipeLines Limited. For reasons discussed in the FEIS, the FEIS analyzes a system to only deliver 422,900 Mcfd. The gas would be delivered to local distribution companies (LDCs), cogeneration, and electric generation customers in New York, New Jersey, and the southern New England area. Iroquois would also deliver gas to Tennessee Gas Pipeline Company (Tennessee) near Wright, New York and Stratford, Connecticut for redelivery to certain LDCs, cogeneration, and power generation customers in Connecticut, Massachusetts, New Hampshire, and Rhode Island. Iroquois would deliver additional natural gas at South Commack, New York, for exchange and redelivery by Texas Eastern Transmission Corporation to three LDCs in New Jersey.

The Phase I pipeline facilities covered in the FEIS include 369.4 miles of 24- and 30-inch-diameter pipeline and appurtenant facilities proposed by Iroquois and 46.6 miles of mainline looping, 13.8 miles of lateral loops and replacement, 2.3 miles of new pipeline extensions, 8,550 horsepower of compression, and appurtenant facilities proposed by Tennessee. Iroquois would transport 422,900 Mcfd of natural gas from the United States-Canada border near Waddington, New York for delivery in New York and Connecticut.

The FEIS will be used in the regulatory decision-making process at the FERC and may be presented as evidentiary material in formal hearings at the FERC. While the period for filing interventions in this case has expired, motions to intervene out-of-time can be filed with the FERC in accordance with the Commission's Rules of Practice and Procedure, 18 CFR 385.214 (d). Further, anyone desiring to file a protest with the FERC should do so in accordance with 18 CFR 385.211.

The FEIS will be placed in the public files of the FERC, and is available for public inspection in the FERC's Public Reference and File Management Branch, Room 3308, 941 North Capitol Street, N.E., Washington, DC 20426. Copies have been mailed to Federal, state, and local government agencies, interested individuals, public interest groups, newspapers, libraries, and parties to the proceeding.

A limited number of copies of the FEIS is available from the FERC's Public Reference and File Management Branch, telephone (202) 208-1371, or from Mr. Mark Jensen, Project Manager, Environmental Policy and Project Analysis Branch, Office of Pipeline and Producer Regulation, Room 7312, 825 North Capitol Street, N.E., Washington, DC 20426, telephone (202) 208-1121 or FTS 268-1121. When these copies are depleted, the FEIS will be available from the National Technical Information Service (NTIS), Springfield, Virginia. Call the NTIS at (703) 487-4780 to obtain the FEIS identification number and information on how to order additional copies.

Lois D. Cashell,
Secretary

EXECUTIVE SUMMARY

MAJOR CONCLUSIONS

The Iroquois Gas Transmission System (Iroquois) and Tennessee Gas Pipeline Company (Tennessee) have jointly proposed to construct and operate interstate natural gas pipelines and associated aboveground facilities. These facilities comprise the Iroquois/Tennessee Pipeline Project. The purpose of the project would be to transport natural gas from Canada and domestic sources to the New England market for use by local distribution companies, cogeneration facilities, and electric power generation companies. The applicants contend this project would provide natural gas to a rapidly expanding market region; improve the existing natural gas transportation systems; and enhance air quality in the region by using clean-burning natural gas rather than coal or fuel oil.

The Iroquois/Tennessee Pipeline Project Phase I Environmental Impact Statement (EIS) is a document prepared by the staff of the Federal Energy Regulatory Commission (FERC or Commission), to fulfill the requirements of the National Environmental Policy Act (NEPA). We (the staff) have concluded that, if our recommended mitigating measures to reduce the anticipated environmental impact are adopted, construction and operation of the proposed facilities would have a limited adverse environmental impact (especially during construction), and would be an environmentally acceptable action.

We have evaluated a range of energy, system, and route alternatives and recommended adoption of a number of route variations that we feel would be environmentally preferable to portions of the project as proposed. In all other regards we found the proposed action to be environmentally acceptable. Use of the minor routing variations and mitigation measures was assumed in coming to the conclusions stated above.

In our analysis of energy alternatives, we have not identified any that would be environmentally preferable to the Iroquois/Tennessee Pipeline Project alone. However, we also looked at two single pipeline alternatives to the construction of <u>both</u> the Iroquois/Tennessee and Champlain Projects. Subsequent to the publication of the DEIS, the Champlain Project was indefinately deferred. As such, the single pipeline alternatives are not directly comparable to the Iroquois/Tennessee Project alone. In fact, the Iroquois/Tennessee Project, as now proposed, closely resembles the Iroquois Mainline Single Pipeline Alternative. Former Champlain Pipeline Project customers have now contracted with Iroquois for transportation services. We also evaluated two system alternatives that appear reasonable but not preferable to the Iroquois/Tennessee Pipeline Project.

PROPOSED ACTION

The overall Iroquois/Tennessee Pipeline Project is designed to transport up to 575,900 thousand cubic feet per day (Mcfd) of natural gas received from TransCanada Pipelines Limited (TransCanada) to various local distribution companies (LDCs), and cogeneration and electric generation customers in the southern New England, New Jersey, and New York regions. The project includes the construction by Iroquois of approximately 369 miles of pipeline from the United States-Canadian border near Iroquois, Ontario, through New York, Connecticut, and across Long Island Sound to a point of interconnection with the facilities of Long Island Lighting Company (LILCO) at South Commack, New York.

The overall Iroquois/Tennessee Pipeline Project also includes the expansion and modification of Tennessee's facilities to transport the above volumes of 382,800 Mcfd of Canadian natural gas received from Iroquois at Wright, New York, and Stratford, Connecticut, for delivery to LDCs and cogeneration customers in Massachusetts, Connecticut, Rhode Island, New York, and New Hampshire; and to transport 70,000 Mcfd of domestic natural gas from Louisiana to an interconnection with Algonquin Gas Transmission Company (Algonquin) for ultimate delivery to an electric power generation customer in Massachusetts and Rhode Island.

In this EIS we have analyzed a delivery system for Phase I that contemplates delivery of 422,900 Mcfd from Canada through the proposed Iroquois system and the expanded Tennessee system. This phase of the project is complete with all facilities (both jurisdictional and nonjurisdictional), customers, and services identified. The remaining services contemplating transportation and delivery of 153,000 Mcfd of Canadian natural gas and 70,000 Mcfd of domestic natural gas will be considered in an environmental document to be issued later this year. The Phase II Project includes facilities and services by Iroquois, Tennessee, and Algonquin. This project is not ready to go forward at this time due to the fact that Algonquin's application does not break down facilities or services by project, for either Iroquois/Tennessee or ANR. In addition, new facility requirements involved with the switched Champlain Pipeline Project customer deliveries created the need for new facilities which could not be evaluated on the schedule for the Phase I facilities.

Construction of the Iroquois/Tennessee Pipeline Project would result in significant effects on forested areas, wetlands, streams, soils, and disruption to residents. Most of the adverse effects would occur during the construction of the facilities and will be reduced through the mitigation measures that we have recommended. Other resources such as air quality, geology, terrestrial and aquatic ecology, and cultural resources would be affected to a lesser extent. Beneficial impact would result to the extent that the natural gas would be used to replace or offset use of higher pollutant fuels.

Construction of the proposed Iroquois pipeline would result in the temporary clearing of 1,665 acres and permanent clearing of 727 acres of forestland. About 267 acres of wetland, including forested wetland, would be disturbed during construction. Approximately 2,128 acres of agricultural land including active cropland, orchards, nurseries and open space would be affected. Residents along the proposed pipelines and adjacent to aboveground facilities would be disturbed by noise, dust, and traffic during construction. Long-term impact includes the encumbrance of the permanent easement. Approximately 20 percent of the Iroquois route would be new right-of-way which could have visual impact due to the cleared right-of-way and aboveground facilities. Although Tennessee's segments are primarily loops and replacement lines, similar effects would occur. Construction of Tennessee's proposed facilities would result in the temporary clearing of 287 acres and the permanent clearing of 111 acres of forestland. Approximately 14 acres of wetland habitat would be temporarily disturbed while 175 acres of farmland would be affected. Additionally, residents in proximity to Tennessee's compressor stations would be subject to noise impact.

ALTERNATIVES CONSIDERED

Alternatives to all or segments of the Iroquois/Tennessee Project were considered. The no action alternative would avoid all the environmental effects of the proposed project but require potential users to find other energy sources, the most feasible of which involve more environmental impact. At least three single pipeline systems were identified as potentially environmentally superior to the construction of <u>both</u> the Iroquois/Tennessee and Champlain projects (see Volume II). Further consideration of these alternatives is not appropriate at this time and is beyond the scope of the EIS for reasons previously mentioned. No project system alternatives or major geographic alternatives were found superior to the project as proposed.

A total of 78 route variations were addressed in the DEIS; 76 of these were associated with the proposed Iroquois route. During the DEIS comment period, 42 new route variations were identified. In addition, further analyses or modifications were provided for 28 of the original 76 Iroquois variations. Of the total 133 variations to the Iroquois route that were evaluated, we recommend the adoption of 94 variations.

AREAS OF CONCERN

The public, concerned environmental organizations, industry, and governmental agencies have had several opportunities to submit concerns and issues that were either specific or generic since Iroquois' initial application was filed in 1986 and later, after Iroquois' and Tennessee's additional filings were received by FERC in January 1988. Although many of the concerns and issues presented would normally be raised for any pipeline project and would be addressed by us to satisfy NEPA requirements, many of the hundreds of comments received were related to site-specific issues. Each one of these comments, whether generic or site-specific, was considered by the preparers of this DEIS. Our responses to EIS comments are be included in Volume III of this final EIS (FEIS).

Many persons were concerned with the effect that the pipeline would have on residential and commercial property values; the impact on remaining open space, especially in southern Connecticut; short-term construction effects on community character, damage to agriculturally productive soils, and visual effects of forest clearing; increased unauthorized access to forestlands and/or remote areas; and the use of eminent domain to establish rights-of-way through private lands rather than public lands.

Concern for the natural environment was expressed by commentors who raised issues related to: the number of wetlands crossed by the pipeline routes; the fact that construction across surface waters could affect downstream and migratory fisheries as well as potable water resources; indication that vegetation clearing would result in habitat alteration for both plant and wildlife species, including deer wintering areas; concerns for other unique areas which contain wildlife habitat and rare and endangered plants; and use of herbicides for vegetation control.

Many other concerns were expressed regarding construction and operation of the project facilities by those who live adjacent to the proposed pipeline right-of-way. These concerns included: proximity to dwellings; blasting, as it may affect the structural integrity of existing buildings and water supply wells; duration of construction; construction safety procedures; construction techniques for traversing water bodies; contamination of water resources; the discharge of hydrostatic test water; land restoration after construction; and noise emissions during compressor station operation.

Safety issues were raised by commentors concerned about operational aspects of the proposed system where located in proximity to residential areas. Safety concerns included: emergency response by operators to pipeline leaks or explosions; procedures for detecting pipe corrosion; the number and location of shutoff valves; and the ability of local fire companies to respond to pipeline emergencies.

Other concerns were related to the cultural resource value of historic and archeological sites and districts and architecturally significant structures. Route alternatives and variations were identified by concerned parties who sought greater use of existing rights-of-way and avoidance of sensitive resources. The State of New York has actively reviewed Iroquois' proposed facilities pursuant to Article VII of the New York State Public Service Law. The State of Connecticut and local cities and towns in Connecticut have commented extensively on Iroquois' proposed route location. The Commonwealth of Massachusetts and State of Rhode Island also provided comments for our consideration.

Approval of Iroquois and Tennessee facilities by New York State would allow route adjustment within a corridor 660 feet to either side of their proposed route. Our approval would allow more limited route adjustment, primarily where the same landowner would be affected.

In three instances we have recommended environmentally superior route variations which cross New York State Forests where the state contends provisions of Article XIV of the State Constitution prohibit pipeline facilities. In these locations the state has approved different facility locations.

We have recommended an extensive number of mitigation measures that would require implementation by the applicants prior to, during, and after construction.

Another area of concern relates to the cultural resource aspects of the project. Historical properties and archeological sites which are in or eligible for listing in the National Register of Historic Places (NRHP) and previously unidentified cultural resources are being identified and evaluated pursuant to the requirements of Section 106 of the National Historic Preservation Act (NHPA). The State Historic Preservation Officer's (SHPO) comments regarding the significance of each identified property and/or site and the project's effect on each, will be obtained. Avoidance of such properties is the goal; however, if an effect would occur, measures to avoid any adverse effect will be developed in coordination with the SHPOs and the Advisory Council on Historic Preservation (ACHP) for any listed or eligible properties that could be affected by the project. Although the site evaluation work and mitigation requirements will not be completed for inclusion in the final EIS (FEIS), completion of this activity prior to construction will be a condition to any Certificate of Public Convenience and Necessity that may be issued by the Commission.

IROQUOIS/TENNESSEE PIPELINE PROJECT
FINAL ENVIRONMENTAL IMPACT STATEMENT

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Note To Reader: The environmental analysis, comparison of alternatives and conclusions and recommendations of the regional system alternatives are contained in Volume II of the Iroquois/Tennessee Pipeline Project DEIS and incorporated herein by reference.

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ACRONYMS AND ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
A-H	Albany-Highland
ACHP	Advisory Council on Historic Preservation
Algonquin	Algonquin Gas Transmission Company
ALJ	Administrative Law Judge(s)
ANR	ANR Pipeline Company
AT	Appalachian Trail
BACT	best available control technology
Bay State	Bay State Gas Company
Berkshire Gas	Berkshire Gas Company
BHC	Bridgeport Hydraulic Company
Boston Gas	Boston Gas Company
Btu	British thermal unit
BUG	Brooklyn Union Gas Company
Central Hudson	Central Hudson Gas and Electric Corporation
CEQ	Council on Environmental Quality
Champlain	Champlain Pipeline Company
CFR	Code of Federal Regulations
CL&P	Connecticut Light and Power Company
CNG	CNG Transmission Corporation
CO	carbon monoxide
Coastal Power	Coastal Power Production
COE	U.S. Army Corps of Engineers
Colonial	Colonial Gas Company
Columbia	Columbia Gas Transmission Corporation
Commission	Federal Energy Regulatory Commission
Con Edison	Consolidated Edison Company of New York, Inc.
Connecticut Natural	Connecticut Natural Gas Corporation
CTDEP	Connecticut Department of Environmental Protection
CWA	Clean Water Act (Federal)
dBA	decibels of A-weighted scale
dbh	diameter at breast height
DEIS	Draft Environmental Impact Statement
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
Dthd	dekatherms (of gas) per day
DWA	deer wintering area
EA	Environmental Assessment
E&SC	Erosion and Sedimentation Control
EIS	Environmental Impact Statement
Elizabethtown	Elizabethtown Gas Company
EnergyNorth	EnergyNorth Natural Gas, Inc.
EPA	Environmental Protection Agency
ESA	Endangered Species Act
Essex County	Essex County Gas Company
FDA	U.S. Food and Drug Administration
FEIS	Final Environmental Impact Statement

ACRONYMS AND ABBREVIATIONS (cont'd)

FERC	Federal Energy Regulatory Commission
FHA	Federal Highway Administration
FWS	U.S. Fish and Wildlife Service
GE	General Electric Corporation
GNE	Greater Northeast
GPD	gallons per day
GPM	gallons per minute
Granite State	Granite State Gas Transmission, Inc.
Great Lakes	Great Lakes Gas Transmission Company
HC	hydrocarbons
hp	horsepower
HVA	Housatonic Valley Authority
Iroquois	Iroquois Gas Transmission System
ISCLT	Industrial Source Complex Long Term
JMC Selkirk	JMC Selkirk, Inc.
Kimberly-Clark	Kimberly-Clark Corporation
kV	kilovolt
L90	sound level exceeded 90 percent of the observation period
lb/hr	pounds per hour
LDC	local distribution company
Ldn	day-night sound level
Leq(24)	24-hour equivalent sound level
LILCO	Long Island Lighting Company
LNG	liquified natural gas
LPEP	Land Preservation and Enhancement Program
MADEM	Massachusetts Department of Environmental Management
MADEP	Massachusetts Department of Environmental Protection
MADFW	Massachusetts Division of Fish and Wildlife
MAOP	maximum allowable operating pressure
MBT	Migratory Bird Treaty
Mcf	thousand cubic feet
Mcfd	thousand cubic feet per day
MEFSC	Massachusetts Energy Facility Siting Council
MEPA	Massachusetts Environmental Policy Act
$\mu g/m^3$	micrograms per cubic meter
Miles	Miles Inc. Pharmaceutical Division
MLV	mainline valve
MMBtu/d	million BTUs per day
Monsanto	Monsanto Chemical Company
MP	milepost
MW	megawatt
NAAQS	National Ambient Air Quality Standards
NEEPC	New England Energy Policy Council
NEP	New England Power Company
NEPA	National Environmental Policy Act
New Jersey Natural	New Jersey Natural Gas Company
NFG	National Fuel Gas Supply Corporation
NGA	Natural Gas Act

ACRONYMS AND ABBREVIATIONS (cont'd)

NHDES	New Hampshire Department of Environmental Services
NHPA	National Historic Preservation Act
Niagara Mohawk	Niagara Mohawk Power Corporation
NIP	Niagara Import Point
NJDEP	New Jersey Department of Environmental Protection
NMFS	National Marine Fisheries Service
NOA	Notice of Availability
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRHP	National Register of Historic Places
NRI	Nationwide Rivers Inventory
NSP	Niagara Settlement Project
NSPS	New Source Performance Standards
NWI	U.S. Fish and Wildlife Service National Wetland Inventory
NYDAM	New York State Department of Agriculture & Markets
NYDEC	New York Department of Environmental Conservation
NYDOT	New York State Department of Transportation
NYDPS	New York State Department of Public Service
NYNHP	New York Natural Heritage Program
NYPA	New York Power Authority
NYPDES	New York Pollution Discharge Elimination System
NYPSC	New York State Public Service Commission
NYSEG	New York State Electric & Gas Corporation
NYSTF	New York State Task Force
OPPR	Office of Pipeline and Producer Regulation
ORV	off-road vehicle
OSHA	Occupational Safety and Health Administration
PADER	Pennsylvania Department of Environmental Regulation
PAHs	polyaromatic hydrocarbons
Pawtucket	Pawtucket Power Associates Limited Partnership
PCBs	polychlorinated biphenyls
PM	particulate matter
Providence	Providence Gas Company (Providence)
Prudential	Prudential Insurance Company
PSD	Prevention of Significant Deterioration
PSE&G	Public Service Electric & Gas Company
psig	pounds per square inch gauge
R&HA	Rivers and Harbor Act
RIDEM	Rhode Island Department of Environmental Management
ROW	Right-of-Way
SCS	U.S. Department of Agriculture Soil Conservation Service
SEQRA	New York State Environmental Quality Review Act
SHPO	State Historic Preservation Officer
Southern Connecticu	Southern Connecticut Gas Company
SO_2	sulfur dioxide
SPCCP	Spill Prevention, Containment, and Control Plan
SRL	(New York) State Reforestation Lands

ACRONYMS AND ABBREVIATIONS (cont'd)

SSA	sole-source aquifer
STOP	Southern Connecticut Townspeople Opposing the Pipeline
Tennessee	Tennessee Gas Pipeline Company
Texas Eastern	Texas Eastern Transmission Corporation
Texas Gas	Texas Gas Transmission Corporation
TransCanada	TransCanada Pipelines Limited
Transco	Transcontinental Gas Pipe Line Corporation
TSCA	Toxic Substances Control Act
USBM	U.S. Bureau of Mines
USCG	U.S. Coast Guard
USFDA	U.S. Food and Drug Administration
USGS	U.S. Geological Survey
Valley Gas	Valley Gas Company
VAT	Vermont Agency of Transportation
VDFW	Vermont Department of Fish and Wildlife
VGS	Vermont Gas Systems, Inc.
VPSB	Vermont Public Service Board
VRM	Visual Resource Management
Yankee	Yankee Gas Services Company

1.0 PURPOSE

1.1 PURPOSE AND NEED

Iroquois, Tennessee, and Algonquin have proposed to construct and operate natural gas pipeline facilities to deliver gas to LDCs, cogeneration and electric-power generation companies in New York, New Jersey, and the New England area. On January 17, 1989, Iroquois applied in Docket No. CP89-634-000 to the Commission for authorization to transport 533,900 Mcfd of natural gas through its proposed pipeline system, Tennessee applied in Docket No. CP89-629-000 for authorization to transport 317,700 Mcfd of Canadian and domestic natural gas through its existing and proposed pipeline system, and Algonquin applied in Docket No. CP89-661-000 for authorization to transport 432,204 Mcfd of Canadian and domestic natural gas to customers of the Champlain Pipeline Company (Champlain), Iroquois/Tennessee Pipeline, and ANR projects.

On December 29, 1989, Iroquois filed an amendment with the Commission, Docket No. CP89-634-001, for authorization to transport up to 575,900 Mcfd of natural gas through its proposed system. This amendment was caused by the deletion of customers from the initial filing, changes in volumes of gas requested by existing customers, and the addition of certain customers from the Champlain Pipeline Project. On January 26, 1990, Tennessee filed an amendment in Docket No. CP89-629-001 and a new application in Docket No. CP90-639-000 to conform its requested services to those proposed by Iroquois in its amendment. In Docket No. CP89-629-001 Tennessee requested authorization to transport 234,800 Mcfd of Canadian and domestic natural gas for customers of the Iroquois/Tennessee Pipeline Project. In Docket No. CP90-639-000 Tennessee requested authorization to construct and operate facilities to transport 118,000 Mcfd for certain former customers of the Champlain Pipeline Project. On February 28, 1990, Algonquin filed an amendment in Docket No. CP89-661-001 to transport up to 245,950 Mcfd of natural gas on behalf of Iroquois/Tennessee and ANR project customers.

The full project as described above is incomplete due to the fact that the facilities identified by Algonquin are not broken down by project or project phase. In its filing Algonquin presented its facility requirements in one group for the Iroquois/Tennessee Project and the ANR Project. In addition Algonquin has only proposed in its amendment to transport 35,000 Mcfd for New England Power Company (NEP) for the ANR Project, while ANR and Columbia Gas Transmission Corporation (Columbia) proposed to provide 60,000 Mcfd of natural gas for NEP in ANR Project Phase I. Further, Algonquin has proposed to provide a transportation service of 30,000 Mcfd for Providence Gas Company (Providence) from the Iroquois/Tennessee Project. Neither Iroquois nor Tennessee have provided a filing to provide this service to Providence. In a filing on March 28, 1990, Algonquin indicated that only two laterals in its amendment would be required to transport natural gas to NEP for ANR Project Phase I. These facilities are currently being analyzed in the NEPA document for that Project.

In this FEIS, the staff is analyzing a complete delivery system for Phase I of the project that contemplates delivery of 422,900 Mcfd of natural gas from Canada through the proposed Iroquois system and the expanded Tennessee system. This phase of the project is complete with all facilities (both jurisdictional and nonjurisdictional), customers, and services identified. All environmental information relevant to this portion has been received and is being considered in this document. The remaining services contemplating transportation and delivery of 153,000 Mcfd of Canadian natural gas and 70,000 Mcfd of domestic natural gas will be considered in an environmental document to be issued later this year. Table 1.1-1 identifies the shippers and volumes proposed for Phase I of the project.

In addition to meeting current market needs, the applicants contend that their pipeline project would: provide additional pipeline capacity to transport natural gas to a rapidly expanding market region; offer region-wide benefits by improving the transportation capabilities of Tennessee to deliver additional domestic natural gas supplies to customers in the northeastern United States; introduce a new price-competitive source of natural gas from western Canada; and enhance air quality in the region by allowing increased use of clean-burning natural gas rather than coal or oil in electric generation plants.

Iroquois believes that a direct transportation link between major gas transmission companies in the eastern United States and Canada would make alternative supply options available to gas consumers on both sides of the United States-Canadian border. Iroquois proposes to provide this link and thereby make New York and southern New England an integral part of an international pipeline grid through which transportation efficiencies (like backhaul and displacement) could be accomplished and relieve existing capacity constraints on pipelines now serving the Northeast.

On January 11, 1990, the U.S. Department of Energy (DOE) Office of Fossil Energy issued DOE/FE Opinion and Order No. 368, a Conditional Order Granting Authorization to Import Natural Gas from Canada and Granting Intervention. This order made a preliminary determination that the import of natural gas from Canada by 16 of the LDC customers of Iroquois would not be inconsistent with the public interest, conditioned upon completion of the environmental impact of the new facilities proposed to import and transport the gas.

Many commenters have commented on the issue of whether this project is needed. It is our position that this issue is most appropriately addressed via the Commission's review of the complete record in the proceeding, so long as the FEIS addresses where these issues are being dealt with and the process is open to public participation. This EIS is **not** a decision document. It identifies the environmental issues the Commission will weigh in its analysis of all issues relevant to the project. To review these issues at length in the FEIS would be duplicative.

The Commission has addressed the issue of need determination in Pacific Alaska LNG Co., et al., 9 FERC ¶ 61,334 at page 61,709 (December 12, 1979) and found that this procedure fully complies with NEPA's requirement.

In that case, the Sierra Club argued that the EIS for the Pacific Alaska LNG Company, et al. project, Docket No. CP75-140, et al., failed to analyze the project need, and thereby violated Section 102 of NEPA.

The Commission disagreed, stating that its final decision would address the issue of need in detail and that all interested parties had an opportunity to contribute to that record. The Commission also stated that the contention that its proceeding does not provide for the broad public review and comment required by NEPA ignored the fact that the Commission issues a Draft EIS and then issues a Final EIS (which contains the comments on the Draft EIS and responses to the comments).

TABLE 1.1-1

Proposed Shippers and Gas Deliveries for Phase I of the Iroquois/Tennessee Project

SHIPPERS	IROQUOIS		TENNESSEE		NONJURISDICTIONAL FACILITIES
	Delivery Point	Quantity a/	Delivery Point	Quantity a/	
Boston Gas Company	Wright, NY	17,100	Beverly-Salem, MA	5,480	Exist. LDC connection at Tennessee
			Reading, MA	3,380	Exist. LDC connection at Tennessee
			Danvers, MA	8,240	LDC Connection at Tennessee
Brooklyn Union Gas	S. Commack, NY	70,000			LILCO connection for backfeed through NYFGDS b/
Central Hudson Gas & Elec.	Pleasant Valley, NY c/	20,000			LDC 16" Lateral to Lagrange, NY & Roseton Plant
Colonial Gas Company	Wright, NY	2,000	Mendon or Tewksbury, MA	2,000	Exist. LDC connection at Tennessee
Yankee Gas Services	Huntington, CT	12,500	Torrington, CT	1,000	Exist. LDC connection at Tennessee
	New Milford, CT	12,500	Winstead, CT	200	Exist. LDC connection at Tennessee
	Stratford, CT	22,000	Derby, CT	100	Exist. LDC connection at Tennessee
			Longridge, CT	100	Exist. LDC connection at Tennessee
			E. Granby, CT	9,000	Exist. LDC connection at Tennessee
			Stamford, CT	10,000	Exist. LDC connection at Tennessee
			Norwalk, CT	1,600	Exist. LDC connection at Tennessee
	Wright, NY	9,000	E. Granby, CT	4,000	Exist. LDC connection at Tennessee
			Wallingford, CT	5,000	Exist. LDC connection at Tennessee
Connecticut Natural Gas	Stratford, CT	35,000	Bloomfield, CT	30,000	Exist. LDC connection at Tennessee
			New Britain, CT	1,800	Exist. LDC connection at Tennessee
			N. Bloomfield, CT	900	Exist. LDC connection at Tennessee
			Farmington, CT	1,400	Exist. LDC connection at Tennessee
			Greenwich, CT	900	Exist. LDC connection at Tennessee
Consolidated Edison of NY	S. Commack, NY	20,000			LILCO connection for backfeed through NYFGDS b/
Elizabethtown Gas Co.	S. Commack, NY d/	5,000			Delivery by Texas Eastern through exchange agreement
Energy North Natural Gas	Wright, NY	4,000	Laconia, NH	4,000	Exist. LDC connection of Tennessee
Essex County Gas Co.	Wright, NY	2,000	Haverhill, MA	2,000	Exist. LDC connection of Tennessee
Granite State Gas	Wright, NY	12,000	Agawam, MA	7,400	Exist. LDC connection at Tennessee
			Pleasant St., MA	4,600	Exist. LDC connection at Tennessee
JMC Selkirk Cogeneration	Wright, NY	23,000	Selkirk, NY	21,000	Niagara Mohawk Gas Lateral to 80 MW cogen.
Long Island Lighting Co.	S. Commack, NY	35,000			LILCO 20" Lateral from Iroquois to Deer Park, NY
Mass Power, Inc.	Wright, NY	25,000	Monson, MA	25,000	Bay State Lateral to 240 MW cogen. at Springfield, MA
New Jersey Natural Gas	S. Commack, NY d/	40,000			Delivery by Texas Eastern by exchange agreement

TABLE 1.1-1 (cont'd)

SHIPPERS	IROQUOIS		TENNESSEE		NONJURISDICTIONAL FACILITIES
	Delivery Point	Quantity a/	Delivery Point	Quantity a/	
Pawtucket Power Associates	Wright, NY	12,800	Lincoln, RI	12,700	LDC connection at Tennessee cogen 61MW at Pawtucket, RI
Public Service Elec. & Gas	S. Commack, NY d/	10,000			Delivery by Texas Eastern by exchange agreement
Southern Connecticut Gas	Milford, CT	18,000			Direct interconnection with Southern Connecticut Gas
	Stratford, CT	17,000			
Valley Gas Company	Wright, NY	1,000	Lincoln, RI	1,000	LDC connection to Tennessee
TOTALS		422,900		162,800	

a/ Gas quantities are shown in thousands of Mcfd (which is nearly equivalent to MMBtus per day)
b/ New York Facilities Gas Distribution System (NYFGDS)
c/ Central Hudson would purchase an additional 100,000 Mcfd during the months of April through October from Brooklyn Union, Connecticut Natural, and New Jersey Natural.
d/ Shippers reserved right to specify Brookfield and Stratford as alternate delivery points.

Moreover, the DEIS does follow the Council on Environmental Quality (CEQ) regulation to briefly discuss the issue of the need for the gas. The public and other agencies had an adequate opportunity to comment on this discussion when the EIS was circulated. Moreover, all interested parties had been provided an opportunity to contribute to the record as parties to the overall Commission proceeding. Such a procedure fully complies with the consultation procedure required by NEPA.

1.2 RELATIONSHIP TO OPEN SEASON SETTLEMENT PROJECTS

The Commission issued orders on January 12, 1989, severing the four settlement projects, Iroquois/Tennessee, Niagara Settlement (NSP), Champlain, and ANR, for processing as discrete projects and required the filing of amended applications to implement the projects. As required by the Settlement, the sponsors of the Iroquois/Tennessee, Champlain, and ANR settlement projects submitted their amended applications on January 17, 1989. The Commission required the proponents of NSP to file their amended applications on January 27, 1989. The proponents filed the required applications with FERC. On February 24, 1989, Great Lakes Gas Transmission Company (Great Lakes) filed an application with the Commission for facilities to support TransCanada Pipelines Limited (TransCanada) deliveries to the Niagara Import Point for the NSP.

On August 2, 1989, Great Lakes filed another application with the Commission to build and operate facilities to support TransCanada deliveries to the Champlain, Iroquois/Tennessee, and ANR Projects. Great Lakes' filing in support of the latter three projects was in Docket No. CP89-1898-000, and included 694.7 miles of 42- and 36-inch-diameter pipeline loops 1/, seven 27,000-hp compressor additions, and modifications to 12 compressor stations, and one meter station. On January 23, 1990, Great Lakes withdrew this application, stating that TransCanada would provide all transportation necessary to provide service to these settlement projects, through its system in Canada.

The four settlement projects and their relationships are briefly described below. Each is being studied in a separate EIS or environmental assessment (EA).

1.2.1 The Iroquois/Tennessee Pipeline Project

The Iroquois/Tennessee Pipeline Project was originally designed to transport up to 533,900 Mcfd of natural gas received from TransCanada to various LDCs, cogeneration, and electric generation customers in the southern New England, New Jersey, and New York regions. The project included the construction by Iroquois of approximately 369 miles of pipeline from the United States-Canadian border near Iroquois, Ontario, through New York, Connecticut, and across Long Island Sound to a point of termination with the facilities of LILCO as South Commack, New York.

The Iroquois/Tennessee Pipeline Project also included the expansion and modification of Tennessee's facilities to transport 243,195 Mcfd of Canadian natural gas received from Iroquois at Wright, New York, and Stratford, Connecticut, for delivery to LDCs and cogeneration customers in Massachusetts, Connecticut, Rhode Island, New York, and New

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1/ A pipeline loop is a segment of pipeline that is usually adjacent to an existing pipeline and connected to it at both ends. The loop allows more gas to flow through the pipeline without additional compression.

Hampshire; and to transport 74,547 Mcfd of domestic natural gas on Tennessee's system from Louisiana to an interconnection with Algonquin for ultimate delivery to NEP in Massachusetts and Rhode Island.

Algonquin proposed to receive up to 20,000 Mcfd of Canadian natural gas from the Iroquois/Tennessee Pipeline Project and redeliver it to LDCs in Connecticut and New York.2/ Algonquin also proposed to receive up to 74,547 Mcfd of domestic natural gas from Tennessee at Mendon, Massachusetts, and redeliver it to NEP's Brayton Point and Manchester Street plants. Finally, Texas Eastern Transmission Corporation (Texas Eastern) was to deliver 55,000 Mcfd of natural gas received via an exchange with three New York City area LDCs at South Commack and Staten Island, New York, to three LDCs in New Jersey.

On December 29, 1989, Iroquois filed an amendment to its application requesting authority to transport up to 575,900 Mcfd of natural gas received from TransCanada to various LDCs, cogeneration, and electric generation customers in the southern New England, New Jersey, and New York regions. This amendment included: 1) additional volumes for three former customers of the Champlain Pipeline Project who have requested that Iroquois transport up 118,000 Mcfd of natural gas on their behalf 3/, 2) the termination of transportation contracts totalling 74,100 Mcfd of natural gas, with five cogeneration customers who did not receive the necessary approvals for natural gas supplies from producers in western Canada; and 3) a reduction of 2,000 Mcfd in transportation volumes for one cogeneration customer and an increase of 100 Mcfd to one cogeneration customer. In its amendment, Iroquois did not change any proposed pipeline facilities as a result of the modified natural gas volumes and added one meter station to its proposed facilities.

On January 29, 1990, Tennessee filed an amendment, in Docket No. CP89-629-001, and a new "expansion" application, in Docket No. CP90-639-000, to conform its project to Iroquois' amendment. Tennessee's amendment deleted service to three original customers, modified the proposed delivery volumes to four other customers, deleted three originally proposed loops, deleted one originally proposed lateral, added two new loops, increased compression at two locations, and modified the length of two of the originally proposed loops. In its expansion application, Docket No. CP90-639-000, Tennessee proposes to transport up to 118,000 Mcfd on behalf of the three former customers of the Champlain Pipeline Project identified above; to construct and operate approximately 35 miles of mainline loop, lateral loop, and lateral replacement; install 7,500-hp of compression at four locations; and construct metering and regulating facilities.

On February 28, 1990, Algonquin filed an amendment, in Docket No. CP89-661-001, to transport up to 245,950 Mcfd of natural gas on behalf of Iroquois/Tennessee and ANR project customers, including customers who originally requested service from Champlain. Algonquin's amendment also modified its facility requirements by: 1) deleting four of its originally proposed loops, 2) adding three new loops along its system, 3) proposing to replace a portion of its existing pipeline with a larger diameter pipeline, and 4) relocating a proposed compressor station. Furthermore, the amendment deleted customers who did not

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2/ Algonquin orignally proposed to transport 20,030 million British thermal units of gas per day (MMBtu/d). We have converted these units to Mcfd for consistency with other units.

3/ These three customers -- Boston Gas, Granite State, and NEP -- were also shippers in the original Iroquois/Tennessee Project.

receive natural gas supplies from producers in western Canada and modified the volume of natural gas that Algonquin would receive for system supply. The amendment also included a request for authorization to transport 30,000 Mcfd of natural gas for Providence, a customer for which no upstream transportation authorization has been requested by either Iroquois or Tennessee and to transport 35,000 Mcfd for NEP for the ANR Project.

As noted above, the additional or facilities modified by Algonquin and Tennessee will be studied in a separate NEPA document later in 1990.

1.2.2 The Champlain Pipeline Project

The Champlain Pipeline Project was originally designed, in Docket No. CP89-654-000, to transport 430,600 Mcfd of natural gas received from TransCanada to various LDCs, cogeneration, and electric power production and pipeline customers in the New England region. The project was to include the construction by Champlain of 4,000-hp of compression and approximately 322.7 miles of pipeline extending from the United States-Canadian border near Philipsburg, Quebec, through Vermont, New Hampshire, and Massachusetts to a point of termination near West Medway, Massachusetts. The proposed pipeline would have had one proposed point of interconnection with Tennessee at Upton, Massachusetts, and one point of interconnection with Algonquin at West Medway, Massachusetts.

On November 7, 1989, ANR, which had become the operator of Champlain, requested that the Commission suspend processing of the Champlain application. In the filing, ANR indicated that the project would be restructured and refiled with FERC sometime in 1990. As a result of this request three original customers of Champlain requested transportation service from the Iroquois/Tennessee Pipeline Project. At this time the Champlain proposal is not being processed.

In Docket No. CP89-661-000, Algonquin originally proposed to receive up to 307,174 Mcfd of Canadian natural gas from the Champlain Pipeline Project, phased in over 2 years, on behalf of 12 customers of Champlain. Algonquin then proposed to redeliver up to 196,574 Mcfd to 10 LDCs and cogeneration and electric generation customers at various points of delivery along the Algonquin system; redeliver up to 60,000 Mcfd to NEP at its Brayton Point and Manchester Street electric generating stations; and to receive up to 50,600 Mcfd for its own system supply requirements.

1.2.3 The ANR Project

The ANR Project involves the expansion of ANR's, Columbia's, CNG's,Texas Gas Transmission Corporation's (Texas Gas), and Transcontinental Gas Pipe Line Corporation's (Transco) systems to deliver 503,000 Mcfd of primarily domestic natural gas on a firm basis on behalf of LDCs, cogenerators, and one electric generation customer. These four companies propose to construct approximately 489 miles of pipeline, 159,450-hp of compression, and appurtenant facilities. ANR would deliver about 115,000 Mcfd to Columbia near Paulding, Ohio.4/ Columbia would deliver 55,000 Mcfd to a cogenerator in New Jersey

4/ Columbia presented their deliveries in terms of dekatherms of gas per day (Dthd). We have converted these units to Mcfd for consistency with other units.

and 60,000 Mcfd to Algonquin for redelivery to the NEP Brayton Point and Manchester Street plants.

ANR would also deliver 138,000 Mcfd to CNG at Lebanon, Ohio, for transportation to end users. CNG intends to deliver 76,900 Mcfd to six cogenerators in New York and 29,600 Mcfd to other cogenerators that are, currently, unidentified. In addition, CNG will redeliver 31,500 Mcfd to Transco at Leidy, Pennsylvania, for ultimate delivery to a cogenerator in New York. Texas Gas proposes to redeliver 250,000 Mcfd to CNG at Lebanon, Ohio. CNG, in turn, will redeliver this gas to Transco at Leidy, Pennsylvania for ultimate delivery to 14 shippers from North Carolina to Massachusetts. Phase I of the ANR Project, which includes deliveries to NEP and a cogenerator in New Jersey, is currently being processed by the staff.

1.2.4 Niagara Settlement Project

All the facilities proposed by the applicants in the NSP are designed to transport up to 592,880 Mcfd of natural gas received from TransCanada and domestic natural gas supplies. The gas would be transported from the Niagara Import Point (NIP) and domestic receipt points and delivered to LDCs, cogeneration plants, storage facilities, and a power plant in the Northeastern United States. The Great Lakes and NSP facilities consist of approximately 630 miles of various diameter pipeline loops, about 13 miles of replacement pipeline, about 46 miles of new pipeline, the addition of 48,600-hp of compression at existing compressor stations, and 20,600-hp of compression at two new compressor stations.

In reviewing the facilities proposed in the NSP, the Commission has determined that the facilities may be phased as three independent projects based on the existing capacity of TransCanada and the firm commitments of downstream users. The three projects are the SS-2 Storage Service Project (SS-2), the Transco Energy Marketing Company (TEMCO) or the NIP Phase II Project, and the NIP or the NIP Phase III Project.

The SS-2 Project consists of the construction and operation of facilities to provide up to 11 billion cubic feet (BCF) of natural gas storage service annually at a rate of up to 100,000 Mcfd to eight electric generators or LDCs. An EA was prepared by the staff for the SS-2 Project and issued in July 1989. On July 27, 1989, the Commission issued an Order Issuing Certificates and Approving Abandonment for the SS-2 Project. The TEMCO or NIP Phase II Project would provide transportation services for 132,480 Mcfd of Canadian and domestic natural gas for LDCs and cogeneration facilities and would require the construction of pipeline, compression, and metering facilities. An EA for these facilities was completed by the Commission staff in January 1990. The SS-2 and TEMCO Projects do not depend upon construction of the facilities proposed by Great Lakes for the Niagara Import Point.

In the NIP project, the Great Lakes facilities are designed to transport up to 417,500 Mcfd of Canadian natural gas for TransCanada between the United States-Canadian border at Noyes, Minnesota, back to TransCanada at two points along the United States-Canadian border near Sault Ste. Marie and St. Clair, Michigan. This would require the construction of approximately 460 miles of pipeline loop in Minnesota, Wisconsin, and Michigan. TransCanada requires this increase in transportation volumes to primarily satisfy the market requirement of export customers in the Northeastern United States. However, part of the transportation by Great Lakes would be for services that TransCanada offers to its customers in eastern Canada.

The NIP Project also includes the expansion and modification of other interstate pipeline facilities to transport 364,000 Mcfd of Canadian natural gas from the Niagara Import Point and 14,000 Mcfd of domestic natural gas to LDCs, cogeneration plants, a power plant, and the proponents' system supply in the Northeastern United States. A draft EIS for the NIP Project was issued by FERC on March 16, 1990.

1.3 PURPOSE AND SCOPE OF THE STATEMENT

A responsibility of FERC is to evaluate applications filed for authority to construct and operate interstate natural gas pipeline facilities. Certificates are issued pursuant to Section 7(c) of the Natural Gas Act (NGA) when FERC has determined that the project is required by the public convenience and necessity. This EIS was prepared by FERC staff in compliance with NEPA and the Commission's implementing regulations under Chapter I, Title 18, Code of Federal Regulations, Part 380. FERC is the lead agency in preparing this EIS. The U.S. Army Corps of Engineers (COE), the U.S. Environmental Projection Agency (EPA), the U.S. Fish and Wildlife Service (FWS), the DOE, and the National Park Service (NPS) are cooperating Federal agencies for this project. The principal purposes of the EIS are to:

- Identify and assess potential impact on the human environment that would result from the implementation of the proposed action.

- Assess reasonable alternatives to the proposed action that would avoid or minimize adverse effects on the human environment.

- Identify and recommend alternatives and specific mitigation measures to minimize the environmental impact.

- Facilitate public involvement in identifying the significant environmental impact.

This EIS addresses all of the facilities proposed by Iroquois in Docket No. CP89-634-001, except for the Brookfield Meter Station which would be used to deliver gas to Algonquin. This EIS also addresses the pipeline facilities, modifications, and compression proposed by Tennessee in Docket No. CP89-629-001 that would be necessary to deliver natural gas received from Iroquois directly to the customers in this initial phase.

Any deliveries or transportation of Iroquois-related natural gas that would involve Algonquin facilities will be addressed in a future environmental document. This document would include the remaining facilities proposed by Tennessee in Docket No. CP89-629-001, the facilities proposed by Tennessee in Docket No. CP90-639-000, the Brookfield Meter Station proposed by Iroquois in Docket No. CP89-634-001, and the Iroquois-related facilities proposed by Algonquin in Docket No. CP89-661-001. The analysis will also include any associated nonjurisidictional facilities.

Environmental analysis in this EIS covers land resources, water resources, air quality, noise, ecology, sociocultural resources, archeological and historic sites, endangered and threatened species, floodplains and wetlands, and unique farmlands.

1.4 SCOPE OF NONJURISDICTIONAL FACILITY ANALYSIS

Under Section 7 of the NGA, FERC is required to consider as part of a decision to certify jurisdictional facilities, all factors bearing on the public convenience and necessity. The Iroquois/Tennessee Project jurisdictional facilities include the mainlines, loops, major laterals, extensions, and replacements, including various aboveground facilities. These are discussed in detail in sections 2.1.1 and 2.1.2.

Further, under NEPA, FERC must consider the environmental impact of nonjurisdictional facilities when, as a practical matter, operation of the nonjurisdictional facilities is impossible without use of the jurisdictional facilities. Such nonjurisdictional facilities would be considered an "integral part" of such jurisdictional projects. Nonjurisdictional facilities required for end use of the gas include major facilities such as electric power plant conversion and cogeneration facilities, as well as less significant facilities such as lateral pipeline connections to LDCs. Our environmental review was limited to these direct tie-ins to the interstate network. These are discussed in detail in section 2.1.4.

The Commission is also obligated by statute to consider the potential impact of a proposed pipeline project on federally listed endangered and threatened species. Under the FWS regulations implementing the Endangered Species Act of 1973, as amended (50 CFR Part 402), the Commission is required to ensure that certificated projects are not likely to jeopardize the continued existence of federally listed endangered or threatened species or result in the destruction or adverse modification of the critical habitat of such species. This requirement extends to related nonjurisdictional projects.

The Commission is also required to ensure that historic and cultural resources are not adversely affected. Section 106 of the NHPA requires the Commission to take into account the effects of the proposed project on properties included in or eligible for listing in the NRHP and, before issuing final approval of the project, to afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on the project. The regulations implementing the NHPA (36 CFR Part 800) also require the Commission to consider the impact of nonjurisdictional projects that are directly related to the jurisdictional proposal.

The scope of this environmental analysis is intended to determine which, if any, of the nonjurisdictional facilities would have potential for significant environmental impact. This EIS includes descriptions of all related nonjurisdictional facilities. The current status of each of these nonjurisdictional projects is identified. If the project has received all necessary state and/or local approvals and no significant issues have been raised before FERC, we do not consider the environmental impact to be significant. In the event that there are outstanding issues associated with any of the projects, we have recommended that any approval granted by FERC be conditioned upon completion of subsequent environmental reviews prior to natural gas service.

We have discussed the potential impact of related nonjurisdictional facilities on federally listed endangered and threatened species and cultural resources.

2.0 PROPOSED ACTION

2.1 PROPOSED FACILITIES

Iroquois proposes to construct and operate pipeline facilities and to transport up to 575,900 Mcfd of natural gas received from TransCanada. Due to the fact that the full project to deliver up to 575,900 Mcfd of natural gas is incomplete because the facilities identified by Algonquin are not broken down by project or project phase, this document only analyzes the delivery by Iroquois of 422,900 Mcfd of natural gas directly to Tennessee and customers along the proposed pipeline system. The deliveries to Tennessee would occur in Wright, New York, and Stratford, Connecticut, for redelivery to certain LDCs, cogeneration, and electric generation customers in Connecticut, Massachusetts, New Hampshire, and Rhode Island. Iroquois would deliver directly to LDCs and cogeneration customers in New York and Connecticut. Iroquois would also deliver additional natural gas at South Commack, New York, for exchange and redelivery by Texas Eastern to three LDCs in New Jersey.

In Docket No. CP89-629-001, Tennessee proposes to transport 162,800 Mcfd of Canadian natural gas received from Iroquois for delivery to certain LDCs and cogeneration customers in Massachusetts, Connecticut, New Hampshire, New York, and Rhode Island and to transport 70,000 Mcfd of domestic natural gas for NEP from Louisiana to an interconnection with Algonquin at Mendon, Massachusetts. For the purposes of this document, we are analyzing the delivery of the 162,800 Mcfd of Canadian natural gas by Tennessee and the facilities associated with these deliveries. We will study the delivery of 70,000 Mcfd of domestic natural gas for NEP in the Phase II environmental document later this year.

As shown in table 1.1-1, the Iroquois/Tennessee Phase I Pipeline Project would consist of two integrated pipeline systems. The first system, proposed by Iroquois would involve the construction of a new, 369.4-mile, 30- and 24-inch diameter pipeline. It would begin at the United States-Canadian border near Waddington, New York, and extend through New York and Connecticut, cross Long Island Sound, and terminate at the facilities of LILCO near South Commack, New York. The system proposed by Tennessee in Phase I would involve the construction of 46.6 miles of mainline loop, 13.9 miles of lateral loops and replacement pipe, 2.3 miles of new pipeline extension, and 8,650-hp of compression in New Hampshire, New York, Rhode Island, Connecticut, and Massachusetts on Tennessee's existing mainline system.

2.1.1 Iroquois Gas Transmission System

2.1.1.1 Mainline

The 369.4 miles of mainline in the Iroquois system would consist of 192.3 miles of buried 30-inch-diameter pipe and 141.6 miles of buried 24-inch-diameter pipe from a point of intersection with the facilities of TransCanada through eastern New York and western Connecticut to a shoreline point near Milford, Connecticut; 26.7 miles of underwater, 24-inch-diameter pipe from the Connecticut shoreline across Long Island Sound to a shoreline point near Northport, Long Island, New York; and 8.8 miles of buried 24-inch-diameter pipe from Northport to a terminal point near South Commack, Long Island, New York. At South Commack, the Iroquois pipeline would interconnect with the existing natural gas distribution system of LILCO. Table 2.1.1-1 lists the location, diameter, and length of each proposed section of pipeline in the Iroquois system. Figure 2.1.1-1 shows the geographic location of the overall pipeline. Detailed Iroquois pipeline route maps are contained in appendix A, figure A-1, sheets 1 to 57.

TABLE 2.1.1-1

Iroquois Pipeline Facility Locations

Proposed Facility	Pipe Diam. (in)	Approx. Length (mi) a/	State	County	Cities or Towns
Mainline	30	52.8	NY	St. Lawrence	Waddington, Lisbon, Canton, Dekalb, Hermon, Edwards, Pitcairn
	30	54.5	NY	Lewis	Diana, Harrisville, Croghan, New Bremen, Watson, Grieg, Turin, West Turin, Lyons Falls, Leyden
	30	18.3	NY	Oneida	Booneville, Steuben, Remsen, Trenton
	30	33.9	NY	Herkimer	Russia, Newport, Norway, Fairfield, Salisbury, Manheim, Danube
	30	23.9	NY	Montgomery	Minden, Canajoharie, Root, Charleston
	30/24	11.7	NY	Schoharie	Carlisle, Esperance, Schoharie, Wright
	24	2.0	NY	Schenectady	Duanesburg
	24	18.8	NY	Albany	Knox, Berne, Westerlo
	24	16.3	NY	Greene	Greenville, New Baltimore, Coxsackie, Athens
	24	15.5	NY	Columbia	Greenport, Livingston, Clermont
	24	38.9	NY	Dutchess	Milan, Clinton, Pleasant Valley, Lagrange, Union Vale, Dover
	24	8.8	NY	Suffolk	Huntington, Smithtown
	24	10.9	CT	Litchfield	New Milford
	24	33.5	CT	Fairfield	Sherman, Brookfield, Newtown, Monroe, Shelton, Stratford
	24	2.9	CT	New Haven	Milford
	24	26.7	CT, NY		Long Island Sound
Total Miles		369.4			

a/ Scaled from USGS topographic maps. Actual length of pipeline to be installed would be slightly larger due to terrain relief.

2.1.1.2 Aboveground Facilities

The Iroquois system would require only a small number of aboveground structures. Iroquois would install 22 mainline valve (MLV) assemblies, five pig launchers/receivers (which would be sited at valve locations), and seven sales meter stations along the pipeline route. No compressor stations would be required.

MLV assemblies would be used to isolate sections of the pipeline system. Each MLV assembly would be installed within the pipeline right-of-way as part of the pipeline itself. The spacing of valve assemblies is specified by U.S. Department of Transportation (DOT) regulations (49 CFR 192.179(a)); the required distance between valves would vary in accordance with the population density along the right-of-way. In rural areas, valves would be placed approximately every 20 miles. In more highly populated areas, valves would be placed approximately 8 miles apart. The precise location of each MLV assembly would also be chosen on the basis of surrounding land use and proximity of existing roads. Each valve assembly would require an area approximately 20 feet by 40 feet. The aboveground components of the assembly would be surrounded by chain-link fence.

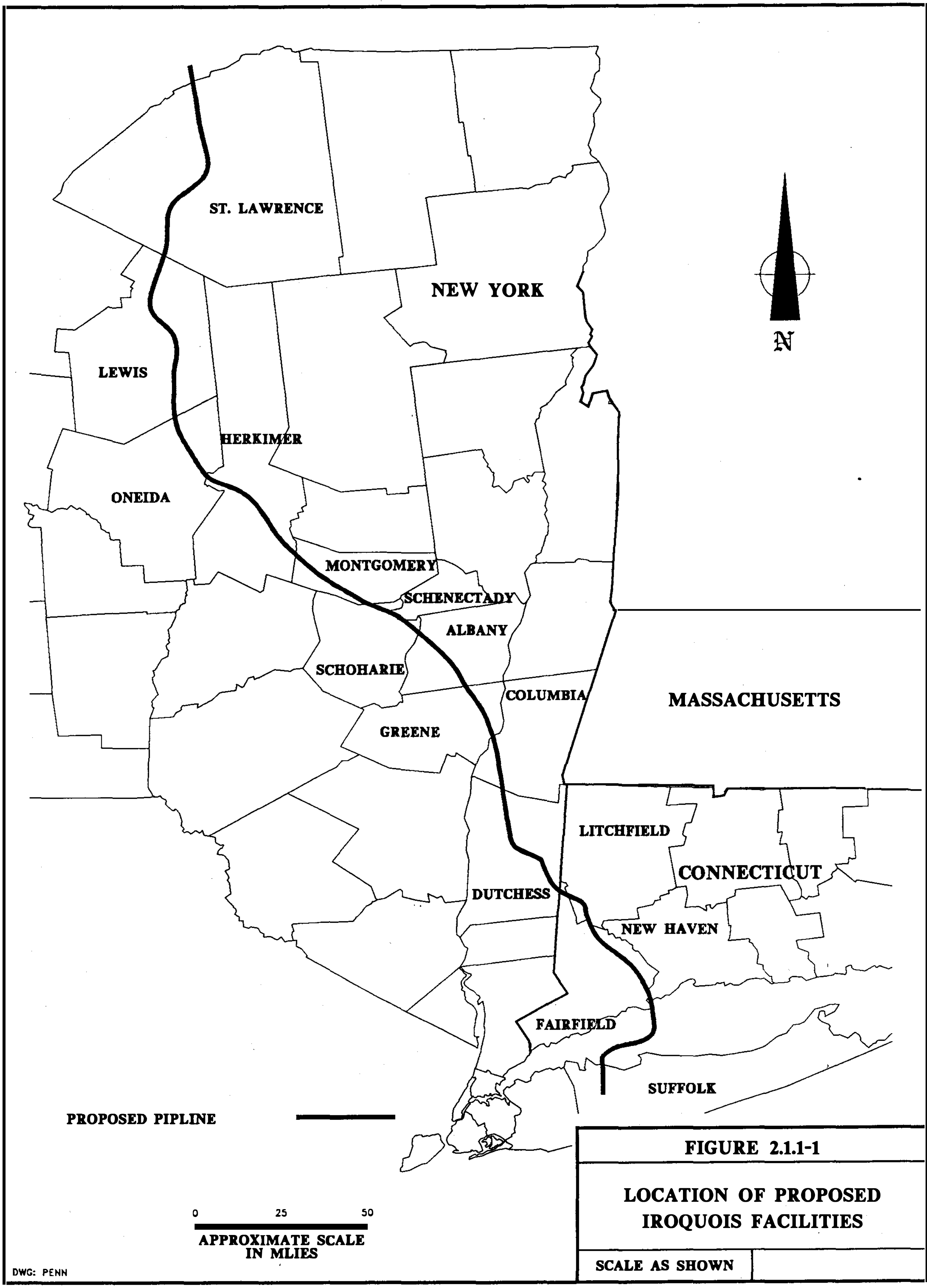


FIGURE 2.1.1-1

LOCATION OF PROPOSED IROQUOIS FACILITIES

SCALE AS SHOWN

Pig launchers/receivers would also be constructed as integral parts of the pipeline. Each launcher/receiver would require an area approximately 120 feet by 210 feet within and adjacent to the pipeline right-of-way. The aboveground components in each area would be surrounded by chain-link fence, and the area inside the fence would be graveled in accordance with safety requirements.

Meter stations would be installed where custody of natural gas would be transferred from one pipeline system to another. A meter station is a gas-flow measurement facility that requires a fenced, graveled area of approximately 100 feet by 200 feet, and is normally constructed outside the pipeline right-of-way. Typically, most piping associated with a meter station would be buried, although meter runs and associated components would normally be housed within a building on the site. Table 2.1.1-2 lists the proposed locations of Iroquois sales meter stations. Nonjurisdictional facilities related to the Iroquois system are discussed in section 2.1.4.1.

TABLE 2.1.1-2

Iroquois/Tennessee Meter Station and Interconnection Point Locations

Applicant/City	State	Location
IROQUOIS		
Lisbon	NY	MP 8.0
Canajoharie a/	NY	MP 162.5
Wright b/	NY	MP 192.5
Pleasant Valley	NY	MP 270.1
New Milford	CT	MP 296.9
Huntington	CT	MP 324.0
Stratford b/	CT	MP 328.5
Stratford	CT	MP 329.9
Milford	CT	MP 331.5
South Commack	NY	MP 369.4
TENNESSEE c/		
Danvers	MA	MP 270C-103+1.0
Greenwich d/	CT	MP 336-1+0.00
Norwalk d/	CT	MP 339A-101+1.74
Torrington d/	CT	MP 259A-102+7.42
Bloomfield d/	CT	MP 347-1+9.39
Farmington d/	CT	MP 346-1+7.82
Lincoln	RI	End of extension
Selkirk	NY	MP 251-1+3.50
Monson	MA	MP 262+4.00
Wright b/	NY	MLV 249-2A
Stratford b/	CT	MP 341+4.9

a/ Interconnection between Iroquois and CNG.
b/ Interconnection between Iroquois and Tennessee.
c/ Tennessee mileposts are indicated by the nearest mainline mile marker or MLV plus the distance in miles toward the next higher mile marker or valve.
d/ Modification to existing meter station.

2.1.2 Tennessee Gas Pipeline Company

Tennessee proposes to construct 46.6 miles of mainline loop, 13.9 miles of lateral loops and replacement pipe, and 2.3 miles of new pipeline extensions in New Hampshire, New York, Connecticut, Rhode Island, and Massachusetts on its existing mainline system. Table 2.1.2-1 lists the location, diameter and length of each section of pipeline in the proposed Tennessee system. Figures 2.1.2-1 and 2.1.2-2 show the geographic locations of the various pipeline components of the proposed system. Detailed Tennessee pipeline route maps are contained in appendix A, figure A-2.

TABLE 2.1.2-1

Tennessee Pipeline Facility Locations

Proposed Facilities	Pipe Diam. (in)	Approx. Length (mi)a/	State	County	Cities or Towns
Schoharie/Albany Loop	36	15.2	NY	Schoharie	Schoharie, Wright, Knox
			NY	Albany	Berne, New Scotland
Columbia/Berkshire Loop	36	21.3	NY	Columbia	Chatham, New Lebanon, Canaan
			MA	Berkshire	Richmond, Stockbridge, Lee, Tyringham
Worcester Loop	30	10.1	MA	Worcester	Sutton, Northbridge, Grafton, Upton
		46.6			
Concord Lateral	12	4.5	NH	Merrimack	Allenstown, Pembroke, Concord
Haverhill Lateral	12	6.1	MA	Essex	Methuen, Haverhill
Wallingford Lateral b/	12	3.2	CT	New Haven	Cheshire
Springfield Lateral b/	10.0	0.1	MA	Hampden	Agawam
		13.9			
Lincoln Extension	10	2.3	RI	Providence	Lincoln, Smithfield
Total Miles		62.8			

a/ Scaled from USGS topographic maps. Actual length of pipeline to be installed would be slightly longer due to terrain relief.
b/ Replacement

Tennessee also proposes to add compression horsepower to its system to facilitate increased flow rates. In New York and Massachusetts, that would involve the addition of 8,650 hp of compression. Compression facilities would utilize clean-burn reciprocating gas engines and gas turbines. The engine/compressor units would be skid-mounted with water jacket and lube coolers, and installed in an insulated compressor building. Proposed compressor station facilities are listed in table 2.1.2-2. Compressor station plot plans are included in section 4.1.8. Maps showing the locations of Tennessee compressor stations are contained in appendix A, figures A-2-10 to A-2-12.

In addition to the compression facilities, Tennessee proposes to construct six new sales meter stations and to modify five existing sales meter stations. Proposed metering station facilities are listed in table 2.1.1-2 and maps showing their location are contained in appendix A, figure A-2-21, sheets 1 to 15. Additional facilities such as maintenance bases,

KEY

PROPOSED PIPELINE

PROPOSED COMPRESSOR STATION

DWG: PEN3

FIGURE 2.1.2-1

LOCATION OF PROPOSED TENNESSEE FACILITIES IN PENNSYLVANIA, NEW YORK AND NEW JERSEY

SCALE AS SHOWN

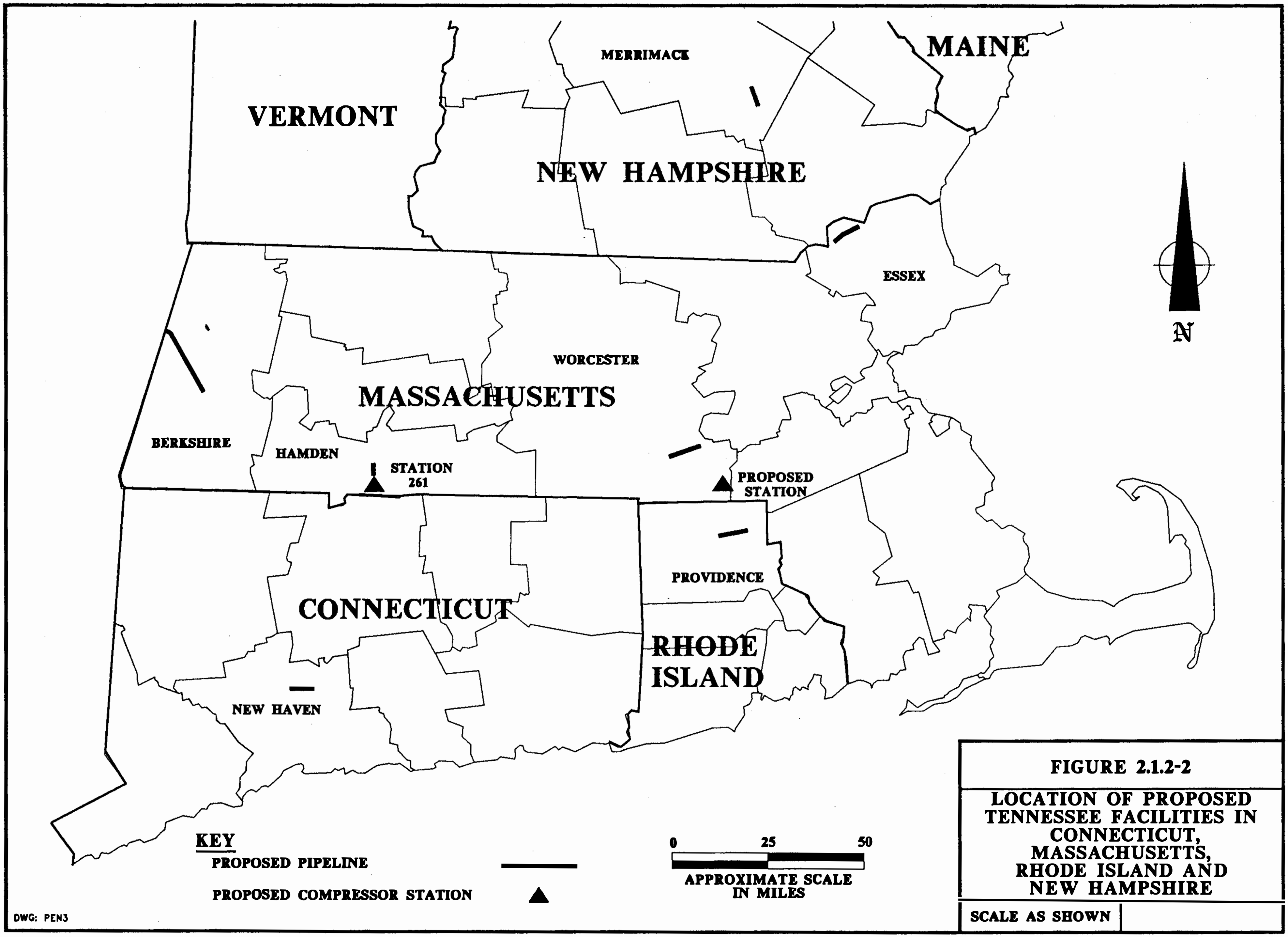


FIGURE 2.1.2-2

LOCATION OF PROPOSED TENNESSEE FACILITIES IN CONNECTICUT, MASSACHUSETTS, RHODE ISLAND AND NEW HAMPSHIRE

TABLE 2.1.2-2

Tennessee Compressor Station Locations

Location	New Horsepower	Added Horsepower	Site Acres	State	County	Nearest City or Town
Station 245		2,100	0.0	NY	Herkimer	Winfield
Station 254		3,500	0.0	NY	Columbia	Nassau
Station 261		1,850	0.0	MA	Hampden	Agawam
New Compressor	1,200		2.1	MA	Worcester	Mendon

communication towers, power lines, and new access roads would not be required for the Tennessee system. Related nonjurisdictional facilities are discussed in section 2.1.4.2.

2.1.2.1 Schoharie/Albany Loop

The Schoharie/Albany Loop would be a 36-inch-diameter mainline loop in Schoharie and Albany Counties, New York. It would extend from MLV 249-2A to MP 250-2+6.5 for a total length of 15.2 miles (see figure A-2-1).

2.1.2.2 Columbia/Berkshire Loop

The Columbia/Berkshire Loop would be a 36-inch-diameter mainline loop in Columbia County, New York, and Berkshire County, Massachusetts. It would extend from MLV 254 to MP 256+8.0 for a total length of 21.3 miles (see figure A-2-2).

2.1.2.3 Worcester Loop

The Worcester Loop would be a 30-inch-diameter mainline loop in Worcester County, Massachusetts. It would extend from MP 265+0.80 to MP 266+3.28 for a total length of 10.1 miles (see figure A-2-3).

2.1.2.4 Concord Lateral

The Concord Lateral would be a 12-inch-diameter lateral loop in Merrimack County, New Hampshire. It would extend from MP 270B-105+10.6 to MLV 270B-106 for a total length of 4.5 miles (see figure A-2-5).

2.1.2.5 Haverhill Lateral

The Haverhill Lateral would be a 12-inch-diameter lateral loop in Essex County, Massachusetts. It would extend from MLV 270B-302 to MLV 270B-303 for a total length of 6.1 miles (see figure A-2-6).

2.1.2.6 Wallingford Lateral

The Wallingford Lateral would be a 12-inch-diameter replacement lateral in New Haven County, Connecticut. It would extend from MLV 345A-201 to MP 345A-201+3.2 for a total length of 3.2 miles (see figure A-2-7).

2.1.2.7 Lincoln Extension

The Lincoln Extension would be a new 10-inch-diameter pipeline system extending from Tennessee's Rhode Island Extension at MP 26SE-103+2.43 to Valley Gas Company's (Valley Gas) Gate Station, Providence County, Rhode Island, for a total length of 2.3 miles (see figure A-2-8).

2.1.2.8 Springfield Lateral

The Springfield Lateral would be a 10-inch-diameter replacement lateral in Hampden County, Massachusetts. It would extend from MP 261B-101+4.11 to Valve 261B-102 for a total length of 0.1 mile (see figure A-2-9).

2.1.2.9 Herkimer Compressor Addition

A 2,100-hp compressor addition would be installed at Tennessee's Station 245 in Herkimer County, New York. Refer to section 4.1.8 for descriptive details of this station and its environmental setting (see figure A-2-10).

2.1.2.10 Columbia Compressor Addition

A 3,500-hp compressor addition would be installed at Tennessee's Station 254 in Columbia County, New York. Refer to section 4.1.8 for descriptive details of this station and its environmental setting (see figure A-2-11).

2.1.2.11 Hampden Compressor Addition

A 3,500-hp compressor addition would be installed at Tennessee's Station 261 in Hampden County, Massachusetts; 1,850 hp of this capacity would be new compression, and the remaining 1,650 hp would replace existing facilities. Refer to section 4.1.8 for descriptive details of this station and its environmental setting (see figure A-2-12).

2.1.2.12 Mendon Compressor Station

Tennessee would install a new 1,200-hp compressor station in Worcester County, Massachusetts. Refer to section 4.1.8 for descriptive details of this station and its environmental setting (see figure A-2-13).

2.1.3 Related Nonjurisdictional Facilities

Iroquois and Tennessee have identified shippers of gas for several end uses. These uses include electric power generation, cogeneration, and local distribution. Table 1.1-1 lists proposed shippers and gas deliveries. The related nonjurisdictional facilities are described in this section. For each shipper, the location and types of major facilities are described.

Maps showing the location of proposed nonjurisdictional facilities are contained in appendix A, figure A-3.

2.1.3.1 Iroquois Delivery

2.1.3.1.1 Brooklyn Union Gas Company

The Brooklyn Union Gas Company (BUG) would use the natural gas shipped through the Iroquois system to an interconnection point with LILCO in South Commack, New York, for general system supply and to Pleasant Valley, New York for sale to Central Hudson Gas & Electric Corporation (Central Hudson) to supply their Roseton Plant. For the months of November through March, Iroquois would deliver 70,000 Mcfd at South Commack. For the months of April through October, 48,125 Mcfd would be delivered at Pleasant Valley with the remainder (21,875 Mcfd) delivered at South Commack. No major new facilities would be required to make the proposed deliveries.

2.1.3.1.2 Yankee Gas Services Company

Iroquois proposes to transport 25,000 Mcfd for Yankee Gas Services Company (Yankee), formerly Connecticut Light and Power Company (CL&P), for delivery to its local distribution system in Connecticut. Direct connection with the Iroquois system would be made in New Milford-and Shelton, Connecticut. Only minor new pipeline facilities would be required (see figure A-3, sheet 1).

2.1.3.1.3 Central Hudson Gas & Electric Corporation

Central Hudson proposes to construct two new 16-inch-diameter pipeline segments. These proposed segments are a 5.1-mile-long pipeline in the towns of Pleasant Valley and LaGrange in Dutchess County, New York, and a 7.7-mile-long pipeline in the towns of East Fishkill and Wappinger in Dutchess County, New York and in the town of Newburgh in Orange County, New York. The first segment would connect the Iroquois system to the Central Hudson system and the second segment would connect Central Hudson's system to the Roseton Generating Station (see figure A-3, sheets 2 to 4). Iroquois proposes to deliver 20,000 Mcfd of natural gas to Central Hudson for system supply, and 100,000 Mcfd of resale gas from BUG (48,125 Mcfd), Connecticut Natural Gas Corporation (Connecticut Natural) (30,000 Mcfd) and New Jersey Natural Gas Company (New Jersey Natural) (21,875 Mcfd) on an intermittent basis for supplemental fuel for the boilers at the Roseton Station (see sections 2.1.4.1.1, 2.1.4.1.7, and 2.1.4.2.3).

2.1.3.1.4 Consolidated Edison Company of New York, Inc.

Iroquois proposes to transport 20,000 Mcfd for Consolidated Edison Company of New York, Inc. (Con Edison) to the interconnection point with LILCO's system in South Commack, New York. No new nonjurisdictional facilities would be required for this delivery.

2.1.3.1.5 Elizabethtown Gas Company

Iroquois proposes to transport 5,000 Mcfd for Elizabethtown Gas Company (Elizabethtown) to the interconnection point with LILCO's system in South Commack, New York. Texas Eastern would deliver the volumes by exchange to existing delivery points.

2.1.3.1.6 Long Island Lighting Company

LILCO proposes to construct approximately 6 miles of 20-inch-diameter, 350-pound per square inch gauge (psig) natural gas pipeline paralleling an existing 12-inch-diameter pipeline. The interconnection point would be in South Commack, New York (see figure A-3, sheet 5). The new pipeline would deliver natural gas to a point in Deer Park, New York. LILCO would receive 35,000 Mcfd through the Iroquois system at an interconnection with its system in South Commack, New York.

2.1.3.1.7 New Jersey Natural Gas Company

Iroquois proposes to transport for New Jersey Natural 40,000 Mcfd of gas to the interconnection point with LILCO in South Commack, New York, for the months of November through March. The gas would then be delivered by exchange by Texas Eastern to existing delivery points. For the months of April through October, 21,875 Mcfd of the volumes would be delivered to Central Hudson at Pleasant Valley, New York for its Roseton plant, with the remaining volumes delivered at South Commack.

2.1.3.1.8 Public Service Electric and Gas Company

Iroquois proposes to deliver 10,000 Mcfd of natural gas for Public Service Electric and Gas Company (PSE&G) at the interconnection with LILCO's system at South Commack, New York. Texas Eastern would provide final delivery by exchange to existing delivery points. Construction of new pipeline would not be required to receive the new supplies of natural gas.

2.1.3.1.9 Southern Connecticut Gas Company

Iroquois would deliver 35,000 Mcfd to Southern Connecticut, 18,000 Mcfd at Milford and 17,000 Mcfd at Stratford, Connecticut. Only minor or no new nonjurisdictional facilities would be required for this delivery.

2.1.3.2 Tennessee Delivery

2.1.3.2.1 Boston Gas Company

Iroquois proposes to deliver 17,100 Mcfd for Boston Gas Company (Boston Gas) at an interconnection with Tennessee's system at Wright, New York. Boston Gas proposes to expand its existing natural gas transmission system to utilize the new gas supply shipped through the Iroquois system. The delivery points and quantities of natural gas to be shipped via the Tennessee system are listed below.

Delivery Point	Quantity (Mcfd)
Beverly-Salem, MA	5,480
Reading, MA	3,380
Danvers, MA	8,240

The proposed extensions to the Boston Gas transmission system would only require municipal permits for street openings and surface restoration.

2.1.3.2.2 Colonial Gas Company

Iroquois proposes to transport 2,000 Mcfd for Colonial Gas Company (Colonial) to an interconnection with Tennessee's system in Wright, New York. The gas would then be transported through the existing Tennessee system to Tewksbury or Mendon, Massachusetts. The new system interconnections would not require the construction of major new nonjurisdictional facilities.

2.1.3.2.3 Connecticut Natural Gas Corporation

Iroquois proposes to transport 35,000 Mcfd for Connecticut Natural to an interconnection with Tennessee in Stratford, Connecticut, for the months of November through March. The gas would then be delivered to existing delivery points in Bloomfield, New Britain, North Bloomfield, East Farmington, and Greenwich, Connecticut. For the months of April through October, 30,000 Mcfd would be delivered to Central Hudson at Pleasant Valley, New York, for its Roseton plant, with the remaining volumes delivered to Connecticut Natural at Stratford.

No new pipeline on Connecticut Natural facilities would be required to transport the gas.

2.1.3.2.4 EnergyNorth Natural Gas, Inc.

Iroquois proposes to transport 4,000 Mcfd for EnergyNorth Natural Gas, Inc. (EnergyNorth) to a connection point with the Tennessee system in Wright, New York. The gas would then be delivered to Laconia, New Hampshire, for distribution within EnergyNorth's system at an existing interconnection.

2.1.3.2.5 Essex County Gas Company

Iroquois proposes to transport 2,000 Mcfd for Essex County Gas Company (Essex County) to an interconnection point with the Tennessee system in Wright, New York. The gas would then be delivered to Haverhill, Massachusetts, for distribution within Essex County's existing system.

2.1.3.2.6 Granite State Gas Transmission, Inc.

Iroquois proposes to transport 12,000 Mcfd for Granite State Gas Transmission, Inc. (Granite State) to an interconnection point with the Tennessee system in Wright, New York. The gas would then be delivered to Agawam and Pleasant Street, Massachusetts.

No nonjurisdictional facilities would be required for this delivery.

2.1.3.2.7 JMC Selkirk, Inc.

JMC Selkirk, Inc. (JMC Selkirk) proposes to construct a 79.9-MW cogeneration facility in Selkirk, New York, at the General Electric Corporation (GE) plastics plant, approximately 8 miles south-southeast of Albany, New York (see figure A-3, sheet 6). Electricity and steam generated by the Selkirk cogeneration facility would be sold to Niagara

Mohawk and GE, respectively. A 2.1-mile-long pipeline would be constructed by Niagara Mohawk to interconnect the existing Tennessee system with the proposed plant site.

Iroquois would transport 21,000 Mcfd for JMC Selkirk to an interconnection with Tennessee in Wright, New York. Tennessee would deliver the volumes to Selkirk, New York, for final delivery by Niagara Mohawk.

2.1.3.2.8 MASSPOWER, Inc.

MASSPOWER, Inc. (MASSPOWER) is proposing to construct a 239-MW cogeneration facility at the Monsanto Chemical Company (Monsanto) plant in Springfield, Massachusetts (see figure A-3, sheet 7). Steam generated by the cogeneration facility would be sold to Monsanto for process use. MASSPOWER is currently negotiating power sales agreements with a number of utilities.

Iroquois would transport 25,000 Mcfd to an interconnection with Tennessee at Wright, New York. Tennessee would then transport the gas to an interconnection with Bay State Gas Company (Bay State) in Monson, Massachusetts. Final delivery to MASSPOWER would be through new pipeline to be constructed by Bay State (see section 5.2.2.2). An equal amount of Algerian liquified natural gas LNG would also be purchased, to meet the requirements of the cogeneration facility.

2.1.3.2.9 Pawtucket Power Associates Limited Partnership

Pawtucket Power Associates Limited Partnership (Pawtucket) proposes to construct a 61-MW cogeneration facility at the Colfax, Inc. (Colfax) facility in Pawtucket, Rhode Island (see figure A-3, sheet 8). The electricity generated by the cogeneration facility would be sold to NEP and the steam would be used by Colfax to meet its total steam demand.

Iroquois would transport 12,800 Mcfd for Pawtucket to the Wright, New York, interconnection with Tennessee. Tennessee would then deliver the gas to Lincoln, Rhode Island. Final delivery would be provided by Valley Gas, which has a pipeline adjacent to the proposed site. Accordingly, no major new nonjurisdictional pipeline would be required for this delivery.

2.1.3.2.10 Valley Gas Company

Iroquois proposes to deliver 1,000 Mcfd for Valley Gas to the Wright, New York, interconnection point with the Tennessee system. Tennessee would then deliver the gas to Lincoln, Rhode Island. The gas would then be distributed through Valley Gas' existing local transmission system. Delivery of additional gas supply will not require the construction of new nonjurisdictional pipeline.

2.1.3.2.11 Yankee Gas Services Company

Natural gas would be delivered to the Tennessee system at the Wright, New York, connection point for delivery to East Granby, Connecticut, (5,000 Mcfd), and Wallingford, Connecticut (4,000 Mcfd). No new nonjurisdictional pipeline would be required to make these natural gas shipments.

2.2 CONSTRUCTION PROCEDURES

Proposed pipeline facilities would be designed, constructed, operated, and maintained in accordance with DOT regulations at 49 CFR Part 192, "Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards"; 18 CFR Part 2.6 "Guidelines To Be Followed by Natural Gas Pipeline Companies in the Planning, Clearing, and Maintenance of Rights-of-Way and the Construction of Aboveground Facilities"; and other applicable Federal and state regulations.

This section describes the proposed general construction procedures that would be used by Iroquois and Tennessee; variations in proposed procedures for each applicant are discussed in sections 2.2.2 and 2.2.3. Figure 2.2-1 depicts the typical installation steps of an overland pipeline construction spread in a rural environment. Also refer to chapters 5 and 7 for additional measures which the FERC staff is recommending to further mitigate adverse environmental impacts associated with construction and operation of the project.

2.2.1 General Pipeline Construction Procedures

After the right-of-way has been surveyed and easements and permits secured, a temporary construction right-of-way would be cleared of obstructions. All utility lines would be marked to prevent accidental damage during construction. A fence crew would lead the construction spread and install temporary gates at all fences encountered on the right-of-way. A second crew would follow and remove large obstacles such as trees, large rocks, and logs. Marketable timber cut from the right-of-way would be purchased by Iroquois at fair market value and sold. Non-marketable timber (e.g., firewood) will be cut in full lengths, delimbed, and stacked for use by the landowner unless otherwise required for construction or unless another disposition method is requested by the landowner.

The right-of-way would then be graded to provide a relatively level surface for trench excavating equipment and for the safe passage of heavy construction equipment. In some areas blasting or extensive grading may be necessary to prepare the right-of-way. On cultivated lands, or if required by the landowner, topsoil would be segregated and conserved for replacement during final cleanup and farmers would be paid fair market value for any crop losses. At this point, a crew would install erosion control facilities, such as temporary interceptor dikes and silt fences.

The trenching crew would then excavate a ditch normally 12 inches wider and 36 inches deeper than the diameter of the pipe. For example, the trench for a 36-inch-diameter pipeline would be approximately 4 feet wide and 6 feet deep. A rotary wheel ditching machine or a conventional backhoe would excavate the trench in most locations. In shaly or rocky areas, a tractor-drawn ripper would break or loosen hard substratum material. In areas where hard rock cannot be ripped, drilling and blasting would be required, followed by the use of a backhoe to remove rock and soil from the trench. Excavated soil would normally be stored on the non-working side of the trench in the case of new right-of-way, or over the existing pipeline area in the case of a loop installation. Temporary ditch plugs would be installed to curtail the flow of water along the trench.

Stringing, welding, and lowering-in of the pipeline would normally occur on the working side of the trench. Pipeline joints 40 to 60 feet long or prewelded double joints (80 feet long) would be strung along the right-of-way parallel to the trench, bent to conform with

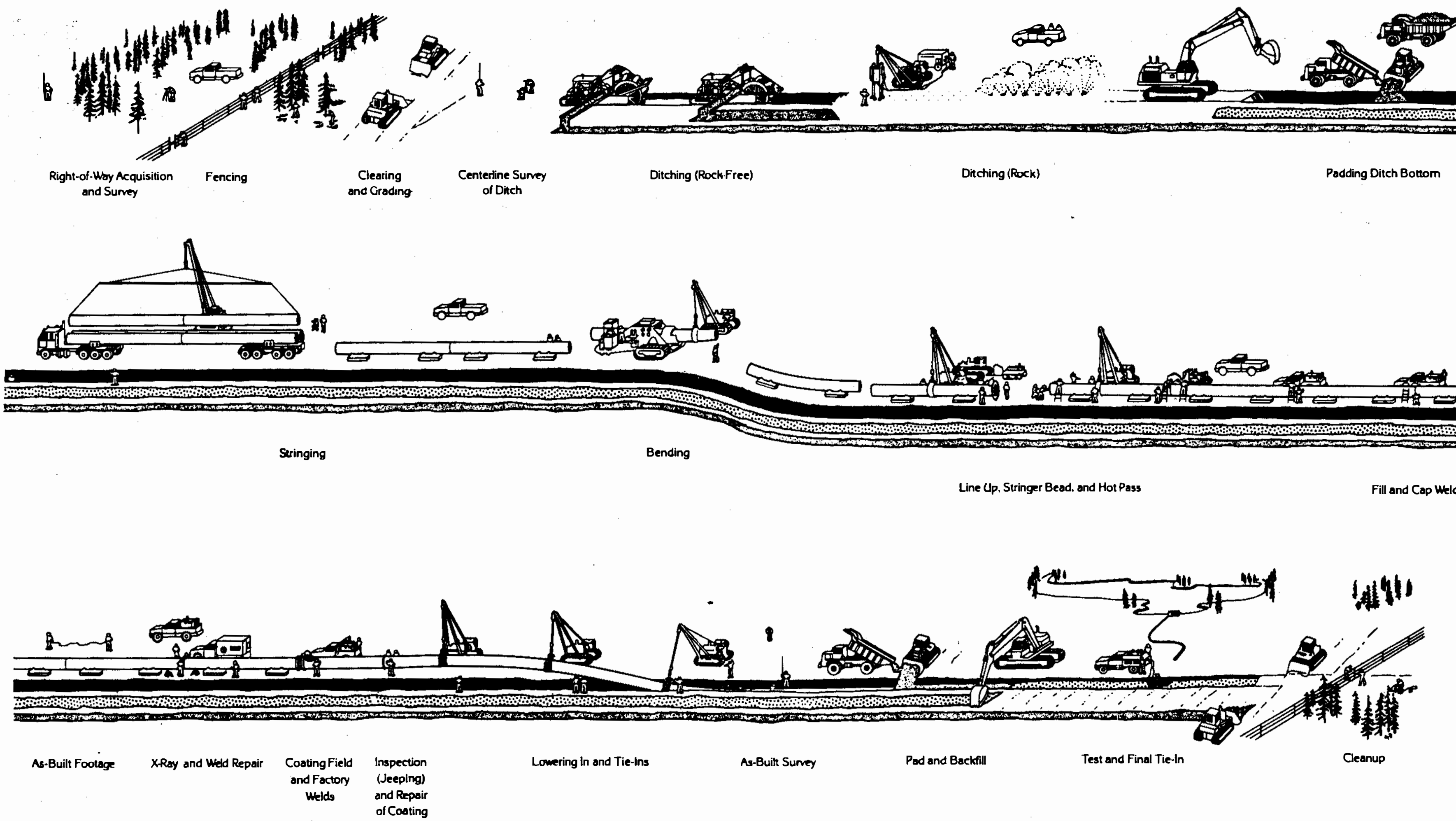


FIGURE 2.2-1

PIPELINE CONSTRUCTION SEQUENCE

the trench contour, aligned, welded together, and placed on temporary supports on the side of the trench. Welds would be visually and radiographically inspected in accordance with DOT regulations, repaired as necessary, and coated. The entire pipe would be electronically inspected to locate any faults or voids in the pipeline coating. The pipe would then be lowered into the trench with side-boom tractors.

After the pipe has been placed in the trench, permanent trench plugs would be installed. Then, a layer of rock-free subsoil or sand would be placed around the pipe to protect the coating. The trench would be then backfilled with previously excavated materials. In trenches surrounded by rock, rock shield, rock jacket, or other suitable protective methods could be used to protect pipe coating. Top soil would not be used as padding. Conserved topsoil would be backfilled to its original horizon, and the right-of-way regraded to its approximate preconstruction contour, except for a slight crown of soil over the trench to compensate for the natural subsidence of the backfill.

Skids, trash, miscellaneous debris, and material unsuitable for backfill would be removed from the right-of-way and deposited in public or private disposal areas. Federal and state hazardous waste regulations prohibit the disposal of chemicals, liquid or solid wastes in the trench. The contractor would install final erosion and sedimentation control structures, i.e., interceptor dikes, silt fences, and erosion control matting to the site-specific requirements contained in the applicants' Erosion and Sedimentation Control Plan (E&SC Plan) which would be incorporated into the Environmental Management and Construction Plans for each spread in New York and into the Development and Management Plan for Connecticut. Revegetation of the right-of-way would conform to the seed mixtures, fertilizer, lime, and mulch as discussed in section 5.1.2 - Soils. All temporary fences and gates would be removed and permanent fences would be restored.

Prior to placing the pipeline in service, all new pipeline segments would be hydrostatically tested to ensure their structural integrity. Each pipeline segment would be divided into separate test sections, with test manifolds welded onto each end. High quality test water, secured from streams, rivers, municipal sources or wells, would be filtered and pumped into the test section. Test pressure would be maintained for 8 hours.

Depending on topography and water availability, it may be possible to reuse the test water in succeeding test sections thereby reducing the amount of water needed for hydrostatic testing. Following the hydrostatic test, the water would be displaced from the test section by pipeline pigs either to the next test section for testing, or discharged. No chemical additives would be used for water treatment or as pipeline drying agents. Test water would be discharged onto a metal splash plate or similar energy dissipation device, and then filtered through hay bales or natural vegetation to control erosion.

Special pipeline construction procedures would be used at road crossings, stream crossings, wetlands, and in residential areas. Private roads, such as farm lanes and driveways, and some public roads, depending on permit requirements, would be crossed with an open cut. Pipelaying and backfilling would proceed as quickly as possible to minimize the duration of an open trench. Most major (i.e., interstates and heavily used state) public roads would be bored or tunnelled. Other public roads would be bored where possible to minimize disruption to traffic. Additional temporary right-of-way, typically about 25 feet wide and 150 feet long, would be required on each side of the crossing to accommodate additional excavation for the boring equipment, and for additional spoil storage.

Temporary bridges consisting of steel culverts covered with crushed limestone or clean granular material would be installed at most crossings of intermittent and perennial streams. These temporary structures provide an in-stream work surface and vehicle access throughout the construction period while maintaining stream flow. Additionally, span bridges are an option for stream crossings, especially for crossing high-quality perennial streams. Other alternative methods could be considered based on site-specific conditions. The trench would be excavated either by a conventional backhoe, or by a crane equipped with a clamshell bucket. All spoil removed from the trench would be stored away from the water's edge or on the stream banks in an area protected by a silt fence.

At small stream crossings, the pipe would be assembled on the culvert and crushed limestone or clean granular stone bridge, and lowered into the trench. At larger streams, the pipe segment may be preassembled in a work area and lowered into the trench by crane, or floated across the stream and submerged into the trench. Negative buoyancy of the pipeline would be maintained by attaching concrete collars or bolt-on river weights, or by using concrete coated pipe. After installation, the trench would be backfilled with the excavated spoil, and the stream banks stabilized with the rock from the culvert, crushed-stone bridge, or with rock riprap or other suitable material.

Trenching in rivers and large streams that have bedrock bottoms would require drilling and blasting before removal of the excavated material for the pipeline burial. Depending on water depth, two spud barges would be employed, one for the drill rig and another for excavating broken rock from the trench with a crane and clamshell. Where bedrock is not encountered, a single barge and clamshell would excavate the trench and deposit the spoil downstream of the trench for later backfilling. The width and depth of water, bank configuration, and accessibility of the water crossing would determine the proper crossing method and equipment required. The preassembly of pipe for the crossing, bending, and weighting would be performed on the banks and floated across the river or stream, submerged into the trench, and backfilled similar to the procedure for small stream crossings. Surplus rock, spoil, debris, and other obstructions resulting from the pipeline installation would be removed from the crossing to prevent interference with normal water flow and use, and the banks would be stabilized with rock riprap.

When constructing in wetland areas, the working side of the right-of-way would be stabilized with granular material over filter cloth timber riprap, or timber riprap with a filter cloth and granular material overlay to provide a solid surface for construction equipment. Following trench excavation, the pipeline, having been fabricated on dry land, or adjacent to the pre-installed workpad within the wetland, would be pushed or pulled across the wetland areas or lowered into the ditch. The granular material and filter cloth would be removed after backfilling the trench. Timber riprap may not be removal unless required to restore wetland hydrology to preconstruction conditions. If timber riprap is to remain in the wetlands, it would be considered as fill and appropriate COE permits would be required.

Construction procedures would be modified in areas where residences are located within the temporary construction right-of-way. For installing pipeline loops in construction work areas with limited widths, construction equipment may work over the existing pipelines, by either padding the right-of-way to provide a minimum 4.5-foot cover over the existing pipelines or using wooden mats. Additionally, drag section or sewer-line construction may be used to reduce the area of impact with no more trench opened than can be backfilled in the same working day. In some locations, it may be possible to reduce the normal 25-foot separation between pipes or use a pipeline crossover to shift the loop to the opposite side of the right-of-way. The site-specific application of these methods is evaluated in section 5.1.9 -Land Use, Recreation, and Visual Resources.

2.2.2 Iroquois

2.2.2.1 Land Pipeline

Iroquois would consult with interested state governmental agencies to determine whether there may be portions of the proposed route where installations of pipe or other materials exceeding Federal standards would be appropriate.

The land portion of the Iroquois system would be constructed using four to five mainline construction spreads, one smaller spread for the Long Island segment, and three river crossing spreads. The spreads and their respective locations and lengths are listed in table 2.2.2-1. Iroquois anticipates that pipeline construction at any one location would typically involve 6 to 12 weeks between initial land disturbance and final right-of-way recontouring and restoration.

Iroquois would employ several environmental inspectors for each construction spread to monitor conformance to environmental conditions, agreements, and stipulations.

Iroquois anticipates that a 100-foot-wide construction area would be needed, including a 60-foot-wide permanent right-of-way and a 40-foot-wide temporary work space. Some areas, such as water crossings or steep areas, would require more than the 40-foot work space. Other areas, such as cropland, forest, or shrubland, would require clearing less than 100 feet.

2.2.2.2 Marine Pipeline Construction

The marine portion of the Iroquois system is proposed to traverse approximately 26 miles of Long Island Sound from Milford, Connecticut, to a landfall at Northport, Long Island. The marine pipeline would consist of 24-inch-diameter carbon steel pipe, which would be concrete-coated to increase stability and to provide protection and negative buoyancy. Water depths along the route (excluding the nearshore areas) typically would range from 60 to 100 feet.

In the offshore area (defined by Iroquois as the area beyond a 50-foot water depth, which amounts to about 16 miles of the 26-mile-long route), the concrete-coated pipeline would be laid directly on the sea bottom; no trenching would be required. Installation for the offshore pipeline would be performed using a lay vessel equipped to join and test the lengths of prepared pipe and lower them to the seabed. It is expected that the offshore pipe would be laid at a rate of about 0.6 to 1.0 mile per day. One pipe-laying spread operation would be anticipated for the construction of the offshore portion of the crossing; this would consist of one lay vessel with a crew of approximately 150 persons. Pipe laying would be a 24-hour-a-day operation.

The landfall portions of the pipeline would be constructed using the pull-from-shore method. The pipe would be fabricated on the lay vessel and pulled to shore using a land-based winch. In the landfall and associated nearshore areas, the pipe would be trenched

TABLE 2.2.2-1

Iroquois Construction Spreads

Location	Length (mi)
Mainline Spreads	
4 Spread Scenario	
St. Lawrence River (MP 0.0) to Burdicks Road Crossing, NY (MP 95.2)	95.2
Burdicks Road Crossing, NY to Highway No. 7, NY (MP 190.2)	95.0
Highway No. 7, NY to Taconic State Parkway, NY (MP 272.2)	82.0
Taconic State Parkway, NY to Silver Sands State Park, CT (MP 334.1)	61.9
5-Spread Scenario a/	
St. Lawrence River (MP 00) to Indian River Pond, NY (MP 73.3)	73.3
Indian River Road (73.3) to Mohawk River, NY (MP 154.0)	80.7
Mohawk River (MP 154.0) to South of NY Thruway, NY (MP 227.4)	73.4
South of NY Thruway (MP 227.4) to NY/CT Border (MP 286.6)	59.2
NY/CT Border (MP 286.6) to Long Island Sound, CT (MP 334.2)	47.6
Long Island Spreads	
Long Island Sound Crossing (Milford, CT to Northport, NY)	26.7
Long Island (Northport to South Commack; MP 360.8 to MP 369.4)	8.6
TOTAL	369.4
Special River Crossings	
St. Lawrence River at U.S./Canada Border (MP 0.0)	1.2
Hudson River at Greene-Columbia County Line, NY (MP 231.9)	1.0
Housatonic River at Towns of Stratford and Milford, CT (MP 330.9)	0.3

a/ Iroquois may use the five-spread scenario in order to ensure construction of pipeline facilities within the 1991 construction season.

rather than laid on the seabed. From shore out to about the 6-foot bathymetric contour (isobar), the pipe would be lowered into the trench and buried so that a minimum of 5 feet of cover would be provided; seaward of the 6-foot isobar out to the 30-foot isobar, a minimum of 3 feet of cover would be provided. Iroquois would accommodate Milford's designated small boat anchorage, a portion of which would be traversed by the pipeline, and the shellfish lease areas in the vicinity with a minimum of 5 feet of cover provided. From the 30-foot isobar to the 50-foot isobar, the pipeline would be post-jetted to a minimum of 3 feet below the seabed.

Approximately three to four months would be required to construct the marine portion of the pipeline. All construction would be scheduled to be performed to the maximum extent possible in the winter, from January through May. All construction activity in Long Island Sound would be required to be completed by May 31 for construction activities in Connecticut waters and June 30 in New York waters 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.

2.2.3 Tennessee

Tennessee proposes to fully utilize existing easements in an effort to minimize the impact from construction and maintenance of rights-of-way. Where required offsets allow placement of new pipeline on the edge of existing easements or within existing easements (as in lateral loops), it would be done to further minimize the impact of the addition.

Generally, Tennessee proposes the use of a 75-foot-wide construction right-of-way, although this would be reduced in New York and Massachusetts to 50 and 60 feet, respectively, for mainline loops and to 40 feet for the proposed lateral line loops. In any case, the widths given may be increased or decreased to avoid obstacles or to accommodate special construction techniques.

Pipeline construction would also result in several short-term releases of natural gas into the atmosphere. When cutting and welding the loop segments to the in-service pipeline, or prior to removing pipeline segments, safe practice dictates that natural gas be evacuated from the pipeline to ensure that a combustible mixture of gas and air does not exist at the work area. After the work would be completed, the natural gas/air mixture present in the pipe segment would be purged with pure natural gas introduced at one end of the segment. The control of venting operations is described more fully in section 5.1.13 - Polychlorinated Biphenyls.

Construction would be divided into seven pipeline spreads as listed in table 2.2.3-1. Each spread would employ 100 to 300 construction workers and would progress at the rate of approximately 1,000 to 1,500 feet per day. Construction would be scheduled to begin May 1991 with service expected by October 1991.

2.3 OPERATION AND MAINTENANCE

2.3.1 Iroquois

Iroquois has indicated that all facilities would be operated and maintained according to standard procedures that insure the integrity of the pipeline system.

TABLE 2.2.3-1

Tennessee Construction Spreads a/

Spread No.	Loop/Segment	Miles
3	Schoharie/Albany Loop	15.21
	Columbia/Berkshire Loop	21.27
4	Worcester Loop	10.11
5	Concord Lateral	4.47
	Haverhill Lateral	6.13
7	Wallingford Lateral	3.20
	Lincoln Extension	2.31

a/ The Springfield Lateral (0.09 mile) would not be a separate spread.

Operating and maintaining the Iroquois system would require a staff of full-time employees made up of three groups: a head office, a gas control center, and a field organization. The head office would be located in Shelton, Connecticut, and would have overall responsibility for the system. An operations department within the head office would provide technical and environmental services, including the development of operations and maintenance procedures and emergency response plans.

The gas control center would be responsible for operating the entire Iroquois pipeline system from a central computer-operated control console located in Shelton, Connecticut. The center would monitor pipeline pressures, alarms, valve configurations, and meter station flows. The operator on duty at the control center would be able to isolate sections of the pipeline system by opening or closing remote-controlled valves; each MLV would also be equipped with low-pressure detection devices so that valves upstream and downstream of the MLV could close automatically in the event of a pipeline break. The control center would be operated as an extension of TransCanada's existing system, although the Shelton office would be responsible for emergency response for the Iroquois system.

The field organization would be made up of three district offices, two in New York state and one in Connecticut, each with regional responsibility for day-to-day operation and maintenance of the pipeline system. Each office would be staffed with a manager and approximately 10 full-time employees; most of the employees would be hired locally. All field employees would be trained and equipped to perform operations, maintenance, and emergency response activities.

2.3.1.1 Land Pipeline

A permanent 60-foot-wide right-of-way would be maintained after the completion of construction of the pipeline system. The remaining 40 feet of the 100-foot-wide construction work area would revert to the landowner and its previous vegetative cover. Most activities except for the installation of buildings or the establishment of woodlands would be allowed on the permanent 60-foot-wide easement. In woodland areas, Iroquois would allow an additional 10 feet of the right-of-way to revert to forested uses, but would retain easement rights for the entire 60-foot-wide right-of-way.

The pipeline right-of-way would be maintained in a cleared, low-growing-vegetation condition to facilitate visual inspection from the air and to ensure access to the pipeline by Iroquois personnel. Where environmental considerations dictate, cutting of woody vegetation would be carried out using hand-held power equipment. In other areas, Iroquois would clear the right-of-way using power-driven equipment on a cycle of 5 to 7 or more years. Other routine vegetation maintenance would be performed from mid-summer to late fall. All wetlands would be allowed to revegetate. No herbicides would be used to maintain the right-of-way.

Other lands acquired for use as meter stations, MLV sites (including pig launchers/receivers), or private access roads associated with these locations would be maintained. Fenced areas within meter station or MLV sites would be graveled in accordance with safety requirements. No herbicides would be used at these sites.

After construction, the pipeline right-of-way would be patrolled from the air on a weekly basis and from the ground periodically. The purpose of the patrols would be to identify pipe exposure or damage to the right-of-way or activities that constitute a safety hazard. Other regular maintenance activities would include instrumented leak surveys, operation, inspection and lubrication of valves and valve actuators, and cathodic protection surveys.

2.3.1.2 Marine Pipeline

An inspection program for the marine portion of the Iroquois system would be implemented as part of the maintenance program for the system. Inspections of marine pipeline would be carried out using a combination of divers and remote sensing equipment (such as side-scan sonar, video cameras, and instrumented inspection pigs). If inspection reveals a problem, remedial actions would be initiated either immediately or within a safe period of time. Remedial actions might include: addition of ballast to increase pipe stability and to reduce unsafe pipe spans caused by wave action or scarfing; addition of sacrificial anodes for increased cathodic protection; or (in extreme cases) replacement of damaged sections of pipe.

The entire marine pipeline route would be designated as a nonanchorage area by the U.S. Coast Guard (USCG) and would be so indicated on navigational maps.

2.3.2 Tennessee

Regularly scheduled gas-leak surveys would be conducted and repairs would be made to correct any potentially hazardous leaks. All pipeline markers such as fence posts, signs, aerial markers, and decals would be maintained to ensure that the pipeline location is clearly visible from the air and from the ground. All valves would be periodically inspected and greased.

Aerial inspection of the pipeline would be conducted on a regular basis. Factors such as population density and activity along the right-of-way would determine the actual frequency of inspection. Inspection from the air would provide information on possible leaks, construction activities, erosion, exposed pipe, and other potential problems that can be seen from the air.

The right-of-way would be mowed periodically where appropriate. Tennessee is evaluating the selective use of herbicides and regrowth inhibitors as part of a vegetation management program.

Repair of terraces and drain tiles and replacement of backfill would be conducted where necessary. Water crossings would be inspected periodically. A supply of emergency replacement pipe, leak repair clamps, sleeves, and related materials would be maintained for repair activities.

Monitoring of the cathodic protection system would be accomplished through regularly scheduled cathodic protection surveys. Problems detected through the monitoring program would be corrected promptly and checked in a follow-up survey no later than 12 months after the initial discovery.

Operating procedures for compressor station personnel would include several daily activities. Routine operations would include recording and transmitting pressure and temperature data, calibrating equipment and instruments, inspecting critical components, maintaining equipment, and cleaning. Safety equipment such as fire protection systems and gas detection systems would be periodically checked. Cathodic protection units within the compressor yard would be regularly monitored.

2.4 SAFETY CONTROLS

The pipeline right-of-way would be clearly marked where it crosses public roads, railroads, rivers and navigable waters, fenced property lines, and other locations, as necessary. All pipeline facilities would be marked and identified in accordance with applicable regulations.

The land portion of the Iroquois pipeline system would be constructed with carbon steel pipe manufactured in accordance with American Petroleum Institute specifications for high-test line pipe. Nominal wall thickness would be based on construction classifications and types in accordance with DOT safety regulations. The marine portion of the Iroquois pipeline system would be constructed with 0.50-inch thick, high-test carbon steel line pipe. The pipe would be completely encircled with a concrete jacket to create negative buoyancy and to protect the pipe. The entire Iroquois pipeline system would be designed for a maximum allowable operating pressure (MAOP) of 1,440 psig in accordance with DOT regulations.

Iroquois would implement its public awareness program for the new pipeline system. The program includes contacting landowners, tenants, contractors, utilities, and municipalities that may interact with Iroquois personnel, facilities, and operations. Types of contacts include mailings of company calendars, distribution of Landowner's Guides, personal visits to landowners and tenants along the right-of-way at least once every four years, and meetings with municipalities, fire departments or volunteer firemen, utilities, contractors, and government agencies.

Tennessee is a participant in the "One Call" system in the states where construction is proposed. Anyone planning excavation activities can call a single phone number to alert all utilities. Representatives of affected utilities can then visit the site and mark their facilities.

Each compressor station would be equipped with hazardous gas and fire detection alarm systems, a fire protection system, and an emergency shutdown system which would be checked periodically to ensure optimum performance.

The emergency shutdown system would be designed to shut down and isolate the compressor station if excessive heat were detected, flames were detected by ultraviolet sensors, or an explosive gas mixture were detected by methane-sensitive detectors. It would also shut down equipment if a mechanical failure endangered the integrity of the equipment or presented a hazardous condition. It would automatically route gas around the compressor station during an emergency. The compressor stations would be equipped with relief valves to protect the piping from overpressurization if compressors or unit control systems failed. Firefighting equipment would include hand-held and hand-wheeled dry chemical fire extinguishers. In addition, an automatic fire extinguishing system would be used inside the turbine compressor building; it would be activated automatically upon excessive or sudden heat rise.

2.5 FUTURE PLANS AND ABANDONMENT

Phase I of the project anticipates throughput of 422,900 Mcfd with an increase to 575,900 Mcfd in Phase II. After Phase II there are currently no plans to increase the capacity of the proposed system.

Flexibility for expanding the Iroquois pipeline system capacity beyond 575,900 Mcfd has been provided by initially designing the 30- and 24-inch-diameter mainline without any compressor stations. By adding future compressor stations along the route to maintain a higher average pipeline pressure, a capacity of approximately 1,000,000 Mcfd could be reached. Future looping of the mainline with a parallel pipeline could also accomplish the same result with less compression. An optimum economic configuration for a maximum flow rate would likely combine compression with pipeline looping, but it is not apparent that any such expansion would be necessary in the near future.

No plans for abandonment of facilities have been developed by either Iroquois or Tennessee within the bounds of the Iroquois/Tennessee Pipeline Project. Abandonment would be subject to the approval of the Commission, and must be in compliance with DOT regulations and specific agreements or stipulations made for pipeline rights-of-way. Normally, a buried pipeline that has reached the end of its service life would be internally cleaned, purged free of gas, isolated from interconnections with other pipelines and sealed without removing the pipe from the trench. This approach minimizes surface disturbance and other potential environmental impacts. Also, the aboveground piping at compressor and meter stations would be completely removed with all related aboveground equipment and foundations, and the station sites would be restored to as near original condition as possible.

Upon abandonment of the pipeline, in part or in whole, the rights-of-way on private lands would be returned to the owners according to their specific easement agreements, and public lands would be returned to the appropriate leasing agency within the local, state or Federal governments.

2.6 PERMITS AND APPROVALS

In addition to the FERC's requirement of a Certificate, other Federal, state, and local government agencies may have permit or approval authority over portions of the proposed project (see table 2.6-1). These include, at the Federal level, compliance with regulations of the Clean Water Act (CWA), the Rivers and Harbors Act, the Clean Air Act, and the Toxic Substances Control Act (TSCA). Each state in which construction would take place requires additional state level permits. Although each state's requirements vary slightly, state-level review generally encompasses wetland and stream crossings; water quality certifications, including review of hydrostatic test water intake and discharge; cultural resources; state-listed endangered species; and highway crossings. At all levels there are overlaps among regulations; therefore, a particular activity (e.g., wetland crossings) could require approval at more than one level of government.

Federal requirements of the CWA include compliance under Sections 401, 402, and 404. Water quality certification (Section 401) has been delegated to the jurisdiction of the individual state agencies or would be reviewed by the EPA. EPA and/or the states would determine if any National Pollution Discharge Elimination System permits (NPDES, Section 402) would be required for discharge of hydrostatic test waters. New York, New Hampshire, Massachusetts, Rhode Island, and Connecticut each review and sign off on water quality certification relating to dredge and fill activities. All these states, except New Hampshire and Massachusetts, review and sign off on NPDES permits. In New Hampshire and Massachusetts, all NPDES permit activities are reviewed by the EPA.

The Section 404 permitting process is administered by the COE for all stream and wetland crossings. The COE has determined that it will require Iroquois to secure a single individual Section 404 permit for each of Iroquois wetland and surface water crossings associated with the Iroquois/Tennessee Project. No determination has been made as to whether the COE will require Tennessee to obtain a single individual Section 404 permit or allow them to use the Nationwide Permit. However, Tennessee filed an application with the COE on April 9, 1990, for an individual Section 404 permit. Section 10 of the Rivers and Harbors Act is also administered by the COE; individual Section 10 permits will be required for all construction activities that occur in navigable waterways.

Before the individual Section 404/10 permit is issued, the CWA requires that a Section 404(b)(1) guidelines analysis must be completed by the permitting agency (i.e., COE). FERC, in the NEPA review required to prepare this EIS, has analyzed all technical aspects required for the Section 404(b)(1) guidelines analysis, including analysis of natural resources and cultural resources affected by the project, as well as analyses of alternatives and route variations which would eliminate or minimize the discharge or fill of material in the waters of the United States. The results of these studies are presented in this EIS in sections 3.6, 3.7, 4.1.3, 4.1.4, 4.1.5, 4.1.7, 4.1.11, 5.1.3, 5.1.4, 5.1.5, 5.1.7, 5.1.11, 6.1 and 6.2. In addition, the FERC staff has proposed a set of best management practices that it would recommend each applicant implement during construction (see appendix D) to minimize adverse impact on the waters of the United States. The COE has preliminarily determined that Iroquois'

TABLE 2.6-1

Environmental Permits and Approvals That May Be Required for the Proposed Iroquois/Tennessee Pipeline Project

Agency	Permit	Applicant
FEDERAL		
U.S. Army Corps of Engineers	Section 404 Permit a/	IROQ/TENN
	Section 10 Permit	IROQ/TENN
U.S. Environmental Protection Agency	National Pollution Discharge Elimination System Permit (NPDES, Section 402)	TENN
	Prevention of Significant Deterioration Permit (Compressor Station Modifications)	TENN
	Alternative Disposal Permit (TSCA)	TENN
	Hazardous Waste Disposal (RCRA)	TENN
U.S. Dept. of Energy	Natural Gas Act Import License	IROQ/TENN
	Fuel Use Act Exemption	IROQ/TENN
U.S. Dept. of Transportation	Federal Highway Crossing Permits	IROQ/TENN
U.S. National Park Service	Easement - Land Exchange	IROQ
STATE		
New York Dept. of Environmental Conservation	Freshwater Wetlands Permit	IROQ/TENN
	Tidal Wetlands Permit	IROQ
	Protection of Waters Permit	IROQ/TENN
	State Pollutant Discharge Elimination System (SPDES)	IROQ/TENN
	Wild, Scenic and Recreational Rivers Permit	IROQ/TENN
	Protection of Waters Permit	IROQ/TENN
	Water Quality Certificates	IROQ/TENN
	Solid Waste Management Permit	IROQ/TENN
New York Dept. of Environmental Conservation, Air Division	Air Permits - Permit to Construct/Certificate to Operate	TENN
New York Public Service Commission	Article VII Certification, Certificate of Environmental Compatibility and Public Need	IROQ/TENN
New York Dept. of State	Coastal Zone Consistency Review	IROQ
Connecticut Dept. of Environmental Protection	State Pollutant Discharge Elimination System (SPDES)	IROQ/TENN
	Coastal Zone Consistency Determination	IROQ
	401 Water Quality Certificate	IROQ/TENN
	Temporary Operating Permit	IROQ/TENN
Connecticut Siting Council	Certificate of Environmental Compatibility and Public Need	IROQ/TENN
	Development and Management Plan	IROQ/TENN
Massachusetts Dept. of Environmental Protection	Letter of Authorization for Hydrostatic Test Water Discharge	TENN
	Wetland and Water Quality Certification	TENN
	Air Emissions Plan Approval for Compressor Engine	TENN
	Waterways Crossing Permit	TENN
Massachusetts Dept. of Public Utilities	Road Crossing Permit	TENN

a/ Tennessee may not be required to obtain an individual section 404 permit, but may use the nationwide permit.

TABLE 2.6-1 (cont'd)

Agency	Permit	Applicant
Mass. Dept. of Public Works	Underground Utility Installation	TENN
Mass. Dept. of Environmental Management	State Forest Crossing Permit	TENN
New Hampshire Dept. of Environmental Services	Hydrostatic Test Water Acquisition and Disposal Permit Significant Alteration of Terrain	TENN TENN
New Hampshire Energy Facility Evaluation Committee	Comprehensive State Level Review	TENN
New Hampshire Agency of Public Works and Highways	Highway Crossings Permit	TENN
New Hampshire Historic Preservation Office	Cultural Resources Review	TENN
Rhode Island Dept. of Environmental Management	Water Quality Certificate Wetland Permit, Dredge and Fill Permits	TENN TENN
Rhode Island Dept. of Transportation	Highway Crossing Permits	TENN
Rhode Island Historic Preservation Commission	Approval of proposed route	TENN
LOCAL		
Towns	Building Permits for compressor station additions	TENN
Counties and Towns	Road Crossing Permits, Soil Erosion and Sediment Control Plan Approval	IROQ/TENN
County Health Departments	Permits to install septic systems at compressor stations	TENN
Zoning Boards	Approvals for aboveground facilities	IROQ/TENN
Railroad Crossings	Conrail and Amtrack	IROQ/TENN
Soil Conservation Districts	Soil Permit	IROQ/TENN

portion of the proposed project complies with the Section 404(b)(1) Guidelines (see figure 2.6-1).

Each state reviews pipeline right-of-way regulatory requirements differently. In addition to the Section 404 requirements, each state has its own wetland permitting process. Although each state works in conjunction with the COE, a state may request additional information. The state environmental regulatory agencies that would review components of the Iroquois/Tennessee projects are the New York Department of Environmental Conservation (NYDEC), the New Hampshire Department of Environmental Services (NHDES) - Wetland Board, the Massachusetts Department of Environmental Protection (MADEP), the Rhode Island Department of Environmental Management (RIDEM), and the Connecticut Department of Environmental Protection (CTDEP). Individual communities normally also require reviews by their Conservation Commissions or similar organization. Table 2.6-1 lists state and local permits.

New York and Connecticut have established coastal zone management policies regarding the use of land and water within their designated coastal zones. Federal and state projects within these coastal zones must be deemed consistent with state management objectives. Iroquois' proposed crossings of the St. Lawrence River, Hudson River, and Long Island Sound would be within New York's coastal zone. Iroquois has filed an application with the New York Department of State for a determination of coastal zone consistency. Iroquois would cross Connecticut's coastal zone in the towns of Milford and Stratford. Iroquois has submitted its coastal zone consistency certificate with the CTDEP.

NANOP-E

EVALUATION OF THE PROPOSED ACTION IN ACCORDANCE WITH THE GUIDELINES PROMULGATED UNDER SECTION 404 (b) (1) OF THE CLEAN WATER ACT 40 CFR 230

APPLICANT'S NAME Iroquois Gas Trans. Sys. APPLICATION NUMBER 89-1123-L4

A. Compliance Review (40 CFR 230.10 (a) - (d))

No.	Criteria	Preliminary* Yes	Preliminary* No	Final** Yes	Final** No
1.	The discharge represents the least environmentally damaging practicable alternative and if located in a special aquatic site (40 CFR 230, Subpart E) the activity associated with the discharge must have direct access or proximity to, or be located within the aquatic ecosystem to fulfill its basic purpose	✓			
2.	The activity does not appear to:				
	(a) violate applicable State water quality standards or effluent standards promulgated under Section 307 of the Clean Water Act;	✓			
	(b) jeopardize the existence of a Federally listed threatened or endangered species or its habitat;	✓			
	(c) violate the requirements of any Federally designated marine sanctuary	✓			
3.	The activity will not cause or contribute to significant degradation of waters of the U.S. including adverse effects on human health, life stages of organisms dependent on the aquatic ecosystem, ecosystem diversity, productivity and stability, and recreational, aesthetic, and economic values	✓			
4.	Appropriate and practicable steps have been taken to minimize the potential adverse impacts of the discharge on the aquatic ecosystem (40 CFR 230, Subpart H)	✓			

*Negative responses to any of the compliance criteria at the preliminary stage signifies the need for a more thorough level of analysis and attachment of the appropriate supporting documentation. Send letter to the applicant which documents reasons for the preliminary determination of non-compliance.

**A negative response to one of the compliance criteria at the final stage indicates that the proposed project does not comply with the guidelines. If the economics of navigation and anchorage are to be evaluated (404 (b) (2)) as a part of the decision making process, attach the appropriate supporting data and evaluation.

Preliminary Evaluation by: [signature] Date: 5 Dec. 1989
Preliminary Evaluation by: [signature] Date: 5 Dec. 1989
C, Eastern Permit Sec.

FIGURE 2.6-1

"Preliminary" Section 404 (b)(1) Compliance Review

3.0 ALTERNATIVES

In accordance with NEPA and with Commission policy, we have evaluated a number of alternatives to the Iroquois/Tennessee Project to determine whether they are reasonable, environmentally preferable alternatives to the proposed action. This section includes descriptions of the following:

- no action or postponed action
- energy conservation and energy alternatives
- single-pipeline system alternatives to the Iroquois/Tennessee and Champlain Projects
- project system alternatives
- major route alternatives
- route variations

3.1 NO ACTION

Under the no-action alternative the construction of the proposed pipeline facilities to transport Canadian natural gas for use in the Northeast market would not occur. This alternative would prevent all environmental impact associated with the construction and operation of the proposed project.

If the Iroquois/Tennessee Project is not constructed, potential users will need to seek natural gas from other systems or increase usage of fuel oil, coal, and other alternative fuels. Transportation of 422,900 Mcfd of Canadian natural gas would not be provided by the proposed Phase I project. The LDCs, cogeneration, and power-generation customers in New York, Massachusetts, Connecticut, Rhode Island, New Jersey, and New Hampshire would not receive the increased natural gas delivery volumes and would forego the environmental benefits associated with the use of natural gas.

The natural gas supplied by this proposed project would be used in two gas-demand situations: 1) to capture new energy markets, and 2) to replace other fuels currently in use. If this project is not constructed, alternative fuels used to replace natural gas would lead to an increase in the use of alternative fuels. Increased volumes of these dirtier fuels would be used to replace natural gas.

One of the major environmental benefits of using natural gas for residential, commercial, industrial, and utility needs is reduced emissions of nitrogen dioxide (NO_2) and sulfur dioxide (SO_2) relative to fuel oil, coal, and wood. The conversion of electric utilities to gas, the construction of gas-fired cogeneration facilities, and to a lesser degree new residential, commercial, and industrial facilities utilizing natural gas instead of fuel oil or coal, would lessen future increases in regional emission of air pollutants.

We have conducted an analysis of the environmental consequences if the three Northeast settlement projects 1/, including Iroquois/Tennessee, were not implemented. These three projects (Iroquois/Tennessee, ANR, and Niagara Import) would account for 1,641,400 Mcfd of natural gas. Approximately 25 percent of this gas would be attributable to Phase I of the Iroquois/Tennessee Project.

The analysis consisted of the following tasks:

1. Analyze increased gas demand in the Northeast by 1997 - both with and without the settlement projects.
2. Determine the volumes of alternative fuels that would be used if the settlement projects are not constructed.
3. Calculate the additional air pollutant emissions from increased alternative fuel use.
4. Determine the additional infrastructure required, if any, to deliver the additional volumes of alternative fuels.

To better understand the gas market in the Northeast and how it might grow, task 1 included a review of a range of forecasts for the region published by the Energy Information Agency, Gas Research Institute, and the American Gas Association (AGA). We also reviewed Stanford University's Energy Modeling Forum, Electric Projections by the North American Electric Reliability Council, state energy plans for New York and New Hampshire, and a number of miscellaneous reports pertinent to the energy demand in the Northeast. The forecasts range from no growth to explosive growth, with the projected volumes bracketing those volumes projected by the Northeast settlement projects reviewed herein. It is not the purpose of this document to judge the merits of either the various forecasts or the settlement demand data. Our analysis merely demonstrates that the settlement demand data fall within the range of published demand forecasts. Further, this document does not evaluate the customer's need for additional gas supplies or the need for the related interstate pipeline facilities.

The Commission will address these issues when it considers the entirety of this proposal including customer markets, transportation and sales rates, and gas supply adequacy. These aspects are being considered by FERC on a track parallel to the environmental analysis. That information along with the environmental record will be placed before the Commission for their review and ultimate decision on this project.

Appendix B details the conversion of the peak-day market data filed as a result of the January 12, 1989, settlement to annual alternative fuel consumption by end-use category under task 2. Emission factors specific to each state, alternative fuel, and end-use category were used to calculate emissions of SO_2, NO_2, and particulate matter (PM). This analysis assumes that the majority of alternative fuels would be used in new facilities since new fuel burning equipment must meet more rigorous emission standards than existing equipment. Further, if the facility is classified as a major source of air pollution, it must apply best available control technology (BACT) and comply with appropriate new-source performance standards.

1/ In the original discussion, a fourth project (Champlain) was also considered. However, Champlain has been indefinitely deferred.

Two fuel substitution scenarios for 1997 were analyzed. Case I is a partial substitution case that assumes additional gas could be delivered off-peak to industrial customers due to the low annual load factor of the systems supplying the Northeast. This analysis adopts the AGA's assumptions that 30 percent of the industrial demand and 75 percent of the electric utility demand could be supplied off-peak with interruptible gas.2/ Under this scenario, only about one-third of the volume of natural gas would be replaced by alternative fuels. Case II is a 100 percent substitution case in which the entire volume of natural gas would be replaced by alternative fuels.

Appendix B-3 presents the emission increases for the total natural gas volumes by end-use category and alternative fuel for both the partial substitution and the 100 percent substitution cases for all Northeast projects and for the Iroquois Phase I and Phase II projects. Although PM emissions are included in the table, increases resulting from the substitution of alternative fuels would be generally minor for all states and are not considered a significant impact for discussion.

Table 3.1-1 presents the relative level of impact for each state by comparing the emission increases for 1997 to EPA's baseline 1985 emissions. The projected increases of SO_2 and NO_2 appear to be significant for Rhode Island, Massachusetts, and Connecticut. Under the 100 percent substitution scenario the following summaries can be made by state for the projects identified above.

- Connecticut - an increase of approximately 9,200 tons of SO_2 (10.5 percent) and 3,200 tons of NO_2 (2.5 percent) per year would occur, primarily from increased usage of #2 fuel oil, residual fuel oil, and coal by electric utilities and cogeneration customers.

- Massachusetts - an increase of approximately 28,400 tons of SO_2 (8.6 percent) and 10,600 tons of NO_2 (3.8 percent) per year would occur, primarily from increased usage of coal, #2 fuel oil, and residual fuel oil by electric utilities and cogeneration customers. Approximately one-third of the SO_2 emissions come from current use of residual fuel oil in New England Power's Brayton Point Unit No. 4.

- New Hampshire - minimal increases (less than 1 percent) would occur from proposed low volumes of natural gas received.

- New Jersey - an increase of approximately 9,100 tons of SO_2 (5.0 percent) and 7,200 tons of NO_2 (2.0 percent) per year would occur, primarily from increased usage of #2 fuel oil and coal for electric utilities and cogeneration customers.

- New York - an increase of approximately 17,200 tons of SO_2 (2.6 percent) and 8,200 tons of NO_2 (1.3 percent) per year would occur, primarily from substitution of #2 fuel oil in all market sectors and coal usage by cogeneration customers.

2/ American Gas Association Issue Brief 1988-6, May 16, 1988.

TABLE 3.1-1

Projected Emissions Increase by State for 1997

State	Base Emissions (tons/yr) a/ NO$_X$	SO$_2$	TSP	Emission Increase (tons/yr) NO$_2$	SO$_2$	TSP	Percent Increase NO$_2$	SO$_2$	TSP
CASE I - PARTIAL SUBSTITUTION (1997)									
Connecticut	127,941	87,298	78,661	1,320	4,152	166	1.03	4.76	0.21
Massachusetts	277,018	328,344	136,038	3,046	8,140	332	1.10	2.48	0.24
New Hampshire	54,617	85,283	56,440	24	80	4	0.04	0.09	0.01
New Jersey	369,024	183,448	218,289	2,597	3,288	505	0.70	1.79	0.23
New York	626,284	665,105	492,698	3,780	7,548	801	0.60	1.13	0.16
Pennsylvania	958,041	1,425,005	1,174,176	179	646	42	0.02	0.05	0.00
Rhode Island	30,318	9,227	17,354	1,695	4,315	158	5.59	46.76	0.91
Vermont	25,200	7,338	95,310	0	0	0	0.00	0.00	0.00
TOTAL	2,468,443	2,791,048	2,268,966	12,641	28,169	2,008	0.51	1.01	0.09
CASE II - 100% SUBSTITUTION (1997)									
Connecticut	127,941	87,298	78,661	3,212	9,205	341	2.51	10.54	0.43
Massachusetts	277,018	328,344	136,038	10,620	28,358	1,059	3.83	8.64	0.78
New Hampshire	54,617	85,283	56,440	32	98	5	0.06	0.11	0.01
New Jersey	369,024	183,448	218,289	7,199	9,108	1,068	1.95	4.96	0.49
New York	626,284	665,105	492,698	8,193	17,176	1,352	1.31	2.58	0.27
Pennsylvania	958,041	1,425,005	1,174,176	304	898	57	0.03	0.06	0.00
Rhode Island	30,318	9,227	17,354	5,671	9,383	483	18.71	101.69	2.78
Vermont	25,200	7,338	95,310	0	0	0	0.00	0.00	0.00
TOTAL	2,468,443	2,791,048	2,268,966	35,231	74,226	4,365	1.43	2.66	0.19

a/ Based upon 1987 National Emission Data System output from U.S. EPA Regional Offices I, II, and III.

- Rhode Island - an increase of approximately 9,400 tons of SO_2 (102 percent) and 5,700 tons of NO_2 (18.7 percent) per year would occur, primarily from alternative fuel usage by Ocean States Power, with #2 fuel oil as backup, and the present operation of the Manchester Street Station using residual fuel oil.

As stated above, the Iroquois/Tennessee Project Phase I represents approximately 25 percent of the study volumes of natural gas to be supplied to New York, Massachusetts, Connecticut, New Jersey, Rhode Island, and New Hampshire (see appendix B, tables 16 - 19 for these increased emissions). It can be assumed that under the 100 percent substitution case, a significant portion of projected SO_2 and NO_2 emissions in 1997 would be attributed to the use of alternative fuels in two of the four states that would be served by the Iroquois/Tennessee Project Phase I.

Although this analysis identifies the potential for significant increase in emissions of air pollutants, it is far more complex to predict the location and significance of ambient pollutant increases. Increased emissions would likely cause higher ambient concentrations of these pollutants in some areas. However, the extent to which higher ambient concentrations have the potential to exceed the corresponding NAAQS can only be predicted by atmospheric dispersion modeling of the affected alternative fuel users. Assembling the detailed source data required for model inputs is beyond the scope of this EIS. However, this type of analysis is normally performed during the permitting process for new major sources, thereby protecting the NAAQS and applicable increments. Nevertheless, the potential impact of increased alternative fuel use on air quality in the Northeast can be avoided if the settlement projects are authorized.

Acid rain and its relationship to SO_2 and NO_2 emissions are of serious concern in the Northeast. Most Northeast states either have enacted or propose to enact legislation to reduce acidic deposition. Natural gas contains negligible amounts of sulfur and, therefore, its combustion leads to negligible emissions of SO_2. Further, NO_2 emissions from natural gas are generally lower than from other fossil fuels; therefore, use of substitute fuels would not provide cleaner burning fuel supplies for use by the Northeast in combating the acid rain problem.

The potential need to expand the infrastructure to deliver the projected additional alternative fuels was evaluated from historical data on alternative fuel deliveries to the Northeast. Deliveries of #2 fuel oil, residual fuel oil, and to a lesser extent coal, have declined significantly over the past two decades. As a result, the unused capacity significantly exceeds the projected increase in alternative fuels. Minor improvements and storage likely would be required in some areas but attempting to determine their location and magnitude was beyond the scope of this study.

However, several governmental bodies are on record concerning need for additional gas. The DOE's Deputy Assistant Secretary, in the Conditional Opinion and Order No. 368, presented the following conclusions, "After reviewing the comprehensive record...I conclude that these imports will serve the consumers' interest in obtaining long-term, reliable supplies of natural gas at competitive, market-responsive prices. The imports will help fill current needs and projected future increases in consumer demand. Additionally, these imports will enhance the energy mix and diversity of natural gas supplies available to the Northeast and improve the natural gas distribution system..." (pg 32).

Although the market data prepared by Iroquois and its individual shippers demonstrate only their perception of need, the NYPSC in its "Opinion and Order Granting Certificate of Environmental Compatibility and Public Need," Opinion No. 89-42 issued December 8, 1989, states that "The need for new gas supplies for New York State is well documented on this record...The record shows also that pipeline delivery capacity is insufficient to serve New York State's current and anticipated demand for gas over the next ten years. The major domestic pipelines serving the shippers are operating at near-peak capacity during the winter season and, even if these pipelines were willing to expand their long-haul delivery capacity, a completely new pipeline, tapping Canadian supplies, will better serve the state in this instance by assuring more reliable service through diversity of supply" (pp. 11-12).

The DOE Conditional Opinion and Order also states that "Under the DOE import guidelines, need for proposed imports is viewed as a function of marketability and gas is presumed to be needed if it is found to be competitive. We have found that the proposed import arrangements are competitive...Accordingly, the proposed imports are presumed to be needed. The intervenors have not made any arguments or submitted any evidence sufficient to rebut the presumption of need...The DOE does not believe that it can do a better job of prognosticating demand than the Repurchasers, which is the primary reason that the energy guidelines presume that a flexible, competitively-priced, freely negotiated sales agreement is the best way to ensure that the proposed gas supply will be needed...although the long-term marketability and competitiveness of the proposed imports is determinative as to the need for the Canadian natural gas, we believe that the record indicates that there is a need for long-term, secure and competitively-priced supply of natural gas in the Repurchasers' markets." (pp 25-26).

3.2 ALTERNATIVE ENERGY SOURCES

In 1986, gas provided approximately 25 percent (approximately 2,023 trillion Btus) of the total energy demand of the eight northeast states; followed by coal, providing 22 percent; residual fuel oil, #2 fuel oil, and nuclear energy, providing approximately 13 percent each; and the remainder provided by hydroelectric, wood, and liquid petroleum gases. Approval of the Iroquois/Tennessee Project would equate to an additional 195 trillion Btus of energy annually available to the Northeast market or an additional 10 percent of the 1986 natural gas energy demand. The volume of natural gas supplied to each state by the Iroquois/Tennessee Project would vary, as would the energy replacement, i.e., New York, Connecticut, Massachusetts, New Jersey, Rhode Island, and New Hampshire would receive approximately 51, 29, 16, 3 and 1 percent of the Iroquois/Tennessee Project quantities, respectively.

The Iroquois/Tennessee Project would provide natural gas to the residential, commercial, industrial, and electric utility sectors. Table 3.2-1 provides a summary of the primary competitive fuels used by sector. The electric utility sector would be the major user, with the remainder being spread across the remaining three sectors.

3.2.1 Existing Natural Gas Pipeline Network

Presently, natural gas reaches the Northeast market from domestic and Canadian production areas through pipelines. Several major pipelines flow to or near underground natural gas storage fields in western Pennsylvania, western New York, and Maryland. A portion of the flow can be diverted into storage during the low-demand summer period for later withdrawal during the peak-demand winter period. During spring, summer, and fall months the systems have excess capacity to move gas east to increase the supply for use during off-peak demand periods and to serve industrial customers and utilities on an interruptible basis. However, there are various pipeline system constraints between the storage reservoirs and proposed delivery points of the Iroquois/Tennessee Project during periods of peak demand.

We looked at the possibility of expanding existing Gulf Coast systems to deliver gas to the Northeast. The cost and facility requirements for such a scenario made that alternative unreasonable.

TABLE 3.2-1

Natural Gas Fuel Used by Sector and Competitive Alternative Fuels

Sector	Gas Use	Competitive Fuel(s)
Residential	Cooking	Electricity
	Space heating	#2 fuel oil, electricity
	Water heating	#2 fuel oil, electricity
	Drying	Electricity
Commercial	Cooking	Electricity
	Space heating	#2 fuel oil, residual fuel oil, electricity
	Water heating	#2 fuel oil, electricity
	Drying	Electricity
Industrial	Cooking	Electricity
	Space heating	#2 fuel oil, residual fuel oil, coal
Electricity	Boiler fuel	Coal, residual fuel oil, wood
	Engines and turbines	Gasoline, kerosene, #2 fuel oil, wood
	Raw materials	Liquified petroleum gases
Electric Utility	Electric generators	Coal, residual fuel oil, #2 fuel oil
	Turbine-driven during "peaking"	#2 fuel oil or plants primary fuel
	New gas fired, combined cycle plants	#2 fuel oil (dual-fuel)

Construction could eliminate the potential supply constraints to specific locations (see existing system expansion analysis, section 3.4). In other instances, major construction of facilities may be required. However, during peak-demand periods, many of these constraints would remain and potentially force curtailments, as occurred in the Northeast in the month of December 1989. This subject was addressed by the NYPSC in its Opinion and Order on the Iroquois Article VII application.

The NYPSC in its Opinion and Order states:

The record shows also that pipeline delivery capacity is insufficient to serve New York State's current and anticipated demand for gas over the next ten years. The major domestic pipelines serving the shippers are operating at near-peak capacity during the winter season and, even if these pipelines were willing to expand their long-haul delivery capacity, a completely new pipeline, tapping Canadian supplies, will better serve the state in this instance by assuring more reliable service through diversity of supply... Iroquois will strengthen the Northeast supply system by establishing interconnections with existing pipelines. Moreover, its delivery capacity can be expanded through the addition of compression if greater supplies are needed in the future." (pp. 11-12)

3.2.2 Oil

In 1986, the Northeast relied on residual and #2 fuel oil to supply approximately 26 percent of its total energy demand. Much of this oil was purchased abroad, making the Northeast heavily dependent on foreign crude petroleum and petroleum products, and increasing its reliance on various unstable oil producing regions. A significant amount of residual and #2 fuel oil would be required yearly in the energy mix for the Northeast to offset the proposed energy supply.

This increased fuel demand would require additional shiploads of oil to the Northeast each year, which would increase the risk of spills and associated environmental impact. Truck and rail deliveries would increase, affecting traffic patterns. Although our analysis indicates that the existing infrastructure is underutilized, minor augmentation of facilities might be required. As discussed in section 3.1, use of fuel oils typically results in increases of SO_2, NO_2, and PM emissions during burning. The existence of SO_2 and NO_2 has been determined to be a major precursor of acid rain.

Much of the natural gas from this project would be used for generating electricity. Oil-fired facilities are a long-lead-time alternative due to the number of issues that require resolution before approval; therefore, they may not constitute a realistic alternative to gas-fired facilities.

3.2.3 Coal

In 1986, coal accounted for approximately 22 percent of the energy demand for the Northeast. During the 1960s and 1970s, the reliance on coal (primarily for coal-fired electric generating plants) declined due to the relatively low cost of oil and the passage of the Clean Air Act. However, with the drastic increase in oil prices in the mid- and late 1970s, there was a resurgence in the use of coal, primarily for generating electricity. Most residences and businesses are not equipped to burn coal. The increased use of coal as an alternative to the proposed Iroquois/Tennessee Project would require the expansion of existing facilities or construction of new coal-fired electrical facilities.

Coal is abundant and available domestically in sufficient quantities to supply the projected energy need. However, it must be transported from the coal fields. Transportation could be difficult and costly if a facility is not adjacent to an existing rail corridor. Expansion of existing facilities or construction of a major new coal plant is difficult and would involve even larger concerns than constructing a new oil-fired facility. Coal is inherently a polluting fuel, and its combustion releases sulfur, nitrogen, alkali and halogen compounds, and volatile traces of metals, affecting air quality. Combustion also requires the disposal of significant amounts of solids. Like oil, coal produces SO_2 and NO_2, which contribute to the formation of acid rain.

Much of the natural gas from this project would be used for generating electricity. Coal-fired facilities are a long-lead-time alternative due to the number of issues that require resolution before approval; therefore, they may not constitute a realistic alternative to gas-fired facilities.

3.2.4 Electricity

Electric utilities in the Northeast accounted for more than 50 percent of the 1986 energy demand, with its normal load being supplied by coal, nuclear power, residual fuel oil, hydropower, natural gas, and #2 fuel oil. Natural gas competes with coal, residual fuel oil, and #2 fuel oil in the electric utility market. Existing hydroelectric and nuclear power, because of their high capital cost and low fuel cost, are used preferentially to meet any load. However, new nuclear power plants may be politically and economically infeasible at present. New hydroelectric plants will almost always be the investment of choice when feasible sites can be obtained. Hence, gas does not actually compete with either nuclear fuels or hydropower in generating electricity. To the extent gas is not available to generate increased electricity, the substitute fuels are coal or one of the fuel oils.

In the northeast, natural gas has been used primarily as a peaking fuel to drive gas turbine-driven generators during peak-demand periods. Since it has been available on an interruptible basis, it has also been used as a supplemental fuel in plants with dual-fuel capabilities when competitively priced. When natural gas is not available for new peaking use, it is usually replaced with #2 fuel oil. The Iroquois/Tennessee Project would provide natural gas on a firm basis for new gas-fired, combined-cycle plants. The likely replacement choice would be a plant capable of burning coal, residual fuel oil, or #2 fuel oil.

3.2.5 Peak Shaving

During the winter months in the Northeast, the capacity of existing pipeline transmission facilities is not adequate to meet peak energy demand. Underground gas storage is the first line of defense to meet increased winter base-load demand (see section 3.2.1). During winter, when supplies of natural gas from underground storage are not adequate to meet peak demand, other forms of energy must be dispatched to supplement pipeline suppliers. Normally a propane-air mixture, liquified natural gas (LNG), or synthetic natural gas is used. Selection of an alternative depends on cost. Availability of existing alternative facilities limits these fuels' usefulness to peak shave for brief periods. Peak shaving is not a viable alternative to the proposed project.

LNG, propane, and synthetic gases do not compete with natural gas directly in most markets, since they are used to supplement (peak-shave) natural gas only in peak-demand periods and are not considered to be an alternative to increasing the availability of natural gas supplies in general market use. These peak-demand supplies are not cost-competitive fuels in any of the four sectors discussed. Peak-shaving gas is injected into the distribution system on short notice during peak demand periods to satisfy demand needs. Peak shaving storage is generally sized to supply only the coldest 10 to 20 days in a heating season. Availability of this type of service is limited by storage capacity and equipment necessary to provide pipeline available gas. As such, peak shaving cannot be considered a reasonable alternative to the increased deliverability and annual supplies of the proposed project.

The New England Fuel Institute et al. (NEFI) indicated that "the available peaking capacity is far in excess of the amounts reported by the shippers" and that "these supplies must be considered and evaluated by FERC before it publishes its EIS..." We disagree with this position. These issues are not part of the EIS for this project and will be considered by the Commission when the full record has been developed. Nonetheless, we did evaluate expansion of existing systems and did not find them to have any environmental advantage.

3.2.6 Other Energy Sources

Other conventional energy sources (e.g., propane, wood, and synthetic fuels) and non-conventional energy sources (e.g., solar, wind, fuel cells, and photovoltaics) are not viable alternatives to the proposed Iroquois/Tennessee Project for a reliable, long-term energy supply to the Northeast.

Propane rarely competes directly with natural gas since it is in limited supply and almost always more expensive. Its use is generally restricted to rural areas where natural gas is not available. Still, it is an excellent substitute for natural gas. Propane-air mixtures are frequently added to natural gas streams to meet peak demand. Some additional propane is used in the form of propane-air mixtures to allow utilities to meet peak-day loads.

Wood is used for residential space heating in small amounts. The amount of wood used has increased during the past 15 years because energy prices have soared, but wood still provides only a small portion of the total residential energy consumed in the Northeast. Almost no wood is used in the commercial market; however, considerable amounts of wood and wood products are burned in the industrial sector. In 1986, wood accounted for approximately 4 percent of the total Northeast energy supply. However, this is mainly from paper, pulp, and wood processing industries, where large volumes of waste wood and wood products are readily available for use as a fuel. Transportation and storage requirements of wood, as well as waste disposal, make it impractical for large-scale use.

Synthetic fuel technology has not been demonstrated on a large scale in the Northeast, but would certainly face environmental and economic uncertainties in the private and public sector.

Nonconventional energy sources have stimulated a lot of interest. These technologies appear to be small-scale in nature, have the potential to be highly efficient, and appear to create few environmental impacts. However, as an energy source, they are not expected to be proven reliable, economical, or available in sufficient quantities in the near term to be considered a reasonable alternative to the proposed Iroquois/Tennessee Project.

3.2.7 Energy Conservation and Electric-Load Management

Residents of the Northeast are well known for their support of energy conservation and protection of their environment. There must be continued effort to provide a realistic approach to the need for continued use of energy, whether it be for current demand or for future expansion to accommodate growth. The continued conservation programs are a significant component in efforts to meet existing and future energy demand in the Northeast.

For conservation to be an alternative to the Iroquois/Tennessee Project, 422,900 million Btus per day of cost-effective conservation and energy-load management measures must be identified. Many of the Northeast utilities, as well as state agencies and environmental groups, have encouraged active conservation efforts and energy load management programs. In fact, demand projections for the Northeast reflect the effects of ongoing energy conservation efforts. However, existing technological, institutional, political, and social barriers make it difficult to expand energy savings significantly through these programs. According to the New England Energy Policy Council (NEEPC), obstacles to energy efficiency improvements (in this case electrical efficiency) are lack of information about the availability, cost, and reliability of conservation measures; the fact that consumers cannot capture the direct benefit or do not control usage; the major initial capital expense; and lack of a strong commitment from the utilities (NEEPC, 1987).

Since the publication of Power to Spare, seven of Massachusetts' investor-owned electric utilities, both of Connecticut's utilities, Vermont's two largest utilities, and other utilities in Rhode Island and New Hampshire have all adopted, or are in the process of developing, electricity efficiency programs on a scale that has no precedent in the United states. This cooperative effort by utilities, public, and interest groups is commendable and deserves recognition. The energy savings are significant and further efforts resulting from the replacement of existing residential furnaces with higher efficiency systems would provide increased energy savings.

The implementation of such conservation measures results in energy savings and decreases energy demand. However, while such programs result in changes in load shape and an initial reduction in energy use, they do not necessarily cause a significant reduction in peak requirements unless the growth in number of users is checked. To encourage energy-saving measures, consideration must be given to accelerating or stimulating conservation action and developing energy-load management programs.

The potential benefits of various electric energy-load management programs, such as reducing the system peak demand, building off-peak load, and shifting energy use from on-peak periods to off-peak periods, varies depending upon utility-specific factors such as current and future mix of power generation, fuel sources, load growth, daily and seasonal load shapes, and regulatory policy. Energy-load management increases the base load by reducing peak energy demands while filling in low-demand periods of the load cycle. This results in a more effective use of energy capacity and is accomplished by attempting to alter customers' energy use patterns. A limiting factor is that successful energy-load management efforts require customer participation, which is usually voluntary. While such initiatives have reduced and would continue to reduce energy demands, forecasted demands are still high enough to require significant new sources.

There are existing technological, institutional, political, and social barriers that will inhibit complete implementation of energy conservation and load-management programs. Although individual components of energy conservation programs, when implemented, will reduce energy demand, the effectiveness of energy conservation will be determined by the success rate for implementation of complete programs. Energy conservation is not likely to be effective to the point that future energy demands, i.e., increased demand to accommodate regional growth, will not require continued upgrading and expansion of fuel delivery systems. The New York Public Service Commission states "while efforts should be and are being made in demand side management and conservation, these efforts are not an adequate substitute for a new supply" (Opinion No. 89-42).

3.3 SINGLE PIPELINE SYSTEM ALTERNATIVES TO THE IROQUOIS/TENNESSEE AND CHAMPLAIN PROJECTS

The proposed Iroquois/Tennessee Project, as evaluated in this EIS, generally would serve the New York and Connecticut areas. It also would serve portions of Massachusetts, Rhode Island, New Jersey, and New Hampshire through interconnections with other pipelines. While preparing the DEIS we concurrently prepared a DEIS for the proposed Champlain Project, a separate system principally serving Vermont, New Hampshire, Massachusetts, and Rhode Island.

Four system alternatives that could accomplish the objectives of both of the proposed projects, while potentially reducing environmental impact, have been examined. Two single pipeline systems have been examined in detail because they appear capable of meeting project engineering objectives while possibly resulting in less environmental impact than implementation of both the Iroquois/Tennessee and Champlain Projects. The environmental analysis of these alternatives is contained in Volume II of the DEIS and incorporated herein by reference.

However, the single pipeline alternatives were presented as alternatives to the construction of both the Iroquois/Tennessee and the Champlain Pipeline Projects. Subsequent to the publication of the DEIS, the Champlain Project was indefinitely deferred. As such, the single pipeline alternatives are not directly comparable to the Iroquois/Tennessee Project alone. In fact, the Iroquois/Tennessee Project, as now proposed in Phases I and II, closely resembles the Iroquois Mainline Single pipeline Alternative. Former Champlain Pipeline Project customers have now contracted with Iroquois for transportation services.

3.4 PROJECT SYSTEM ALTERNATIVES

Project system alternatives are those alternatives that meet the stated objectives of the project, but utilize a different gas import point or delivery system. The two project system alternatives examined are described in the following sections.

3.4.1 Niagara Import Alternative

Based on public comment and the reduced volume of gas to be transported in Phase I of the Iroquois/Tennessee Pipeline Project (see section 1.0), we reexamined the feasibility of an alternative to the proposed project that would interconnect with TransCanada at Niagara Falls, New York, and maximize the use of existing pipeline corridors. Several combinations of major existing east-west pipelines through New York and Pennsylvania were considered. For the Niagara Import Alternative, we found that such a preferred system would include portions of the Tennessee system and portions of the proposed Iroquois pipeline. This alternative would provide gas deliveries to the same Phase I shippers as the proposed Iroquois/Tennessee Pipeline Project.

The facilities required for this alternative are significantly different from those identified for a similar alternative in the DEIS. This results from the changed volumes of gas involved in the project, the deferral of the Champlain Project, and a design concept using a mix of pipeline looping and compression rather than relying on maximum use of looping. Use of compression optimizes the design of the overall alternative. If the flow requirements still were met with a "no more compression" design concept, the mileage of looping required would increase substantially. With such an increase of pipeline mileage the number of environmental problems would increase dramatically.

To accommodate a capacity increase of 422,900 Mcfd at the Niagara import point, a new 27.8 mile spur pipeline, including a crossing of the Niagara River, would be required between Niagara and Tennessee's existing 200 mainline near East Aurora, New York. At this point, the gas volumes would go into the 200 system. The 200 mainline, expanded by 288.6 miles of 30- and 36-inch-diameter looping, would deliver gas to Tennessee's shippers in Connecticut, Massachusetts, and New Hampshire. Looping required for Iroquois' deliveries would be in addition to looping proposed for the NIP Project.

The Roseton Plant at Newburgh, New York, would be serviced through a new 33.9-mile lateral from Algonquin's mainline in Connecticut. Long Island customers would be serviced by a new 63.9-mile lateral extension from Algonquin's mainline (see figure 3.4.1-1). These two laterals follow the exact routing of the proposed Iroquois mainline.

In addition to this looping of the mainline and the new laterals described above, modifications to laterals would be required in Massachusetts, New Hampshire, and Connecticut. The existing Blackstone Lateral (9.6 miles) would be replaced with a 36-inch pipe. Segments of the Concord and Haverhill (Massachusetts) laterals would be looped, 4.5 miles and 6.1 miles, respectively. The Lincoln Extension would be extended with 2.3 miles of 10-inch pipe. Finally, the Wallingford and the Springfield Laterals would be replaced with 3.2 miles of 12 inch pipe and 0.10 mile of 10-inch pipe, respectively.

Compression totalling 35,300 hp would be added at eight locations along the 200 mainline at stations 233, 237, 245, 249, 254 in New York; stations 261 and 264 and the Mendon station in Massachusetts; and at one location on the Niagara Spur, at station 230C in New York. In addition, a new 7,700 hp compressor station would be constructed in Brookfield, Connecticut.

Both the Iroquois/Tennessee Pipeline Project and the Niagara Import Alternative have in common construction of several Tennessee laterals, extensions and loops, the laterals to the Roseton Plant and Long Island customers as well as construction at compressor stations 245, 254, 261 and a new site at Mendon.

Facilities unique to The Iroquois/Tennessee Pipeline Project include the northerly 272 miles of the Iroquois Mainline. Facilities unique to the Niagara Import Alternative include 252 miles of looping on the Tennessee mainline and 34,350 hp of compression at ten locations (four of these sites are common to the Iroquois/Tennessee Pipeline Project but require more compression for the alternative). For the proposed project and the Niagara Import Alternative, we developed the comparative data listed in table 3.4.1-1.

The Iroquois/Tennessee Pipeline Project and Niagara Import Alternative would be similar in overall length but would be different in other characteristics. Essentially, the reason for such differences is that the Iroquois/Tennessee Pipeline Project would follow more new rights-of-way, whereas the majority of the Niagara Import Alternative would loop sections of Tennessee's existing 200 Mainline. New rights-of-way (297 miles for the proposed project would cross more waterbodies and require more clearing than the alternative. In

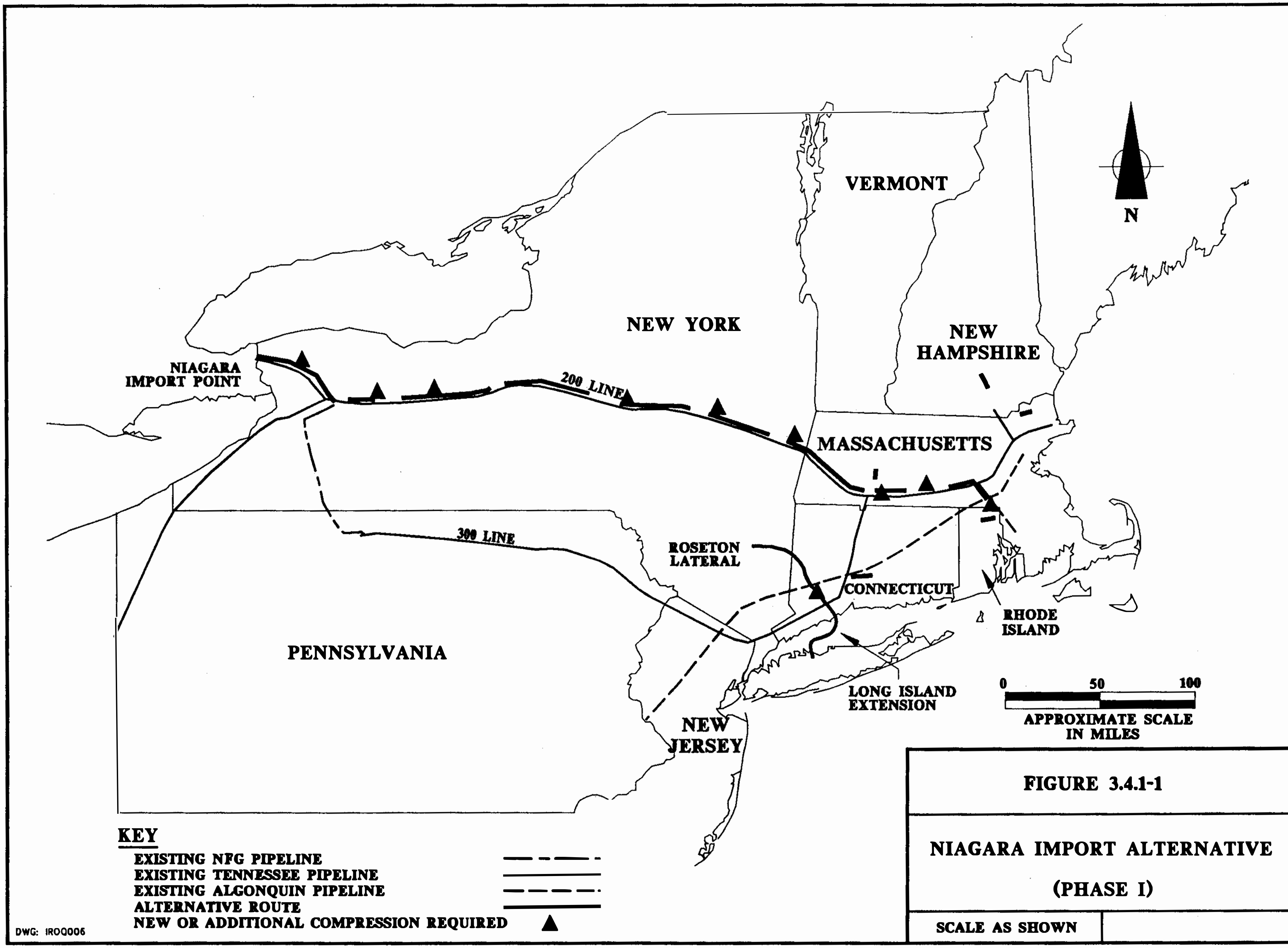


FIGURE 3.4.1-1

NIAGARA IMPORT ALTERNATIVE

(PHASE I)

SCALE AS SHOWN

TABLE 3.4.1-1

Comparison of Environmental Factors for the Iroquois/Tennessee Pipeline Project and Niagara Import Alternative

	Unit	Iroquois/Tennessee Pipeline Project	Niagara Import Alternative
Total length	mi.	432	415
New ROW	mi.	297	99
Parallel to existing ROWs	mi.	135	315
New compressor stations	no.	1	1
Compressor station additions	no.	3	9
New and added compression	hp	8,650	43,000
Waterbodies crossed	no.	380	290
Forest clearing required for construction	ac.	1,954	1,171
Agricultural areas disturbed during construction	ac.	2,303	1,506
Existing residences within 50 feet of ROW	no.	181	220
Federal and state lands crossed	no.	1	8

contrast, looping for the alternative would result in constructing in proximity to more homes. The most congested of these areas would be in Longmeadow, Massachusetts, where the alternative would parallel the 200 mainline through 1.4 miles of residential area and within 50 feet of 39 homes. This is the same area that has received extensive public comment in the NIP Project (see NIP Project DEIS CP88-171-001, sections 5.1-9 and 6.2-1).

Also, the alternative would cross Federal and state lands, including Joseph Davis State Park, Montezuma National Wildlife Refuge, Onondaga Indian Reservation, Otis State Forest, Sandisfield State Forest, Tolland State Forest, Silver Sands State Park Reserve, and Upton State Forest. Crossing of the Montezuma National Wildlife Refugee could have significant effects and because of its configuration and proximity to Cayaga Lake would be difficult to avoid. The proposed route would cross only the Silver Sands State Park Reserve. Both the Iroquois/Tennessee Pipeline project and Niagara Import Alternative would require the same pipeline facilities to be constructed in Connecticut and across Long Island Sound. About 250 miles of new pipeline for the Niagara Import Alternative would loop segments of Tennessee's existing 200 Mainline that have not been studied in detail. These segments would require further study if this alternative were adopted.

For the Niagara Import Alternative, a total of 43,000 hp of compression would be required at ten locations. Of these, six are unique to the alternative and four would involve sites common to both alternatives but require 11,300 hp more compression at these sites than the Iroquois/Tennessee Pipeline Project. The new site unique to the alternative would have to be located in proximity to the connection of the Roseton Lateral and Long Island Extension with the existing Algonquin mainline in Brookfield, Connecticut. We have reviewed this area using current aerial photographs and ground reconnaissance. Potential sites that would not cause significant effects on residents or wetlands are extremely limited.

Our evaluation of the Niagara Import Alternative to transport 422,900 Mcfd of Phase I natural gas by substantially looping existing pipeline indicates that it is a reasonable alternative but not preferable. More detailed study of looping Tennessee's system in western New York, the Longmeadow, Massachusetts, area, and construction of a new 7,700 hp compressor station in Brookfield, Connecticut, are required. It may not be possible to construct new facilities in Longmeadow and Brookfield and cross the Montezuma National Wildlife Refuge without significant environmental effects.

Because Phase II involves the transportation and delivery of an additional 83,000 Mcfd of Canadian gas and 70,000 Mcfd of domestic gas in the foreseeable future, we also considered what additional facilities would be needed for either the Iroquois/Tennessee-Phase II or a comparable expanded Niagara Import Alternative. The facilities are as follows:

	Unit	Iroquois/Tennessee Project	Niagara Import Alternative
Total Length	mi.	141.6	164.3
New ROW	mi.	0	0
Parallel to Existing ROWs	mi.	141.6	164.3
New Compressor Stations	no.	1	1
Compressor Station Additions	no.	4	9
New and Added Compression	hp	20,100	45,150

The new pipeline facilities needed to transport volumes in Phase I are about 17 miles less for the alternative than the proposal. Also, the alternative would involve a third loop through the Longmeadow area, a compressor station in Brookfield and looping through congested but less significant areas along Tennessee's system such as in Waterloo, New York and Stockbridge and Agawam, Massachusetts. We believe that these areas are more controversial than the most controversial portions of the proposed Iroquois route that would be replaced by the alternative. Since the NIP Project already involves construction of a loop through the same portion of the Longmeadow area, there would be significant cumulative impacts to using the Niagara Import Alternative.

In addition, the alternative would involve substantially more air emissions because of its increased reliance on compression, and would increase noise at a number of locations.

Because of these factors, we do not believe the Niagara Import Alternative is environmentally preferable to the proposed project. We analyzed the Niagara Import Alternative to the level of detail necessary to support these conclusions.

Decision makers should be aware that the choice of the Niagara Import Alternative would require the filing of applications with the FERC and would require additional, more detailed environmental analysis. This may make use of this alternative unreasonable with regard to service to the markets which is proposed in 1991.

Another point for decision makers to consider is the comparison between the Niagara Import Alternative and the Iroquois/Tennessee Pipeline Project at the Phase II level. When the facilities identified above are factored into this comparison, the alternative is about 5 miles longer and involves 3 times as much compression as the proposal. All other factors remain equal.

When compared incrementally - Phase II of the alternative to Phase II of the proposal - the alternative has no significant advantages over the proposal, and has several disadvantages: more pipeline, more compression, and the resultant increase in air emissions.

When compared on a total project basis, the alternative has virtually the same amount of pipe and substantially more compression and resulting air emissions. In neither case are the impact on controversial areas significantly reduced.

For all these reasons, we do not think that the Niagara Import Alternative would be environmentally preferable to the proposed project.

3.4.2 Highgate Import Alternative

Another alternative to Iroquois' substantially new pipeline route would originate at the U.S./Canadian border near Highgate, Vermont. Gas would be delivered to this point by TransCanada's spur pipeline in southern Quebec, which originates at its Montreal mainline and interconnects at the U.S./Canadian border with a Vermont Gas Systems, Inc. (VGS) 10-inch-diameter pipeline. As discussed below, two alternatives originating from this point would be possible (see figures 3.4.2-1 and 3.4.2-2). As discussed below, these alternatives are basically similar to the Champlain Project route through Vermont. One alternative would connect with the existing Algonquin mainline system in eastern Massachusetts, and the other would connect with the existing Tennessee 300 mainline system in Connecticut.

A Highgate/Algonquin Alternative would extend south from the import point to the vicinity of Springfield, Vermont. A reasonably direct route would then cross the Connecticut River and continue in a southeasterly direction across southern New Hampshire and Massachusetts to Mendon, Massachusetts, where it would interconnect with the existing Algonquin mainline system. The Algonquin system would be modified to accommodate the gas backflow/displacement operation for delivering 336,800 Mcfd (Iroquois/Tennessee Phase I volume) to Brookfield, Connecticut. From this point a 63.9-mile lateral would be constructed following Iroquois' proposed route south across Long Island Sound to South Commack, New York. A 33.9-mile lateral pipeline along Iroquois proposed route would be needed to service the Roseton Plant.

The second alternative (Highgate/Tennessee Alternative) would continue south from the vicinity of Springfield, Vermont, across Massachusetts to Agawam, Massachusetts, where it would parallel Tennessee's 300 mainline to its intersection with Algonquin's mainline near Southington, Connecticut; a total of 271.6 miles. Algonquin's system would be modified in a manner similar to the Highgate/Algonquin Alternative and 97.8 miles of laterals would be constructed to service Long Island customers and the Roseton Plant.

The new mainline component of the Highgate/Algonquin Alternative would require 362.5 miles of pipeline. The Highgate/Tennessee Alternative would require 349.4 miles of new pipeline. While both alternatives would require less new mainline pipeline construction as compared to the proposed Iroquois pipeline (369.4 miles), we felt that the Highgate/Algonquin Alternative would be the more preferable alternative; it would follow more existing right-of-way south of Springfield, Vermont. The Highgate/Tennessee Alternative would follow new rights-of-way through portions of Vermont and Massachusetts. Therefore, we eliminated the Highgate/Tennessee Alternative from further consideration.

In our discussion of the Highgate/Algonquin Alternative in the DEIS, we assumed that the Champlain Pipeline would also be built in the same timeframe. We also assumed that both pipelines would be constructed along a common right-of-way. While our analysis of the Champlain Pipeline route indicates it would avoid significant environmental impact for

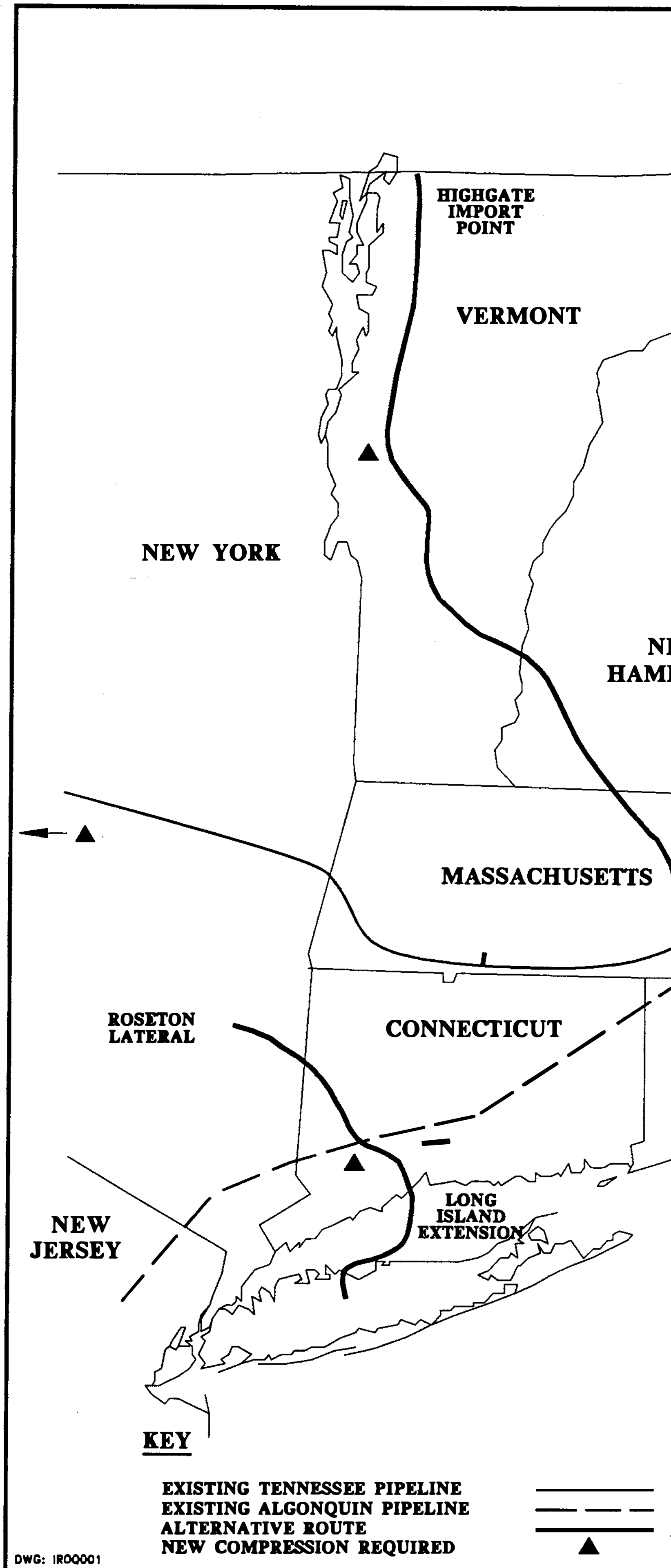


FIGURE 3.4.2-1

HIGHGATE/ALGONQUIN ALTERNATIVE (PHASE I)

SCALE AS SHOWN

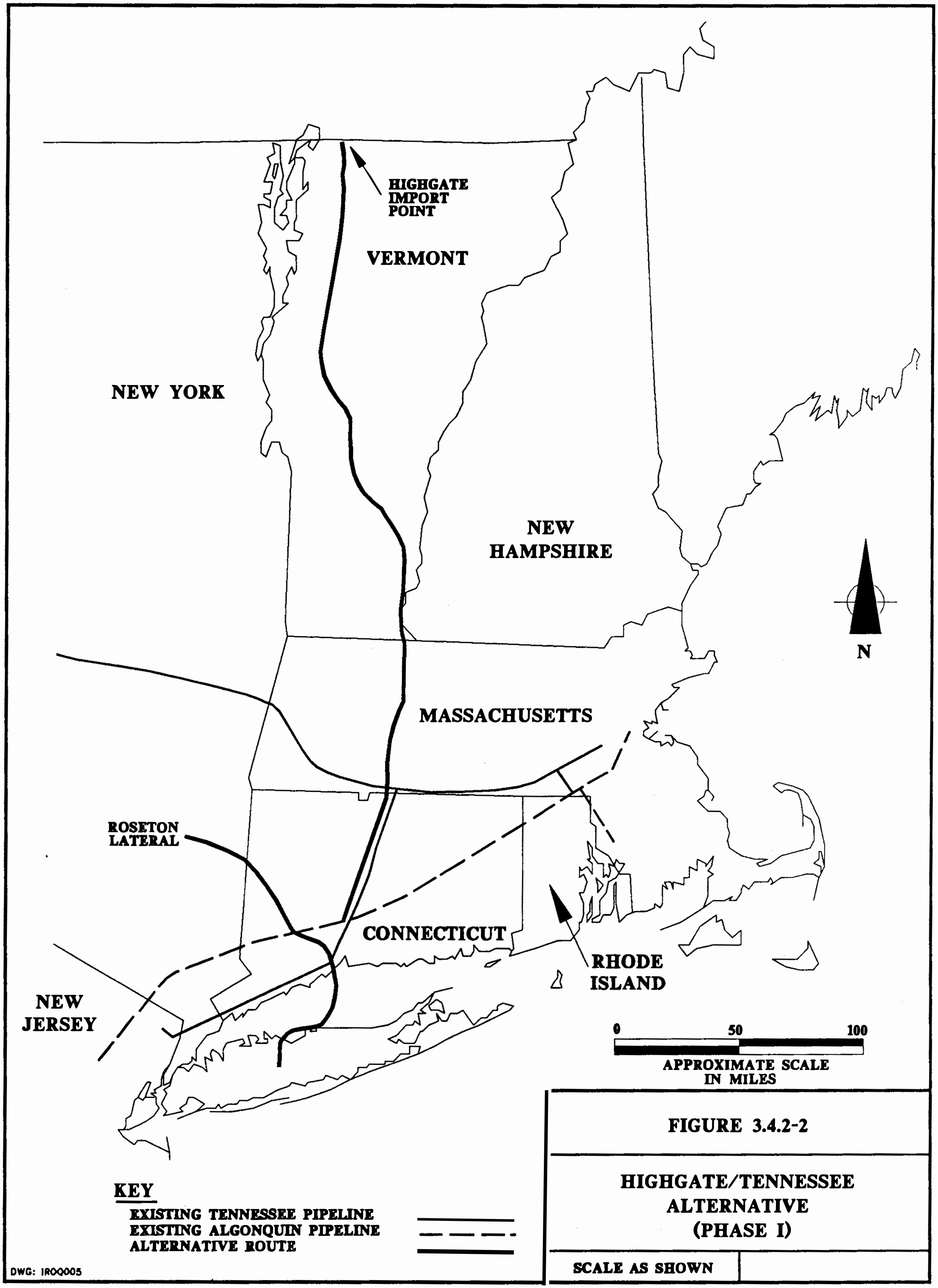


FIGURE 3.4.2-2

HIGHGATE/TENNESSEE ALTERNATIVE (PHASE I) one pipeline, the cumulative effects of two pipelines along the same route, built at approximately the same time, could be significant. Furthermore, we felt that from a practical point of view it is unlikely that two mainlines would be independently constructed and operated on essentially the same right-of-way. Since the issuance of the DEIS, the Champlain Pipeline has been indefinitely deferred. Therefore, we reevaluated the Highgate/Algonquin Alternative assuming it would be the only pipeline built along the Champlain mainline route.

We first evaluated the facilities and routes required to transport and deliver 422,900 Mcfd of natural gas proposed for the Iroquois/Tennessee Pipeline Project Phase II. The Highgate/Algonquin Alternative would consist of portions of the facilities and routes proposed by Iroquois, Tennessee, and Champlain (see figure 3.4.2-1). The route would begin in Highgate, Vermont, and follow Champlain's proposed mainline to MP 237.9 (see Champlain Pipeline Project DEIS, Volume III). From this point, the Champlain mainline route would be realigned to terminate at the interconnection between the existing Tennessee and Algonquin systems in Mendon, Massachusetts, a distance of 248.5 miles. It would also connect with Tennessee's existing mainline and, through backhauling, serve Tennessee's customers in western Massachusetts. At Mendon a 1,200 hp compressor station would be required. This alternative would involve backhauling gas through Algonquin's existing pipeline to Brookfield, Connecticut. From that point extensions to Pleasant Valley, New York (33.9 miles) and Long Island, New York (63.9 miles) would be constructed. A new 7700 hp compressor station would be constructed in the vicinity of the interconnection point in Brookfield, a 4,000 hp compressor station would be constructed at MP 73 of the Champlain mainline and 2,100 hp would be added at Tennessee station 245.

In addition, Tennessee's laterals and extensions would be part of the alternative. Tennessee's Haverhill Lateral would be looped for 6.1 miles in Essex County, Massachusetts. The Concord Lateral would involve 4.5 miles of construction through Merrimack, New Hampshire. The Lincoln Extension would consist of 2.3 miles of new pipeline through Providence County, Rhode Island. The Wallingford Lateral would cross 3.2 miles of Cheshire, Connecticut. The Springfield Lateral would traverse 0.1 mile through Agawam, Massachusetts. Tennessee's facilities would total 16.2 miles of pipeline in Massachusetts, New Hampshire, Rhode Island, and Connecticut.

Both Iroquois/Tennessee Pipeline Project and Highgate/Algonquin Alternative have in common construction of the Pleasant Valley Extension, Long Island Extension, Concord Lateral, Haverhill Lateral, Wallingford Lateral, Springfield Lateral, Lincoln Extension, Mendon Compressor Station, and Station 245. Facilities unique to the Iroquois/Tennessee Project include the Schoharie/Albany Loop, Columbia/Berkshire Loop, Worcester Loop, and the addition of compression at Tennessee stations 254 and 261. Facilities unique to the Highgate/Algonquin Alternative include the Champlain mainline and new compressor stations in Brookfield, Connecticut, and Middlebury, Vermont. For analysis purposes, existing data for the Champlain mainline to the West Medway segment was used instead of Champlain to the Mendon. This segment is approximately the same distance.

Except for approximately 9 miles, the realignment of the Champlain mainline from West Medway to Mendon, each segment of the Highgate/Algonquin Alternative is discussed in detail in other sections of this FEIS or in the Champlain Pipeline Project DEIS and incorporated herein by reference. Characteristics of this alternative are discussed below and shown in table 3.4.2-1. The Highgate/Algonquin Alternative would be 69.7 miles shorter in length than Iroquois/Tennessee Pipeline Project and would require approximately 51 percent less new right-of-way (152 miles versus 297 miles). The total temporary construction right-of-way for Iroquois/Tennessee, using the proposed 60-foot right-of-way, would be 4,677 acres, while it would only be 3,209 acres for the Highgate/Algonquin Alternative. The Highgate/Algonquin Alternative permanent right-of-way would be 628 acres less than Iroquois/Tennesee.

TABLE 3.4.2-1

Comparison of Environmental Factors for the Iroquois/Tennessee Pipeline Project and Highgate/Algonquin Alternative

	Unit	Iroquois/ Tennessee	Highgate/ Algonquin a/
Total length	mi.	432	362.5
New ROW	mi.	297	152
Parallel to existing ROW	mi.	135	184
Total temporary construction ROW	ac.	4,677	3,209
Total permanent ROW	ac.	2,687	2,059
New compressor stations	no.	1	3
Compressor station additions	no.	3	1
New and added compression	hp	8,650	15,000
Hydric soils	mi.	2	6
Water bodies crossed	no.	380	277
High quality water bodies crossed			
Class A	no.	41	44
Class B	no.	42	209
Fisheries of concern crossed	no.	71	36
Significant wildlife habitat crossed	mi.	3	23.26
Forested and scrub shrub wetlands cleared	ac.	229	144
Herbaceous wetlands cleared	ac.	28	26
Annual NO_X emissions based on continuous operation	tons		
Forest clearing required for construction	ac.	1,954	1,702
Agricultural areas disturbed during construction	ac.	2,303	93
Existing residences within 50 feet of ROW	no.	181	173
Federal & state lands crossed	no.	1	1
Other recreational areas crossed	no.	18	34
National Rivers Inventory	no.	8	1
National and state trails crossed	no.	5	3
Landfills or hazardous waste sites crossed or bordered	no.	3	2
Schools wthin 200 feet	no.	3	1

a/ For analysis purposes, existing data for the Champlain mainline between Highgate and West Medway was used. This segment is approximately the same distance as Highgate to Mendon, which is now part of the Highgate/Algonquin alternative.

Iroquois/Tennessee Pipeline Project would have less of an impact on water resources than the Highgate/Algonquin Alternative. The number of Class A waterbodies crossed by both routes would be comparable: 41 for the Iroquois/Tennessee and 44 for the Highgate/Algonquin Alternative. However, the Highgate/Algonquin Alternative would cross 167 more Class B water bodies. Iroquois would cross 35 more significant fisheries.

During construction, the Iroquois/Tennessee Pipeline Project would result in clearing 85 more acres of forested and scrub-shrub wetlands than the Highgate/Algonquin Alternative.

There would be a greater impact to more land use resources from the Iroquois/Tennessee Pipeline Project than the Highgate/Algonquin Alternative. Iroquois/ Tennessee Pipeline Project would cross more forested areas, agricultural areas, rivers noted in the Nationwide Inventory of Wild and Scenic Rivers (NRI), national and state trails, and landfills. However, the Highgate/Algonquin Alternative would cross 16 more recreational areas.

Compression totalling 15,000 hp would be added at four locations along the Highgate/Algonquin Alternative as compared with 8,650 hp of compression at four locations for the Iroquois/Tennessee Pipeline Project. Both projects would require a new compressor station in Mendon, however, the Highgate/Algonquin Alternative would also require a new compressor station in Brookfield, which would probably involve significant effects (see section 3.4.1), and one in Middlebury which we feel can be constructed without significant effects.

Because Phase II involves the transportation and delivery of an additional 83,000 Mcfd of Canadian gas and 70,000 Mcfd of domestic gas in the foreseeable future we also considered an expanded Highgate/Algonquin Alternative. The comparative facilities are as follows:

	Unit	Iroquois/Tennessee Project (Phase II)	Highgate/Algonquin Alternative (Phase II)
Total Length	mi.	141.6	143.2
New ROW	mi.	0	0
Parallel to Existing ROWs	mi.	141.6	143.2
New Compressor Stations	no.	1	2
Compressor Station Additions	no.	4	6
New and Added Compression	hp	20,100	28,600

The new pipeline facilities needed to transport volumes of gas in Phase II are essentially the same for the Highgate/Algonquin Alternative and the Iroquois/Tennessee Pipeline Project. However, the Highgate/Algonquin Alternative would require 9,000 hp of additional compression at the Middleburg Compression Station and a new 13,000 - hp compressor station at MP 156 of the Champlain mainline in Walpole, New Hampshire. This area of the Champlain mainline is rural, offering the potential to site a new compressor station without causing significant effects.

We believe that the Highgate/Algonquin Alternative, if constructed and operated in accordance with recommendations similar to those discussed in section 7.3 for the proposed project, may be environmentally preferable to the Iroquois/Tennessee Pipeline Project as proposed (Phase I) or for the foreseeable future (Phases I and II). The greatest disadvantage of the Highgate/Algonquin Alternative may be unavoidable significant effects of locating a new compressor station in Brookfield, Connecticut and acceptance of a route through Vermont and New Hampshire.

These aspects of this route were very controversial when Champlain was being studied. Since the project is not being processed, work to resolve these issues at the Federal and state level was halted. Therefore, even though on strictly environmental grounds the route may be preferable, the project would take a significant amount of time to resolve. This timing differential may make the alternative unreasonable with regard to service to the markets which require natural gas service.

3.4.3 New Jersey-Long Island Alternative

In response to comments by the State of Connecticut, local Connecticut governments, and private individuals, we analyzed an alternative, in lieu of constructing the proposed Long Island Sound crossing, that would cross the Raritan and Lower Bays from New Jersey to the south shore of Long Island (see figure 3.4.3-1). Iroquois would still be required to construct the mainline to approximately MP 328.5 in Stratford, Connecticut. In this alternative, Iroquois would deliver all volumes destined for Long Island to Tennessee at this point, or to Algonquin at MP 305 in Milford, Connecticut. The gas would then be transported by Algonquin or Tennessee to Transco by backhaul and exchange agreements with Algonquin, Tennessee, Transco, and Texas Eastern, to Transco's proposed 12,000 hp Station 205, near New Brunswick, New Jersey. Transco would need to add another 4,000 hp of compression at this location to transport the gas volumes to Long Island.

From Station 205 the gas would be transported by Transco to the landfall of its underwater pipeline in South Amboy, New Jersey. From South Amboy, located downstream of Station 205, to Long Beach, Long Island, a 33.7-mile-long 24-inch-diameter pipeline would need to be constructed adjacent to Transco's existing 26-inch-diameter pipeline across Raritan and Lower Bays. From the proposed landfall at Long Beach to South Commack, the route would follow existing roads and the Long Island Railroad, a distance of about 36 miles, to the proposed Iroquois/LILCO interconnection.

The alternative would involve pipeline construction across the U.S.-Coast-Guard (USCG)-designated Ambrose and Raritan Bay fairways, the major routes in and out of the Port of New York. The COE and USCG would require the pipeline be buried across these man-made and maintained navigation channels. Under Section 10 of the River and Harbors Act, the COE would require the pipeline be buried to a depth of at least 55 feet below mean low water. This would be necessary to provide adequate depth in the fairways and to allow for routine maintenance dredging projects to be undertaken without disturbing the pipeline. In discussions with the COE to determine the known extent of potential contaminated sediments in the vicinity of the alternative crossing, we learned that the potential exists for encountering dioxins (2, 3, 7, 8, TCDD), polychlorinated biphenyls (PCBs), heavy metals, and elevated levels of petroleum hydrocarbons at the locations where the crossing would be dredged. The COE stated that there are strict disposal requirements for sediments contaminated with these materials and that ocean dumping as a disposal method is possible, but not preferable, for the large amounts of potentially contaminated materials that could result from this alternative (Bode, 1990).

In many areas, construction along this alternative would involve placing the pipeline adjacent to roads or railroad tracks that traverse heavily developed areas. In some places there may not be enough space to install a 24-inch-diameter pipeline in an existing corridor and a new corridor would be necessary. Further, where the pipeline is adjacent to the railroad, special construction techniques and pipeline protection measures would probably be required. See section 3.6.37.2 for further discussion of the problems of following a railroad corridor.

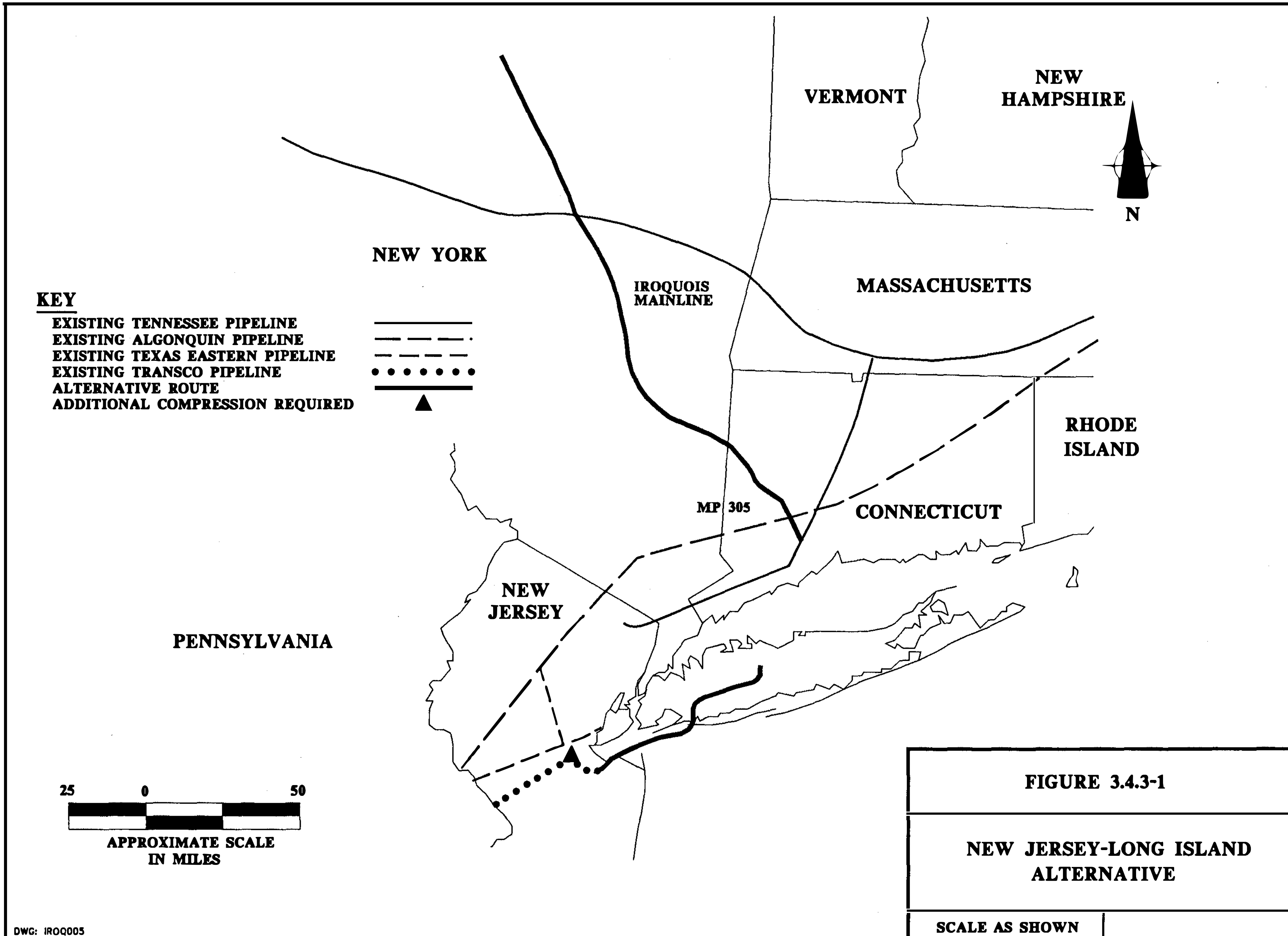


FIGURE 3.4.3-1

NEW JERSEY-LONG ISLAND ALTERNATIVE

SCALE AS SHOWN

We have concluded that a New Jersey to southern Long Island alternative would have the following significant disadvantages: 1) contaminated sediments are expected to occur at the crossing sites and resuspension of contaminated sediments during dredging operations would most likely would lead to water quality degradation in the vicinity; 2) all dredged spoils found to be contaminated could not be used as backfill and would have to be disposed of at an approved site while the proposed Long Island Sound crossing is not subject to this restriction; 3) the route would cross two man-made and maintained navigation fairways while the proposed route would traverse a naturally deep area not subject to maintenance dredging; and 4) the extent of the area traversed adjacent to residential and developed areas would be greater than the proposed route and would require the creation of a new utility corridor.

This alternative would involve construction of 69.7 miles of pipeline and 4,000 hp of compression as compared to 40.9 miles for the proposed portion of the Iroquois route. We concluded that this alternative would potentially have greater environmental impact than the proposed facilities; therefore, we eliminated it from further consideration.

3.5 MAJOR ROUTE ALTERNATIVES

Many alternative routes, several of which utilize existing rights-of-way, have been identified by state and local agencies and as a result of public comment. In accordance with Commission regulations [18 CFR, Section 2.69(1)(i)], we have given consideration to the utilization, enlargement or extension of existing rights-of-way belonging to the applicant or others, including pipelines, electric power lines, highways, and railroads.

Major route alternatives are those that have the same import and delivery points as the proposed project, but follow routes significantly different from those proposed by the applicant. Generally, the major route alternatives we considered for the Iroquois/Tennessee Project take advantage of existing pipeline, electric transmission line, or highway rights-of-way to reduce the need for construction of new pipeline on new right-of-way.

Additionally, we reviewed the original routing of the Iroquois pipeline through Litchfield County, Connecticut, in comparison to its currently proposed location.

3.5.1 Alternatives Utilizing Electric Transmission Line Rights-of-Way

The possibility of using existing transmission line corridors for several segments of the proposed Iroquois route to reduce environmental impact, or at least to confine impact to a "utility corridor," has been raised during the scoping process. For two segments of the proposed Iroquois route, existing electric transmission line rights-of-way are aligned in the same general direction. We considered the possibility of combining the two rights-of-way into a single corridor for this portion of the proposed route.

Locating pipelines and electric transmission lines in the same or adjacent right-of-way has both advantages and disadvantages, and depending on site-specific factors, may decrease or increase environmental impact and associated costs. Consequently, each case must be evaluated on its own merits.

An electric transmission line and a pipeline are very different in their ability to traverse sensitive environmental areas. Transmission lines are more easily constructed in hilly or mountainous areas and can span steep slopes, wetlands, rivers, agricultural areas, and other sensitive areas with substantially less impact than a buried pipeline. Construction of pipelines in similar areas may necessitate deviations around sensitive resources or use of special construction methods. Pipeline construction in hilly areas often results in more grading to create a working bench, more exposed soil, and expanded rights-of-way with associated impact. In many areas, residential development has occurred adjacent to existing rights-of-way. Use of rights-of-way in these areas would result in the new pipeline being closer to residences than when located on a new right-of-way. However, when following existing electric transmission rights-of-way, where the pipeline right-of-way can wholly or partially utilize the existing right-of-way, impact from clearing may be reduced. Also, following existing corridors avoids introducing a new land use (pipeline right-of-way) in a previously undisturbed area.

Important safety measures must be followed when constructing a pipeline parallel to an electric transmission line in proximity to overhead conductors and support structures. Depending on voltage and utility operating criteria, construction equipment must avoid the area within 15 to 50 feet of the suspended conductor. Such restrictions may severely limit the available work space within the cleared transmission right-of-way or require the pipeline to be located on an adjacent right-of-way.

Another high-risk safety problem is the shock hazard to construction personnel from capacitive coupling while stringing, bending, welding, coating, and lowering the pipe into the trench. An electric (capacitive) field exists on the transmission right-of-way that can induce voltages on pipeline sections situated aboveground during construction. These electric fields are stronger with higher voltage lines, i.e., 345 kV and 765 kV lines. Capacitive coupling on the pipeline may be reduced to workable levels by increasing the distance between the transmission line and the pipeline (15 volts with insulated gloves is considered safe under U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) regulations). Also, an inductive voltage may be imposed on the installed pipeline by a longitudinal electrical field with voltages that can vary according to the length of pipe adjacent to the transmission line. By installing a special longitudinal grounding system, safe distances may be assumed to be approximately 75 feet (345 kV) and 175 feet (765 kV), respectively, depending on the amount of soil resistivity at the specific site (Dabkowski, 1989).

We considered major alternatives that would utilize electric transmission line rights-of-way as described in the following sections.

3.5.1.1 Massena-Marcy 765 kV Alternative

We considered following the route of the Massena-Marcy 765 kV transmission line to avoid Iroquois' predominantly new right-of-way route in upstate New York. The New York Power Authority (NYPA) 765 kV line originates at the United States-Canadian border near Massena, New York, and extends for approximately 110 miles to its termination in Marcy, New York, near Utica. Our studies, and prior evaluations by Iroquois and New York state agencies as part of the state review process, identified two 765 kV route alternatives (see figure 3.5.1-1).

The first of the two alternatives would begin in the vicinity of Edwards, New York, at MP 46 and run south for 40.2 miles (33.7 miles parallel to the 765 kV line) to where it would rejoin the proposed Iroquois route at MP 94 in the Town of Greig. This alternative

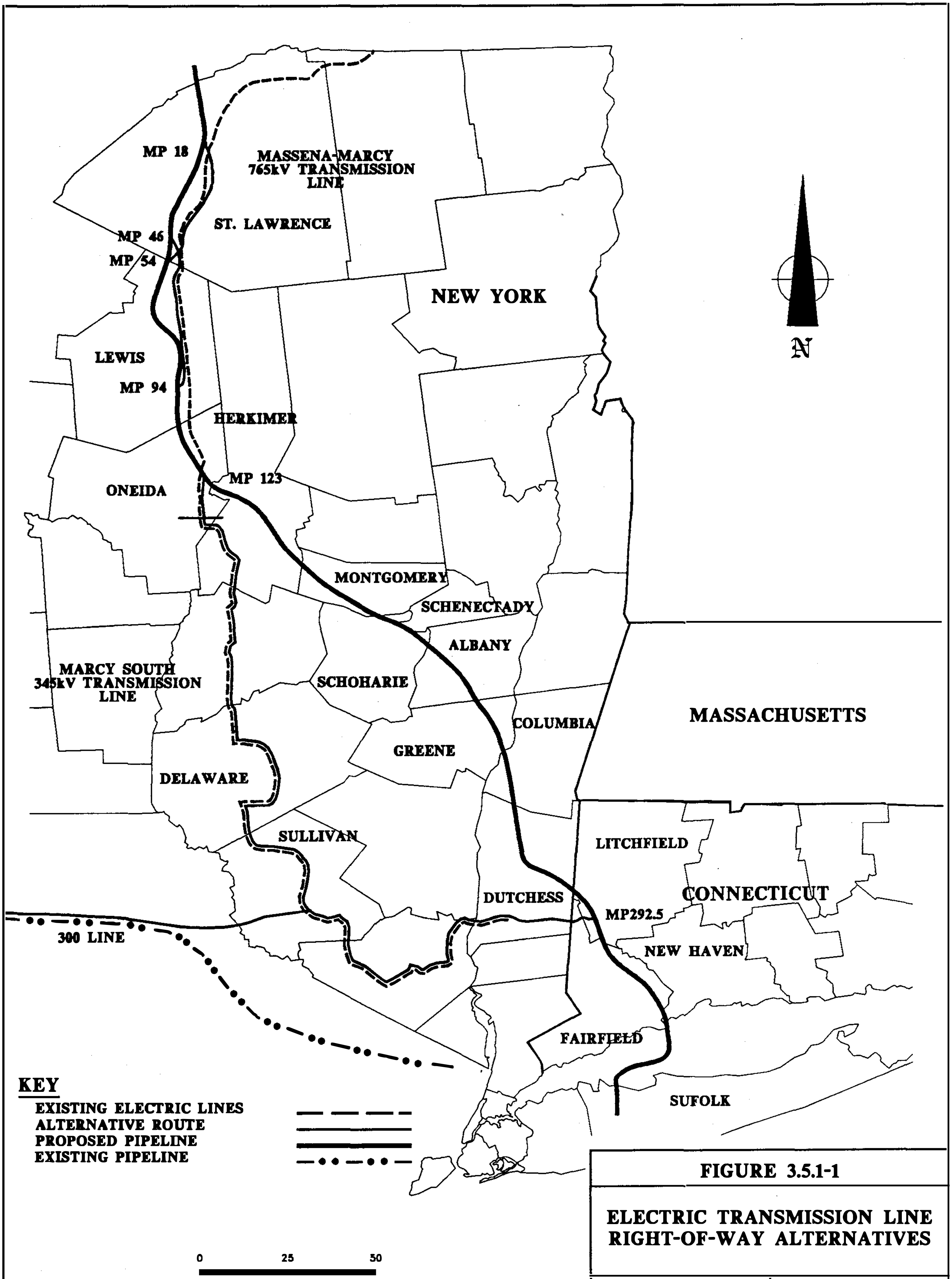


FIGURE 3.5.1-1

ELECTRIC TRANSMISSION LINE RIGHT-OF-WAY ALTERNATIVES

SCALE AS SHOWN

was eliminated during the state review process primarily because it would traverse state reforestation lands. A second alternative paralleling the 765 kV line would originate at MP 18.0 in the town of Canton and extend south for 36.1 miles rejoining Iroquois' proposed route at MP 54.0 near the village of Harrisville. While we have concerns about the validity of avoiding state reforestation land (see section 3.6.11), we found environmental and engineering factors a sufficient basis on which to eliminate the 765 kV alternatives.

Specific environmental problems associated with following the 765 kV line would require substantial deviations to avoid steep terrain, wetlands, and homes. These deviations would result in moving away from the existing line for about 50 percent of its length and creating a new right-of-way. Even with deviations, more wetlands and streams would be affected than on Iroquois' proposed route (New York State Pulic Service Commission (NYPSC), 1989). Also, current agricultural land use already affected by up to three electric transmission lines would be further affected by the addition of the pipeline. Furthermore, electrical engineering considerations indicate that the pipeline could not be built within the right-of-way without implementing complex mitigation measures. A minimum of 175 feet of separation between the pipeline and the 765 kV line would be preferable. Therefore, the pipeline would be located on a new right-of-way, adjacent to the existing right-of-way, and no right-of-way would be shared.

Following hearings held by the NYPSC, the ALJ's preliminary decision found that constructing the pipeline "in proximity to NYPA's 765 kV overhead transmission line is undesirable option." They found that because of electrical engineering considerations, construction of this alternative could be costly and would expose workers to a significant safety risk; environmental and construction constraints would make it impossible to locate the pipeline in NYPA's corridor; and this alternative would have significant impact on agricultural resources (NYPSC, 1989). Our review confirms these findings and led to elimination of this alternative.

3.5.1.2 Marcy-South 345 kV Alternative

An existing 345 kV utility corridor originates in Marcy, New York, and extends south and east to a termination at Central Hudson's Roseton Plant (see figure 3.5.1-1). This right-of-way is principally occupied by NYPA's Marcy-South 345 kV transmission line for 190 miles of its 207-mile length and the Central Hudson Rock Tavern-Roseton 345 kV transmission line for the remainder. We considered an alternative between MPs 123 and 292.5 of Iroquois' proposed route that would substantially follow these rights-of-way and eliminate a second crossing of the Hudson River required to deliver gas to the Roseton Plant. We found that the significantly greater length (247 miles versus 169.5 miles for the comparable segment of Iroquois' pipeline) and severe terrain that would be crossed (Catskill and Shawangunk Mountains) make the Marcy-South Alternative inferior to Iroquois' proposed route. We therefore eliminated it from further consideration.

3.5.2 Alternatives Utilizing Highway Rights-of-Way

Numerous comments provided at public scoping meetings called for the proposed Iroquois pipeline route to follow existing major highways, including portions of the New York Thruway (Thruway), the Taconic Parkway (Parkway), and Interstate 84. We evaluated the feasibility of the two major highway corridors that most closely follow portions of the proposed Iroquois pipeline: the Thruway and the Parkway (see figure 3.5.2-1). Our evaluation focused on Federal and state policies toward accommodating pipelines in highway rights-of-way, special design and construction practices for locating the pipeline within highway rights-of-way, and the more common physical constraints typically encountered on highway rights-of-way.

Federal and State Policy

Regulations governing the placement of pipelines in Federal-aid freeway rights-of-way have been administered by the Federal Highway Administration (FHA) since the beginning of the Interstate Highway system in 1956. From the beginning, utilities were permitted to cross freeways, but were prohibited from installing utility facilities along the sides of freeways except for a limited extent and in extremely unusual situations. This policy was revised in February 1988, to allow each state to exercise limited regulatory controls over federally-aided freeways, such as determining the merit of longitudinal utility use of the freeway right-of-way in accordance with an FHA-approved state utility accommodation plan. The regulatory changes were motivated, in part, by the desire to reduce the environmental impact of constructing new utilities across agricultural and forest lands where existing transportation corridors could be utilized.

The Federal and state governments have spent millions of dollars of Federal aid relocating existing utilities from the rights-of-way of interstate highways during their construction. However, FHA and American Association of State Highway nad Transportation Officials (AASHTO) policies now recognize that there may be unique circumstances where a new longitudinal utility installation is unavoidable (FHA, 1986). To be considered as an exceptional case, the utility must meet all of the following conditions:

1. the accommodation must not adversely affect the safety, design construction, operation, maintenance, or stability of the highway;

2. the accommodation will not be constructed and/or serviced by direct access from the traffic roadways or connecting ramps;

3. the accommodation will not interfere with or impair the present use or future expansion of the highway; and

4. any alternative utility location would be contrary to the public interest. This determination would include an evaluation of the direct and indirect environmental and economic effects of any loss of productive agricultural land or any productivity of any agricultural land that would result from disapproval of the use of such right-of-way for the accommodation of the utility.

As a rule, an exception is granted only for very short distances, usually for less than 1 mile of right-of-way, or to provide the only feasible route around a critically located structure or a sensitive environmental area.

The New York Department of Transportation (NYDOT) is proposing a revised policy that will meet the conditions of the AASHTO utility accommodation policy as modified by the Federal Highway Program Manual 6-6-3-2 and as further modified by the FHA Final Rule published in the Federal Register, February 2, 1988. Previously NYDOT has not

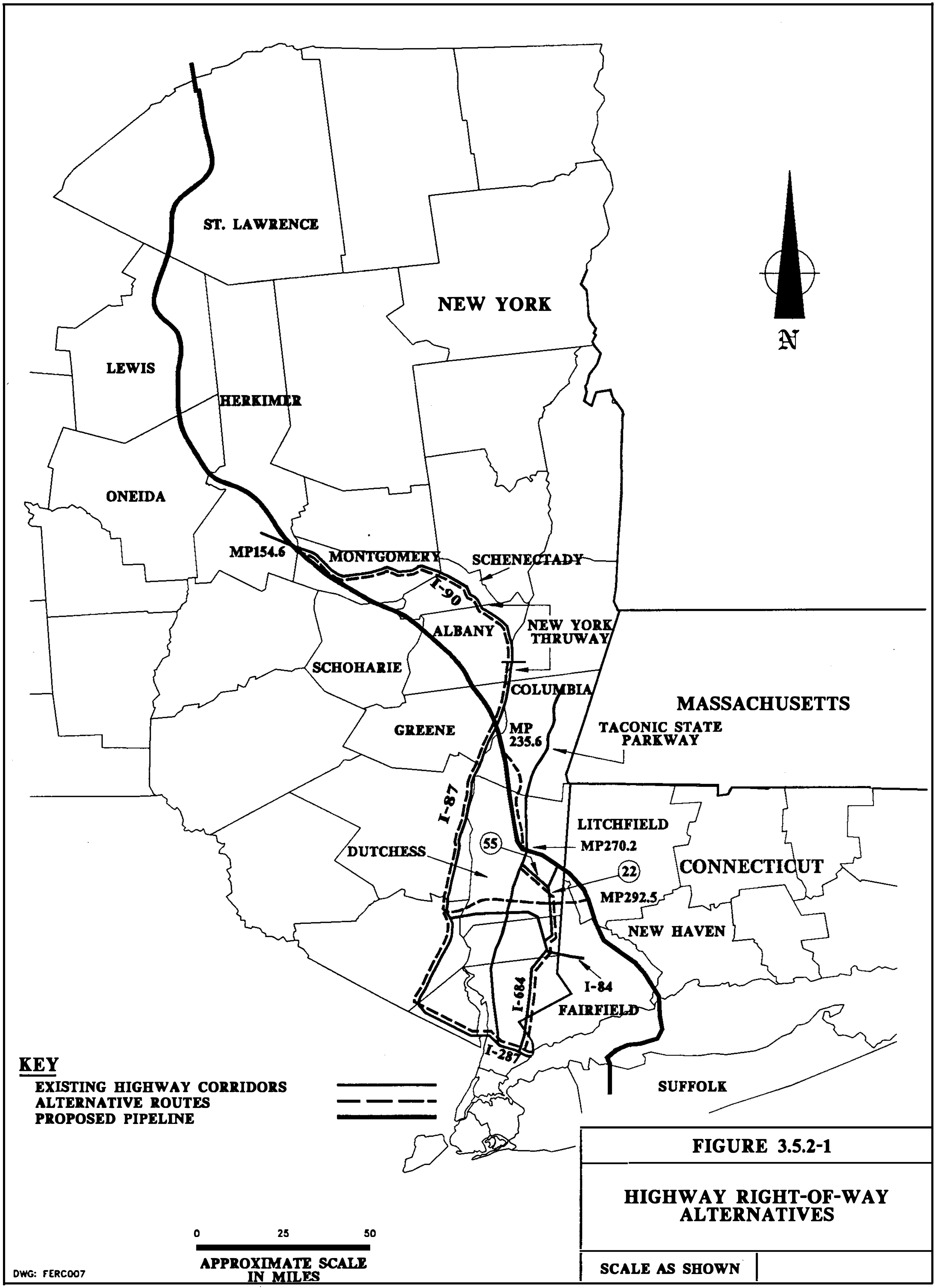


FIGURE 3.5.2-1

HIGHWAY RIGHT-OF-WAY ALTERNATIVES

SCALE AS SHOWN

allowed any longitudinal use of their highways by pipeline utilities, and currently there is no indication that this policy will change (Brown, 1988).

Special Design and Construction Practices

Special design and construction practices resulting in significantly higher costs would be required when constructing within highway rights-of-way. These are listed below:

1. Additional pipe wall thickness or pipe yield strength is required by 49 CFR Part 192 Subpart C (111b) for Class 1 locations where a pipeline enters a highway right-of-way. For longitudinal use, this would significantly increase both pipe cost and construction cost.

2. Compared to private rights-of-way, the buried depth of a pipe in a highway right-of-way must be increased for vehicular safety purposes.

3. A minimum 30-foot-wide permanent right-of-way with an additional 25 feet of temporary construction right-of-way would normally be required to install a new pipeline. Because of topographic variations, most highways do not have a continuous 55-foot strip of land between the edge of the road and the right-of-way boundary.

4. Additional rights-of-way would be required to route the pipeline away from the controlled access area to cross streams, lateral roads, and highway interchanges.

5. Special procedures would be required that are not typical of cross-country pipeline construction methods:

    - highway traffic control during longitudinal construction activities
    - right-of-way access for construction equipment
    - hauling, unloading, and stringing pipe adjacent to traffic
    - rock trench blasting in proximity to traffic
    - potential trench erosion that could affect road foundations

Physical Constraints

In evaluating the constraints of paralleling the Thruway with a pipeline, we relied on a review of topographic maps as well as data generated by the Vermont Agency of Transportation (VAT) for a similar facility. The VAT carried out a detailed study on longitudinal uses of I-89 and I-91 to determine the feasibility of locating utilities (specifically the Champlain pipeline) within the highway right-of-way lines. The study showed that only short segments of the interstate corridor could accommodate a pipeline. Moreover, these separate segments would not be connected, so that a pipeline could not be installed within the right-of-way over long distances. Steep cut-and-fill slopes, drainage structures, wetlands, road interchanges, ramps, and bridges were the principal factors constraining construction

(Vermont Public Service Board (VPSB), 1989). A detailed initial analysis indicated that only 10 to 12 percent of the rights-of-way, representing all the combined small segments, would be suitable for installing a pipeline (Fisk, 1989). In our opinion, these findings are indicative of the type of difficulties we might encounter constructing a pipeline along the Thruway or the Parkway.

Summary

Based on our analysis, accommodating the proposed pipeline substantially within the interstate highway system rights-of-way is not feasible. Typically, only short discontinuous segments of highway rights-of-way have physical characteristics suitable for pipeline installation. In many locations, construction along the highway right-of-way would result in substantial environmental effects associated with steep side slopes, wetlands, the visual effects of additional clearing, and disruption of traffic. Also, costs associated with special design and construction practices and pipeline material would increase significantly.

While we determined that locating a pipeline completely within either highway corridor is not feasible, a route combining pipe located within and adjacent to the corridor may be possible. We considered this further.

3.5.2.1 New York State Thruway/I-287

This alternative route would start at the intersection of the proposed Iroquois route with I-90 (MP 154.6) near Little Falls, New York. From this point, this route would parallel I-90 around Albany, joining I-87 and proceeding south along the west side of the Hudson River. In Newburgh, this alternative would turn east and cross the river to rejoin the proposed Iroquois route at MP 292.5 in New Milford, Connecticut. We assumed that the alternative alignment would be located primarily adjacent to, rather than within, the 144 miles of the paralleled Thruway right-of-way.

This alternative was found to be approximately 42.1 miles longer than the proposed Iroquois route. Based on map review, there appear to be numerous locations where significant deviations from the existing highway may be required. Constraints requiring deviations would include several bridges and 20 interchanges; water resources such as Norman Kill, Vloman Kill, Catskill Creek, Kaaterskill Creek, Patterkill Creek, Saw Kill, and Esopus Creek; areas such as in Colonie, Ulster, and Bethlehem where development has occurred essentially adjacent to the highway; and areas of steep topography such as those found along I-87 in Coxsackie. In some locations, such as Kingston, existing transmission lines, residential development, and other constraints would severely limit opportunities to make reasonable deviations from the Thruway. As a result of these types of constraints, it appears that a route following the Thruway would require many lengthy deviations. Because this longer route primarily would involve adjacent use and require extensive deviations with essentially all new right-of-way and its associated impact, we eliminated this alternative from further consideration.

In response to comments on the DEIS we evaluated the Thruway further south to its intersection with I-287, as shown on figure 3.5.2-1, where it then extends east following I-287 to the vicinity of Rye, New York.

Based on map analysis it appears that dense development located adjacent to I-287 (e.g., in the Towns of Elmsford, Fairview, White Plains, and Rye), numerous bridges, steep topography, and other local constraints would prove prohibitive in paralleling along or adjacent to I-287. To utilize this alternative, a satisfactory landfall would be required on the New York or Connecticut shore near the southeastern terminus of I-287 in the vicinity of Rye. The applicant studied the New York/Connecticut shore in detail. Based on their analysis, three landfall sites were studied in Connecticut (Stamford, Bridgeport, and Milford). None were identified along the New York/Connecticut coast in the vicinity of this alternate due to existing congestion along the shore and in adjacent areas.

In response to several comment letters pertaining to the I-287 alternative as well as a more direct route, we also made a map review of the coastal area in the Rye, New York, and Greenwich, Connecticut, area. Based on this review, it is apparent that landfall locations suitable for construction are very limited and that routing to these areas though dense development adjacent to the coast would be more difficult than at the proposed location.

3.5.2.2 Taconic State Parkway

We considered a route partially following a segment of the Parkway as an alternative to a 34.6 mile segment of Iroquois' proposed route between MPs 235.6 and 270.2. From MP 235.6, the alternative route generally would parallel SR 23 and 82 to their intersection with the Parkway, a distance of approximately 7.6 miles. From this point, the route primarily would be adjacent to the Parkway to an intersection with the proposed route, a distance of 28 miles.

We determined that a pipeline located on or immediately adjacent to the Parkway would be environmentally unacceptable. The Parkway is a New York State-designated scenic highway constructed to provide a roadway in a park-like setting. The right-of-way is irregular and much of it has been left in a natural state with right-of-way clearing kept to a minimum. About 70 percent of the lands adjacent to the Parkway segment we considered are wooded. We felt that the impact of clearing within the visual corridor of the Parkway would be significant. A secondary but important consideration would be access. Only non-commercial vehicles or special permit vehicles are allowed on the Parkway, and there are few access points along the Parkway. Construction operation and maintenance would also be difficult, if not prohibitive.

3.5.3 Greater Northeast (GNE) Alternative to Southern Iroquois Route

We examined several alternatives because they appear to have significantly fewer miles of new right-of-way construction than the corresponding southern segment of the Iroquois pipeline. One alternative that we considered and subsequently rejected would require substantial looping of Tennessee's 200 mainline east of Wright, New York, with impact similar to system alternatives discussed in section 3.4. Another alternative that we considered would replace the 134.5 mile southern section of the proposed Iroquois mainline from MP 171 near Canajoharie, New York, to MP 305.5 in Brookfield, Connecticut (see figure 3.5.3-1). This alternative follows a easterly route proposed in the Greater Northeast (GNE) and Algonquin applications (CP88-191-000 and CP88-192-000, respectively) to deliver gas to the Algonquin pipeline system at Mendon, Massachusetts, a distance of 197.1 miles. For our alternative, the gas would be backhauled from Mendon in a southwest direction to rejoin the proposed Iroquois pipeline at MP 305.5.

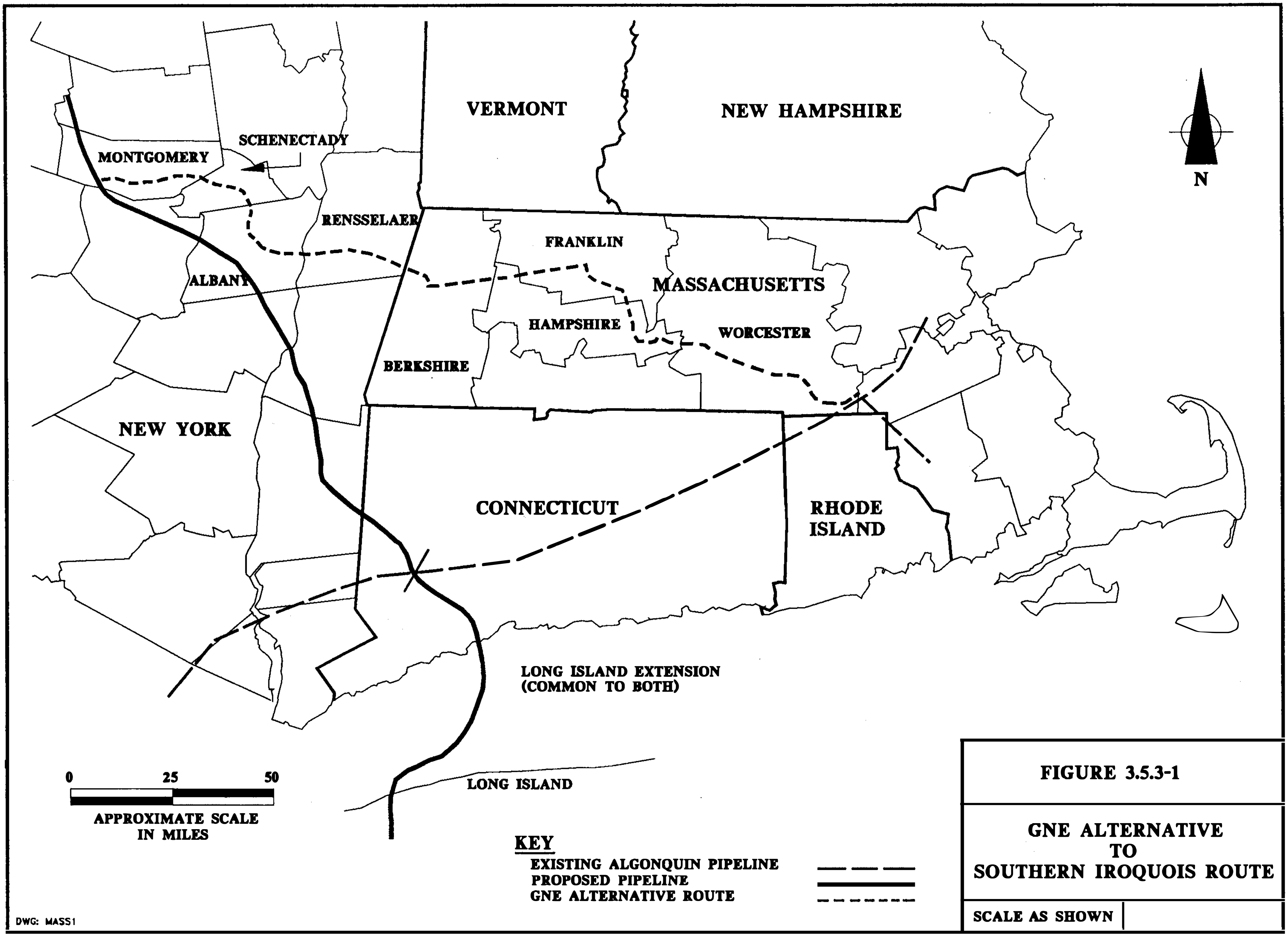


FIGURE 3.5.3-1

GNE ALTERNATIVE TO SOUTHERN IROQUOIS ROUTE

Although this alternative would require considerably more pipeline than its comparable Iroquois segment, it would be substantially parallel to a CNG pipeline right-of-way from Canajoharie, New York to Albany, New York, parallel to electric transmission lines of Niagara Mohawk and Northeast Utilities, Inc. from Albany, New York to the Deerfield River in Massachusetts; and parallel to portions of NEP transmission lines from Deerfield to Mendon, Massachusetts. The GNE alternative would be 62.6 miles longer than the comparable segment of the Iroquois route. However, 174.6 miles of the GNE alternative route would be parallel to existing right-of-way as compared to 37.1 miles for the segment of the proposed Iroquois route.

To compare this alternative with the corresponding segment of the Iroquois project, we evaluated potential impact on selected resource factors based on topographic maps, aerial photography, and aerial reconnaissance. We concluded that in spite of greater use of existing rights-of-way, the longer length of the GNE alternative would result in greater potential impact for nearly all resource areas examined. The GNE route has potential for greater impact on water use and quality due to a significantly larger number of stream and major river crossings; vegetation and wildlife, since nearly double the amount of forested areas would need to be cleared; fisheries, since twice as many crossings are required of high quality fisheries' streams; and to soils and farmland, since nearly 20 miles more of farmland with drainage tile would be crossed.

Although impact may be reduced by routing around some of the resources, deviation would reduce the amount of the GNE route parallel to existing right-of-way, thereby negating the chief reason for considering this route as a reasonable alternative.

A realistic comparison must also take into account service to the Roseton Plant that would be served by Iroquois as well as changes in Tennessee facilities. To deliver gas to Roseton using the GNE route would require an additional 33.9-mile lateral pipeline from Algonquin's mainline in Brookfield, Connecticut. In addition, a new 7,700 hp compressor station would be required in Brookfield. Since this lateral could follow the Iroquois pipeline route, the GNE alternative would be 231 miles. This would be somewhat reduced because some Tennessee length loops east of Wright, New York, would not be needed. Based on our evaluation, it was determined that further detailed consideration of the GNE alternative was not required.

3.5.4 Athens to New Milford Alternative

The original route of the Iroquois pipeline traversed Litchfield County, Connecticut. The modified route currently proposed by Iroquois, which passes through central Dutchess County, New York, and avoids most of Litchfield County, incorporates Alternatives 7 and 7A that were presented as alternatives in Iroquois' original environmental report. This shift to the west was proposed to facilitate the delivery of gas to Central Hudson's Roseton Plant and the Poughkeepsie area in general. This westerly shift and a required second Hudson River crossing led us to consider a pipeline route on the west side of the Hudson River from the south.

West of the Hudson River there is a well-defined geographic corridor bounded by the river to the east and the Catskill Mountains to the west. Within this corridor are several existing rights-of-way, such as Central Hudson's Albany-Highland (A-H) gas pipeline right-of-way and the Thruway corridor. Based on initial map review, a modified route utilizing segments of the A-H gas pipeline west of the Hudson River and a new east-west connector from Roseton to New Milford appeared feasible (see figure 3.5.4-1). As discussed earlier, we found that following the Thruway could have significant impact. Therefore, our evaluation focused on the A-H gas pipeline.

The gas pipeline alternative would originate at MP 229.6 of Iroquois' proposed route in Athens, New York and follow Central Hudson's 10-inch-diameter A-H line for approximately 59.3 miles to the Roseton Plant. From the plant it would follow the route proposed by Central Hudson in its New York Article VII Applications east to its existing Mahopac-Poughkeepsie (M-P) line (8.1 miles) and continue east (21.5 miles) rejoining the proposed Iroquois route at MP 292.5 in New Milford, Connecticut. The latter two segments would parallel existing transmission and railroad rights-of-way for 5.4 of the 29.6-mile length.

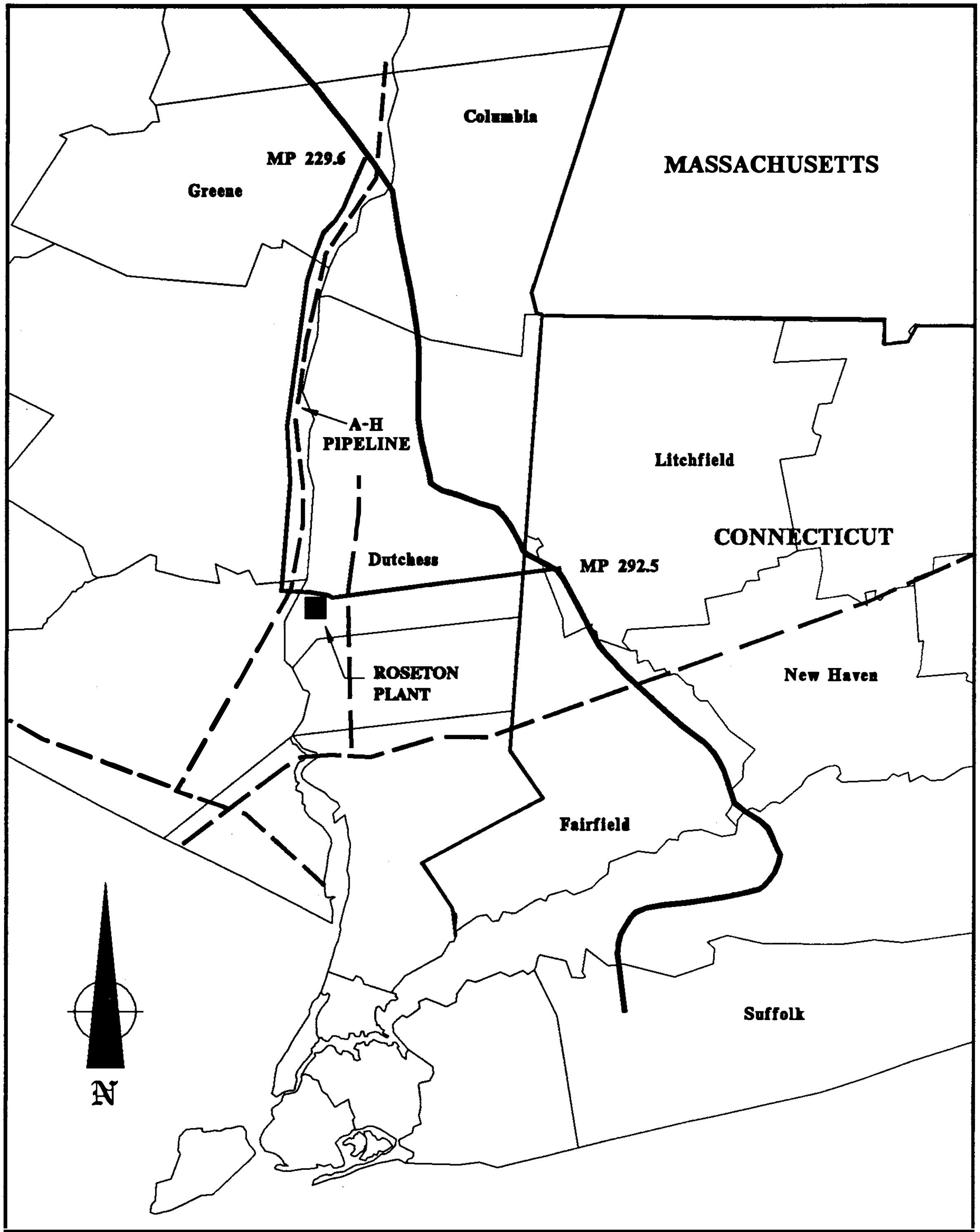
Although this alternative parallels more existing rights-of-way (64.7 versus 30.5 miles for the proposed Iroquois route), we believe significant adverse environmental impact could occur where Central Hudson's A-H line would be paralleled. The A-H line, which was constructed over 30 years ago, has narrow rights-of-way and numerous sharp turns, and its location in city streets would require deviations to accommodate Iroquois' mainline. The area adjacent to the A-H line is heavily developed in several locations (e.g., Kingston) requiring home relocations or additional deviations. Also, any pipeline route on the west side of the Hudson would cross several tributaries of the Hudson River, including designated significant fisheries, such as Esopus Creek.

The only advantage to locating a route on the west side of the Hudson River would be to avoid a second pipeline crossing of the river. This second crossing would be required to construct a lateral pipeline from the Iroquois facility to deliver gas to the Roseton Plant. We have found no indication that crossing the Hudson River twice (once by Iroquois and once by Central Hudson) would result in significant additional environmental impact. No unresolvable issues are associated with the proposed Iroquois crossing location (MP 232). Concerns related to disruption of the wetland areas on the west bank of the river and timing of construction are adequately addressed through the implementation of mitigation measures we have recommended. Central Hudson's proposed crossing location is in proximity to recently installed submarine 345 kV electric cables. The routing and construction of the electric cables was approved after extensive Federal and state review (NYPSC, 1984).

We concluded that the Athens-to-New Milford Alternative was environmentally inferior and more costly as compared to the proposed route; therefore, we eliminated it from further consideration.

3.5.5 Litchfield, Connecticut Route

This original route proposed by Iroquois in October 1986 consisted of an alignment from Columbia County, New York, through Litchfield County in northwestern Connecticut. The route as currently proposed was also presented in 1986 as Alternative 7 and Alternative 7A. Alternative 7 provided an alternative route in southeastern New York through Columbia and Dutchess Counties before entering Connecticut in southern Litchfield County. Alternative 7A provided an alternative route in New Milford, Brookfield, and Newtown, Connecticut. Subsequently Alternatives 7 and 7A were incorporated into the proposed route between MP 235 and MP 324; (see figure 3.5.5-1).



EXISTING PIPELINES

PROPOSED PIPELINE

ALTERNATIVE ROUTE

0 25 50

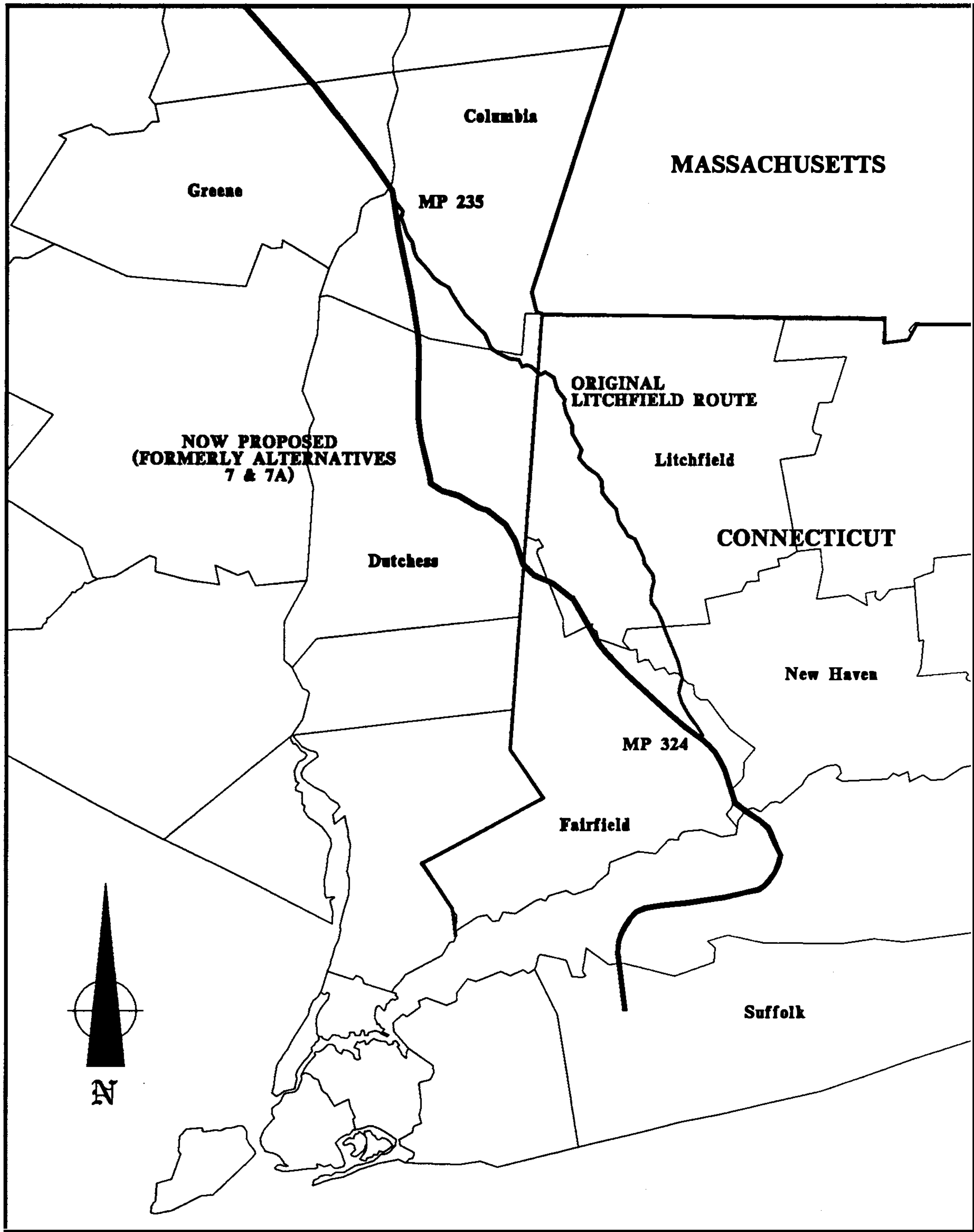
APPROXIMATE SCALE

DWG: P5

FIGURE 3.5.4-1

ATHENS TO NEW MILFORD ALTERNATIVE

SCALE AS SHOWN



ALTERNATIVE ROUTE

PROPOSED PIPELINE

0 25 50

APPROXIMATE SCALE

DWG: PS

FIGURE 3.5.5-1

LITCHFIELD, CONNECTICUT ROUTE

SCALE AS SHOWN

The original route through Litchfield County has not been seriously considered by Iroquois since the adoption of Alternatives 7 and 7A into the proposed route. However, in response to numerous scoping comments received from residents of southeastern New York, we have re-examined the original route through Litchfield County to ensure that the selection of the currently proposed route would not cause the abandonment of a route that might be environmentally superior.

Our review included an examination of the applicants' original Environmental Report filed in October 1986, augmented by a helicopter reconnaissance conducted in May 1989. In addition, we reviewed the information supporting the New York ALJ's Recommended Decision in the Article VII proceeding (NYPSC, 1989).

In general, the environmental features of the proposed route are similar to those along the original route. The comparable portions of the proposed route would be approximately 13 miles longer than the 76.2 miles of the original route. However, the proposed route takes advantage of existing rights-of-way for approximately 40.2 miles, as compared to no parallel sections in the original. The terrain along both routes is hilly, but the topography along the proposed route is generally less steep than along the original route. The soils along both routes are also similar, however, less erosion control would be necessary along the proposed route because of the generally less steep slopes. Nearly the same number and type of streams are crossed along both routes, but the original route would require two additional crossings of the Housatonic River and one crossing of the Shepaug River in areas that are listed on the NRI and under study for inclusion in the program. Both routes would require a crossing of the Appalachian Trail (AT); however, the crossing along the original route would be in a densely forested area, whereas the crossing along the proposed route would be through an existing break in vegetation across an agricultural field. The NPS has reached agreement with Iroquois concerning the proposed AT crossing. Similar impact is expected in the areas of vegetation, wildlife, fisheries, and land use.

Since there are no clearly superior advantages of one route over the other, we examined the basis for the selection of Alternatives 7 and 7A over the original route. The proposed route would provide an alignment closer to Central Hudson's two steam generating stations, Danskammer and Roseton, as well as existing gas markets in the Poughkeepsie, New York, area. The proposed route would enhance the economic feasibility of constructing a new lateral to supply natural gas to Roseton to facilitate the conversion of this plant from coal and oil to natural gas; Central Hudson has identified an alignment for such a lateral and received a Certificate of Environmental Compatibility and Public Need from the NYPSC (section 2.1.4.1.3).

Without the proposed Iroquois route, a new pipeline approximately 60 miles in length would have to be built to connect to the Tennessee system near Cedar Hill, Albany County; or a lateral which we estimate to be approximately 30 miles in length would have to be built from Roseton to the nearest point on the original route. With the proposed route, the lateral connecting Roseton to the Iroquois pipeline would be only 12 miles long. In addition to the reduced length of lateral line construction, Central Hudson would also benefit from diversified fuel sources and avoid the need for future upgrading of its natural gas distribution system.

An important environmental benefit of the proposed route would be the elimination of oil consumption at the Roseton plant and the reduction of oil dependence by Central

Hudson. Air emissions from Central Hudson's plant would be reduced thus improving air quality and reducing the potential for acid rain. Conversion from oil to gas would also reduce oil barge traffic on the Hudson River by approximately 50 percent, thereby reducing the potential for oil spills. It should be noted that the NYDAM and the NYDPS agreed that the proposed route through Dutchess County is justified regardless of whether Roseton is converted.

Dutchess County has opposed the proposed route, citing the lack of accurate environmental information as the basis for their opposition. We have found no indication of any special environmental concerns in Dutchess County that could not be adequately addressed through the mitigation measures we have recommended. The proposed route in Dutchess County also incorporates three route variations including Anne's Alternate #3 and the Simon Alternative which have both been the subject to detailed evaluation (see section 3.6.21 and 3.6.22). These route variations appear to be resolved to the satisfaction of most of the interested parties.

We concluded that the proposed route through Dutchess County, New York, is superior to the original route through Litchfield County, Connecticut, and we eliminated the original route from further consideration.

3.6 PIPELINE ROUTE VARIATIONS EVALUATED IN THE DEIS

Route variations differ from system or major geographic alternatives (see sections 3.4 and 3.5) in that they are intended to resolve localized resource issues (e.g., wetlands, residential areas). While some route variations are several miles in length or deviate into different towns, most are short and in proximity to the applicant's proposed route. This section describes the 76 Iroquois route variations evaluated in the DEIS.

During the DEIS comment period, 42 new route variations to the proposed Iroquois route were identified. In addition, further analysis or modifications were provided for 28 of the original 76 Iroquois variations. Of the total 133 variations to the Iroquois route which were evaluated, we recommend the adoption of 95 of those variations.

New or modified route variations are addressed in section 3.9. Section 6.1 includes the comparative analyses presented in the DEIS for those variations which have not been modified or re-evaluated. Section 6.2 includes an analysis of the route variations and modifications identified during the DEIS comment period. Original variations that have been modified or re-evaluated are so noted in sections 6.1 and evaluated in section 6.2.

Iroquois' proposed route alignment, filed with the Commission in October 1988, is the result of three years of routing investigations by the applicant, jurisdictional authorities, and the public. The original 1986 route has been refined in many locations through the New York Article VII process. As a result of the Article VII process, 46 reroutes or line changes were proposed to the original route in New York. Resource issues of New York State agency and public concern that resulted in reroutes include minimizing impact on agricultural lands including sugarbushes; avoidance of new residences and proposed subdivisions; optimizing water body and road crossings; avoiding conservation areas and watersheds; avoiding state reforestation lands; and avoiding hazardous waste sites. The proposed route in New York reflects the incorporation of 30 such reroutes. In addition, 11 line changes were made through coordination with the NYDAM specifically to avoid agricultural areas with drain tiles.

In Connecticut, refinement of the proposed Iroquois route has not been as extensive, due to the lack of a hearing process equivalent to the New York Article VII process. Nevertheless, four route variations in Connecticut were evaluated by Iroquois after the original route was filed with the Commission in 1986. The proposed route through Connecticut incorporates two of those reroutes as well as Alternatives 7 and 7A (see section 3.5.5).

Tennessee's proposed facilities have not had extensive public review beyond our public scoping process. Tennessee filed an Article VII application with the NYPSC in July 1989; however, hearings have not yet commenced. The Massachusetts Energy Facility Siting Council (MEFSC) conducted public hearings on Tennessee's facilities in Massachusetts and has provided comments to FERC.

While the public review process to date has improved the original route, as reflected in Iroquois' proposed facility, Federal and state agency review, as well as scoping comments and our own review, have raised issues that warrant the identification and evaluation of additional route variations for both the Iroquois and Tennessee routes. The resource issues that resulted in the identification of additional route variations include wetlands; new residential areas; habitats associated with threatened, endangered, and sensitive species; potential use of existing rights-of-way and certain public lands such as New York State reforestation lands (SRLs); and other refinements that would lessen impact on developed land uses.

The following sections describe the identified route variations contained in the DEIS. Affected resources for each route variation are tabulated in section 6.0. Route variations that would minimize wetland impact without affecting other resources are described in section 3.6.35. Maps showing the location of route variations are contained in appendix A.

3.6.1 St. Lawrence Wetland Variation

The St. Lawrence River Wetland Variation was identified by Iroquois to minimize an apparent 1,600-foot crossing of a forested wetland as indicated on Federal and state wetland maps. This 1-mile-long variation would replace that portion of the proposed route between MP 0.7 and MP 1.5, and would be aligned approximately 800 feet to the west of the proposed route (see figure A-1, sheet 1 of 57).

Resources affected by the variation that differ from the proposed route include vegetation and land use. The route variation would traverse mostly forestland (approximately 3,700 feet) including approximately 800 feet of forested wetland. One dwelling, a trailer fronting on State Route 37, would be within 50 feet of the variation's right-of-way and two homes would be within 75 feet.

3.6.2 Morey Ridge Variation

Iroquois identified this route variation in Lisbon, New York, to minimize impact on Federal- and state-mapped wetlands. This variation would deviate from the proposed route at MP 10, proceed closely parallel to the east of the proposed route, cross Tait Road approximately 200 feet to the east of the proposed crossing, and diverge approximately 500 feet from the proposed route before rejoining it at MP 11 (see figure A-1, sheet 2 of 57). The route variation would be approximately the same length as the proposed route.

This route variation would reduce the length of scrub-shrub wetland crossed from 900 feet to 250 feet, and would traverse approximately 4,200 feet of agricultural land and 1,100 feet of forestland. The route variation would cross Brandy Brook (MP 10.5) approximately 350 feet east of the proposed crossing. Brandy Brook has been identified as a significant recreational fishery.

This area was previously the subject of a routing alternative developed by the NYDAM during the New York Article VII proceedings. Their routing alternative was reflected in the proposed route, but would be modified by this variation.

3.6.3 Fulton Road Variation

Iroquois identified a route variation along Fulton Road in Lisbon, New York, to provide greater distance between the proposed right-of-way and Federal- and state-mapped wetlands. This variation would deviate from the proposed route at MP 11.6 and would parallel Fulton Road for approximately 0.8 mile before rejoining the proposed route at MP 12.5. The variation would be located approximately 200 feet from the proposed route along most of the length (see figure A-1, sheet 3 of 57).

The variation would avoid disturbance of forested and scrub-shrub wetlands which would be traversed or bordered by the proposed route for a distance of approximately 1,430 feet. The variation would traverse agricultural lands for most of its 0.9 mile length.

The NYDAM expressed concern with this route variation, stating that the proposed route would avoid wetlands by traversing the extreme edge of the cropland outside of the wetland, but the route variation would traverse the center of these agricultural fields.

3.6.4 Dandy Road Wetland Variation

We identified a route variation in Lisbon, New York, to avoid a 1,580-foot crossing of Federal- and state-designated wetlands. The variation would deviate from the proposed route at MP 12.7, proceed southwest across Dandy Road, and continue roughly parallel to Dandy Road before crossing the road a second time and rejoining the proposed route at MP 13.4 (see figure A-1, sheet 3 of 57). The route variation would be approximately 0.9 mile in length.

The specific resources of the variation pertaining to geology, soils, fish, wildlife, and threatened and endangered species would be similar to the proposed route in this area. This variation would traverse approximately 670 feet of forestland and 2,650 feet of active agricultural land. This variation would also cross three intermittent streams, two of which flow into the wetland area that would be avoided. A federally designated emergent wetland would be traversed for approximately 200 feet. Although the variation would move the pipeline closer to one residence, the right-of-way would still be approximately 400 feet away from this residence.

3.6.5 Canton Wetland Variation

This route variation was identified by Iroquois to minimize the amount of wetland crossed by the proposed route. It would extend from MP 16.1 to MP 17.2 in Canton, St. Lawrence County, New York (see figure A-1, sheets 3 and 4 of 57). Resources affected by this wetland variation are similar to the corresponding proposed route described in section 4.1 except for agriculture, wetlands, and land use. The variation would traverse 2,300 feet of agricultural land which is a mixture of crop, hay, and pasture; would avoid wetlands; and would be no closer than 500 feet to any building.

3.6.6 Marshville Wetland Variation

We identified a route variation between MP 30.2 and MP 31 in Hermon, St. Lawrence County, New York. Subsequently, Iroquois proposed a variation in the same area (see figure A-1, sheet 6 of 57). Our variation would deviate from the proposed route to avoid two wetlands in an agricultural field. Resources affected by this wetland variation are similar to the corresponding proposed route except for agricultural, wetland, and forest. The variation would traverse 2,800 feet of hay and pasture, avoid wetlands, and cross 500 feet of forest.

3.6.7 Edwards Variation

We identified a potential route variation for a 2.4 mile segment of the proposed route in Edwards, New York, between MP 41.1 and MP 43.5, in response to public concerns that use of existing rights-of-way should be maximized (see figure A-1, sheets 7 and 8 of 57). Iroquois' proposed route is aligned near but not adjacent to an electric transmission right-of-way. The route variation is 2.3 miles long and would be adjacent to the NYPA's 756 kV transmission line right-of-way for its entire length. Our concern in evaluating this segment of the proposed facility was to ensure maximum use of existing right-of-way where possible. Resources encountered would be similar to the proposed route except for steep slopes, wetlands, forest, and agricultural land. The alignment would cross 600 feet of scrub-shrub wetland and an area of moderate side slopes and rock outcrop for a distance of about 4,800 feet. It would cross about 0.4 mile of agricultural land and 1.2 miles of forest.

3.6.8 Route 58 Wetland Variation

Iroquois identified this route variation in Edwards, New York, located to the west of the proposed route between MP 43.2 and MP 43.7 (see figure A-1, sheet 8 of 57). The proposed route partially parallels the NYPA's 765 kV transmission line through this rural area, but would traverse or border approximately 800 feet of federally designated forested and scrub-shrub wetland.

Resources affected by this variation would be similar to the corresponding proposed route except for agricultural land, wetlands, and forest. The variation would reduce the length of wetland crossed to 50 feet, but would traverse 450 feet of agricultural land and 1,480 feet of forest. The variation would also be located closer to a new home on Route 58. The NYDAM and the NYDEC have expressed a preference for the proposed route.

3.6.9 Harrisville Variation

The area near Harrisville, New York, was the subject of several routing alternatives during the New York Article VII proceedings. The proposed route was planned to avoid SRL, but would result in impact on a forest plantation and would be located in proximity to a number of residences. We identified a route variation that would deviate from the proposed route at MP 53.2 and proceed to the west of the proposed route to MP 54.7, avoiding the forest plantation and reducing the disturbance to residences (see figure A-1, sheet 9 of 57). Iroquois also identified a route variation that would reduce, but not eliminate, impact on the forest plantation while still avoiding SRL. We do not believe that avoiding SRL is a legitimate environmental issue, and have evaluated our variation since it would totally avoid the forest plantation and have less impact than Iroquois' route variation. A more detailed discussion of the SRL issue is provided in section 3.6.11 as part of the Jadwin Memorial State Forest Variation.

The route variation we identified would traverse forestland for all of its 1.1 mile length, including about 900 feet through the Bonaparte Cave State Forest. The route variation would cross two unnamed tributaries to the West Branch of the Oswegatchie River, as would the proposed route. The route variation would also traverse approximately 350 feet of federally designated scrub-shrub wetlands associated with these two tributaries.

3.6.10 Sugarbush Variations

The identification and protection of commercial sugarbushes was raised as an issue during scoping and during the New York Article VII proceedings. Iroquois is obligated by conditions of its pending state certification to identify and avoid commercial sugarbushes. This commitment has resulted in Iroquois proposing several variations to its proposed route. We have evaluated these, and as a practical matter can expect further route variations, especially in St. Lawrence and Oneida Counties in New York. Two small variations are proposed: between MP 57.7 and MP 59.1 (Diana Sugarbush Variation); and MP 73.6 to MP 74.0 (Croghan Sugarbush Variation) (see figure A-1, sheets 10 and 12). These were aligned to avoid sugarbush based on mapping provided by the Lewis County Planning Department. Resources affected by these variations are similar to those of the proposed route.

Iroquois has also proposed a substantially longer sugarbush variation between MP 74.3 in Croghan to MP 83.5 in New Bremen (New Bremen Sugarbush Variation). This 9.32 mile variation would generally be parallel to and 1,500 to 4,000 feet west of, the proposed route (see figure A-1, sheets 12, 13, and 14 of 57). Resources affected by this route variation would be similar to the 9.2 mile proposed route it would replace.

The New Bremen Sugarbush Variation would cross 12 streams, including Balsam Creek, Beaver River, Murmur Creek, and Black Creek. Eight of the streams crossed support trout fisheries and three of the streams support significant fisheries. Several of the streams crossed are designated as C(T). The New Bremen Sugarbush Variation would pass within 1.2 miles of a significant deer habitat, as identified by the NYDEC. Two palustrine wetlands would be traversed by the route variation for a distance of 450 feet.

The area crossed by the New Bremen Sugarbush Variation is primarily rural, consisting of forest stands and active agricultural land. A total of 3.78 miles of forestland and 3.6 miles of active agricultural land, not including sugarbush, would be crossed.

Approximately 0.3 mile of the reroute would traverse sugarbush stands. The sugarbush stand located on the southerly side of High Falls Pond identified by Lewis County's Planning Department is not included, since aerial photos show that this area consists of open lands, not sugarbush.

Another significant land use in proximity to the route variation is the High Falls Natural Area. The boundary of this 145-acre natural area would be within 250 feet of the route alignment. The area around High Falls Pond is leased to cottagers.

3.6.11 Jadwin Memorial State Forest Variation

Our analysis of Iroquois' proposed route identified several areas where it was apparent that the alignment was developed to avoid crossing SRLs. Transfering impact on private property owners by avoiding state lands was also raised in scoping. This concern is most apparent along Iroquois' proposed route between MP 57.3 and MP 76.3, where it deviates around Jadwin Memorial State Forest. The proposed route results in a pipeline route 5.3 miles longer than a more direct route through the state forest.

Iroquois' proposed route (which has been revised from their original route filed in 1986) was based on NYDEC's position, supported by legal memoranda, that SRLs are protected by Article 14, §3 of the New York State Constitution (NYDEC, 1988). While Iroquois did not endorse the NYDEC interpretations of pertinent state statutes, it concluded that the prudent course of action, in terms of the state certification, would be to reroute the pipeline around SRLs (NYPSC, 1989).

Our responsibility in assessing Iroquois' proposed facilities was to identify an environmentally superior route, not to interpret state constitutional and statutory provisions. Consequently, we compared Iroquois' proposed route with a more direct alignment based on the route originally proposed by Iroquois based solely on environmental factors. This original route was also evaluated by interested parties in the New York Article VII proceedings.

The 13 mile Jadwin Memorial Forest Variation would begin at MP 57.3 of the proposed route in Diana and end at MP 76.3 in Croghan (see figure A-1, sheets 10 and 12 of 57). No portion of the variation would be parallel to existing rights-of-way. Three areas with steep slopes would be encountered. The variation would cross 13 streams, 6 of which are classified for coldwater fisheries. No public water supplies are within 0.5 mile. The variation would cross a tributary to Carthage Reservoir, a public surface water supply. The variation would cross 4,000 feet of Federal- and state-designated wetlands. A forested wetland and significant habitat, Carley Swamp, would be crossed for 1,400 feet. No threatened and endangered species occur within 1.5 miles of the variation. A total of 7.8 miles of forestland would be crossed, consisting mainly of northern hardwood forest. Common deciduous species include sugar maple, red maple, basswood, black cherry, aspen, and yellow birch; common conifers include white cedar, red spruce, and white pine. No deer wintering areas (DWAs) would be crossed. The route variation parallels the County Route 812 corridor and would be within several hundred feet of it at several locations. Three stands of commercial sugarbushes would be crossed totaling 5,200 feet. Finally, the variation would cross 15,000 feet of Jadwin Memorial Forest.

3.6.12 Indian Pipe State Forest Variation

The proposed route between MP 83 and MP 86 curves to the east to avoid the Indian Pipe State Forest Preserve. The proposed route in this area is actually a reroute developed by Iroquois during the New York Article VII proceedings. Their original route in this area was more direct, but traversed the state forest for a distance of approximately 300 feet. Since we do not consider the crossing of state forest to be a significant environmental issue, we evaluated Iroquois' original route as a variation to their currently proposed route.

This variation would deviate from the proposed route at MP 83.5 and proceed in approximately a straight line due south, connecting with the proposed route at MP 85.7 (see figure A-1, sheet 14 of 57). The variation would cross Crystal Creek, a designated trout spawning stream and significant recreational fishery. The variation would also cross another unnamed tributary. Most of the land along the route variation is forested (approximately 1.3 miles); there is also approximately 3,000 feet of agricultural land. The state forest preserve would be traversed for a distance of approximately 300 feet; according to NYDEC records obtained by Iroquois, this portion of the state forest is a jack pine plantation.

3.6.13 Rose Valley Landfill Variation

Between MP 132.5 and MP 135 in Russia, Herkimer County, New York, Iroquois proposes a reroute to avoid the Rose Valley Landfill, also referred to as the J & J Trucking Site (see figure A-1, sheet 22 of 57). The reason for this reroute is that the landfill site was recently investigated by the EPA as a potential hazardous waste site. Although the EPA reached no firm conclusions regarding the potential hazards at the site, and it is consequently unknown as to whether the proposed route would actually intersect or otherwise affect hazardous wastes, Iroquois has determined that a reroute in this area would be prudent in order to avoid potential controversy and lengthy delays in obtaining a right-of-way through the landfill. The route variation that is being proposed would be approximately 2.3 miles long and would deviate south from the proposed route. The variation would not traverse any wetlands, and would cross about 1.5 miles of forest. It would not cross the landfill, and would be located away from the estimated direction of groundwater flow from the landfill based on the review of the studies conducted by the EPA.

3.6.14 Little Falls Watershed Variation

Iroquois identified a route variation in Fairfield, New York, to avoid state-mapped wetlands. This variation coincides with a variation presented by Little Falls, developed to align the right-of-way at least 1,000 feet from the city's watershed catchment area, in accordance with their local rules and regulations. This 1.4 mile variation would deviate from the proposed route at MP 142.9 and rejoin the route at MP 144.3 (see figure A-1, sheets 23 and 24 of 57). Resources affected by this route variation would be similar to the corresponding proposed route except for water resources, wetlands, forestland, and agricultural land. The variation would traverse one tributary of Beaver Creek, a public water supply. In addition, 50 feet of a forested wetland (Basic Creek tributary) and 4,700 feet of agricultural land would be crossed. No forestland would be crossed by the route variation.

3.6.15 Basic Creek Wetland Variation

Iroquois identified a route variation in Westerlo, New York, to avoid the crossing of a state-mapped wetland. The variation would deviate to the north of the proposed route at MP 213.1 and proceed roughly parallel to the proposed route before rejoining it at MP 213.9 (see figure A-1, sheet 35 of 37). The variation would be at most 200 feet from the proposed route. Resources affected by this route variation are similar to the corresponding proposed route described in section 4.1, except for wetlands and residential land use.

The variation would be approximately 0.8 mile long and would traverse mostly forest (2,950 feet). The variation would apparently eliminate the 630-foot crossing of a state-mapped, class III wetland, but would move the right-of-way to within 50 feet of one residence and within 200 feet of two other residences.

3.6.16 Greenport Orchard Variation

We identified a route variation in Greenport, New York, in an attempt to avoid traversing an orchard at MP 234.7. The variation would deviate at MP 234.5 and proceed to the west of the proposed route for a distance of approximately 0.5 mile before rejoining the proposed route at MP 235 (see figure A-1, sheet 39 of 57).

Resources along this route variation are similar to those along the proposed route with the exception of steep slopes, water resources, forest, and orchards. The route variation would traverse an intermittent stream and an area of steep slopes (greater than 25 percent) associated with the stream. Other areas of steep slope would be encountered further along the route variation. The route variation would traverse forested areas for a total distance of approximately 850 feet; these forested areas generally correspond to the areas of steep slope. The route variation would avoid crossing an orchard for a distance of 900 feet.

3.6.17 Greenport Quarry Variation

We initially had a concern at MP 236.4, where the proposed route traverses an active sand and gravel quarry. Iroquois determined that the quarry was expanding into the area traversed by the proposed route and developed this route variation to avoid the quarry. This route variation deviates from the proposed route at MP 236.3, proceeds along the eastern edge of an overhead electric transmission line, then crosses under the transmission line to avoid the Mt. Pleasant Church cemetery, proceeding along the western edge of the transmission line before crossing under again and rejoining the proposed route at MP 237 (see figure A-1, sheet 39 of 57).

The resources affected by the route variation are essentially the same as those along the proposed route. The route variation would parallel or be located within the right-of-way for the transmission line for a distance of approximately 3,350 feet. This includes 2,900 feet of land in active agricultural use. Two forested areas adjacent to the transmission line would require clearing, for a total distance of approximately 200 feet. The route variation would avoid an 800-foot crossing of the quarry property.

3.6.18 ROW Alignment Variation

We identified the ROW alignment route variation in Milan, New York, to align the proposed route parallel and adjacent to an existing overhead electric transmission line right-of-way. The 0.5 mile route variation would deviate from the proposed route at MP 255.3 and rejoin the route at MP 255.8 (see figure A-1, sheet 42 of 57). Our concern in evaluating this segment of the proposed facility was to ensure maximum use of existing right-of-way where possible. Resources affected by this variation are similar to the corresponding proposed route except for land use. The variation would traverse 2,200 feet of forestland. Both routes would cross two tributaries of Wappinger Creek and 50 feet of forested wetland, as delineated by Iroquois using the FWS classification system.

3.6.19 Silver Lake Wetland Variation

The Silver Lake Wetland Variation was identified by Iroquois to eliminate the crossing of a state-designated class II wetland in Milan, New York. The variation would deviate from the proposed route at MP 255.8 and rejoin the route at MP 256.2 (see figure A-1 sheet 42 of 57). The 0.4 mile reroute would be 500 feet to the west of the proposed route and would cross electric transmission line rights-of-way twice.

Resources affected by the variation that differ from the proposed route include wetlands, areas of steep slope, and land use. The route variation would traverse forestland for its entire length. The reroute would be in proximity to a residential development near MP 255.8. One dwelling would be within 50 feet of the variation. A federally designated scrub-shrub wetland would be crossed by the reroute for 1,050 feet. Iroquois determined the extent of the wetland crossing using the FWS classification system.

3.6.20 Little Wappinger Creek Variation

Iroquois identified this route variation between MP 257.8 and MP 258.2 to avoid crossing a forested wetland in Clinton, New York. The 0.5-mile-long route variation would be the same length as the proposed route but would be located roughly 300 feet to the east (see figure A-1, sheet 43 of 57).

A wetland associated with Little Wappinger Creek would be traversed for a total of 600 feet. The wetland is a state-designated class I wetland. Iroquois has identified the wetland as a forested wetland using the FWS classification system.

Land uses to be traversed by the reroute are forest and residential land. Forestland would be traversed for 0.1 mile. A residence which fronts on an unimproved road is located 50 feet to the east of the variation.

3.6.21 Anne's Alternate #3

During the scoping process, Dr. Anne Mueser submitted for our consideration a variation (Anne's Alternate #3) to Iroquois' proposed route between MP 260.2 in Clinton, New York, and MP 265.9 in Pleasant Valley, New York (see figure A-1, sheets 43 and 44). Dr. Mueser contended that Anne's Alternate #3 would not affect as many wetlands and residences or a new daycare center. Dr. Mueser also filed her proposed route variation in the New York Article VII proceeding. We reviewed Anne's Alternate #3 to determine if it would be environmentally superior to Iroquois' proposed route.

Anne's Alternate #3 would be 5.8 miles in length, traversing primarily a forested rural area, east of the proposed route. The route variation would cross four areas of steep side slopes. Three perennial streams and Wappinger Creek would be crossed. Wappinger Creek supports a significant trout fishery and is included on the NRI. No wetlands would be crossed, although the alignment would be in proximity to a state-designated wetland. Anne's Alternate #3 would be within 1.5 miles of a reported location of Blandings turtle, a state-listed threatened species. Approximately 2.7 miles of forest would be crossed. The route variation pipeline would be 1,000 feet from the Taconic State Parkway at its closest point and traverse mostly open fields and agricultural lands, including an orchard.

3.6.22 Simon Alternative

Scoping comments included a request from the estate of Max M. Simon that the Commission evaluate the Simon Alternative as an alternative to the Iroquois route between MP 267.3 in Pleasant Valley, New York, and MP 271.7 in LaGrange, New York. This alternative was concurrently reviewed by interested parties in the New York Article VII proceedings. The estate's concern centered on creating a new right-of-way corridor (including a crossing of estate property) versus using an existing right-of-way which is located nearby. This alternative has been modified since its initial identification, in part, due to Central Hudson's plans to construct a nonjurisdictional pipeline to connect with the Iroquois pipeline. It was decided during the New York Article VII proceedings that both proposals could be better served and potentially result in less impact by modifying the Simon Alternative. Our evaluation is based on the modified Simon Alternative shown on figure A-1, sheets 44 and 45.

The modified Simon Alternative would be 5.2 miles in length, traversing forested area with scattered residential development west of the proposed route. Along this alignment it would parallel a Central Hudson 69 kV transmission "G" line and then a Con Ed 345 kV transmission line for a total of 4.3 miles. Steep slopes are common along the route variation, including three areas of steep side slopes. Two tributaries to Wappinger Creek would be crossed, as well as one tributary to Sprout Creek. None of these tributaries are classified for trout. Two water supply wells would be within 0.5 mile of the route variation. Approximately 0.2 mile of wetland would be crossed. A reported location of Blanding's turtle occurs within 1.5 miles of the route variation, and a county-designated significant habitat is located within 1.5 miles of the reroute. A total of 4.1 miles of forest and 0.6 mile of agricultural land would be traversed.

At least nine residences along Pleasant View Road would be in proximity to the modified Simon Alternative, since Central Hudson's line runs directly adjacent to those homes. The route variation would cross the Taconic State Parkway near the existing transmission line, crossing about 1 mile south of Drake Road.

3.6.23 Gidley Road Variation

Iroquois identified a route variation between MP 272.1 and MP 272.4 in LaGrange, New York (see figure A-1, sheet 45). The variation would cross over the existing 345 kV transmission line right-of-way 0.3 mile further west than originally proposed. Resources affected by the variation would be similar to those of the proposed route. About 0.2 miles of forest and Sprout Creek, a coldwater fishery, would be crossed. Moderately steep slopes would also be encountered. A residence which fronts on Gidley Road would be immediately adjacent to the pipeline right-of-way.

3.6.24 Dover Variation

This route variation, originally identified by Iroquois as Reroute No. 26, maximizes the use of an existing right-of-way and eliminates the 900-foot crossing of the Dover Plains High School property. This 0.8 mile route variation would diverge from the proposed route at MP 281.7, parallel Con Edison's 345 kV transmission line right-of-way for 0.3 mile, then rejoin the proposed route at MP 282.5 (see figure A-1, sheet 47 of 57).

Resources affected by this variation would be similar to the corresponding proposed route except for steep slopes and land use. The predominant land use traversed by the route variation would be forestland, which would be crossed for 2,600 feet. Mica Products, an EPA-listed hazardous waste site, is located 1,300 feet to the south of the route variation. The Walter Vincent Landfill, a state-listed hazardous waste site, would be 500 feet from the reroute.

3.6.25 State Route 55 Variation

The area between MPs 283 and 287 has been the subject of several routing alternatives and numerous scoping comments. The resources of concern in this area include Tenmile River, Deuel Hollow Brook, Leather Hill, the Appalachian Trail (AT), and protected species habitats.

The original route in this area (part of Alternative 7) was modified by Reroute No. 31, filed as part of the first Routing Amendment report in October, 1987. In response to local landowner opposition, Reroute No. 37 was developed and filed as part of the Second Routing Amendment in February 1988. Reroute No. 37 drew opposition from the Deuel Hollow Conservation Association, AT officials, and the NYDPS; the proposed route reflects Reroute No. 37A, developed in June 1988. Through the New York Article VII process, a stipulation was reached between the applicant and the NYDPS and NYDAM regarding the acceptance of Reroute No. 37A (i.e., the proposed route) in this area. The New York ALJs, however, revisited the routing issues in this area and in their recommended decision issued July 6, 1989, concluded that Reroute No. 31 was preferable to the proposed route filed with the FERC (Reroute No. 37A) (NYPSC, 1989). However, the NYPSC has certificated Iroquois' proposed route.

In light of the numerous issues in this area, the arguments put forth by the New York ALJs and actions of the NYPSC, we have evaluated Reroute No. 31 as a variation to the proposed route (see figure A-1, sheet 47). This variation would begin at MP 282.9 and continue generally parallel and to the north of the proposed route, rejoining the proposed route at approximately MP 286.6 at the New York - Connecticut border.

3.6.26 Wimisink Variation

Independent of each other, we and Iroquois identified the need to consider a route variation between MP 287.3 to MP 288.1 in Fairfield, Connecticut, to improve the alignment across the Naromi Land Trust/Wimisink Valley Sanctuary and the partially developed Smoke Ridge subdivision (see figure A-1, sheet 47 and 48 of 57). The 0.8 mile route variation would parallel the proposed route about 400 feet further north along hedgerows through the Wimisink Valley Sanctuary, and cross the expanding subdivision in such a way as to minimize disruption to planned residential lots. The variation is about the same length as the proposed route. It would traverse two areas of steep slope, 2,400 feet of forest, and 1,600 feet of emergent wetland. Wimisink Brook, a coldwater fishery, would be crossed. About 1,650 feet of the Smoke Ridge subdivision would be crossed and one residence on County Route 39 would be within 50 feet of the pipeline right-of-way.

3.6.27 Still River Variation

The Still River Variation was identified by Iroquois to minimize the crossing of wetlands and avoid an oxbow crossing of the Still River. This was also an area of general concern during scoping. The 0.5 mile variation would replace that portion of the proposed route between MP 297.5 and MP 298 and would be aligned approximately 250 feet to 350 feet north of the proposed route (see figure A-1, sheet 49 of 57).

The resources affected by the variation that differ from the proposed route would be wetlands, vegetation, and land use. About 200 feet of wetlands and 1,000 feet of forest would be crossed. The variation as well as the proposed route would cross the Still River Meanders Natural Area. State-listed rare species known to occur in this area include agrimony, side-oats grama grass, cliff swallow, and purple martin.

To avoid the oxbow, the variation would deviate from the electric transmission right-of-way that is paralleled by the proposed route. The variation would cross the Still River to the north of the proposed crossing, and pass within 100 feet of a dog pound.

3.6.28 Algonquin Variation

Iroquois identified a route variation which would shift the proposed pipeline from the north side to the south side of an existing Algonquin pipeline between MP 307 and MP 308.3 in Newtown, Connecticut (see figure A-1, sheet 50). The reroute was identified to eliminate two extra crossings of Algonquin's pipeline and minimize disturbance to existing residences.

The route variation would traverse a predominantly forested area. An area of federally designated scrub-shrub and emergent wetlands would also be traversed for a distance of approximately 150 feet.

3.6.29 Fairfield County Subdivision Variations

Iroquois has identified four route variations in Fairfield County, Connecticut, that it contends would provide better alignment through subdivisions that are planned or under construction. The subdivision route variations are intended to limit the disturbance to subdivisions crossed or affect fewer lots within the developments. These variations are listed in the following table:

Variation Designation	Mileposts	Town	Major Subdivisions Affected	Figure-A-1 (Sheet No.)
Old Farm Hill	308.2 to 310.1	Newtown	Old Farm Hill, Teachers Ridge	50, 51
Newtown Subdivisions	312.2 to 315.2	Newtown	Feather Meadow 1&2, Deer Ridge, Cobblers Mill, Mountain Manor, Green Ridge, Trout Run	51, 52
Forest View Subdivision	315.8 to 316.3	Newtown	Forest View	52
Monroe Subdivision	316.7 to 318.2	Monroe	Whispering Pines, Buckhill Estates	52

3.6.30 Pootatuck River Variation

The Pootatuck River Variation was identified by Iroquois to reduce the number of crossings of the Pootatuck River. The variation would be 0.4 mile in length, between MP 311.0 and MP 311.4 of the proposed route (see figure A-1, sheet 51). Resources affected by the variation would be similar to the proposed route except for the number of crossings of the Pootatuck River, which would be reduced to one.

3.6.31 Conrail (STOP) Variation

We received a number of comment letters from residents in Monroe and Shelton opposing the location of Iroquois' proposed route. Several had joined together forming STOP (Southern Connecticut Townspeople Opposing the Pipeline). A primary concern was a segment of the proposed route between MPs 316 and 323.7. It would cross remaining open space, a large forested wetland, and an area of rural farms and forestland which is part of the regional Hill and Harbor Tourist District and would be located in the vicinity of collapsed limestone caves along Boys Halfway River.

STOP specifically requested that we consider an alternative route that would run parallel and adjacent to Conrail's tracks along the Housatonic River or follow electric transmission lines and highways. The State of Connecticut also requested consideration of maximum use of shared corridors in Newtown and Shelton. We identified two route variations, one of which was eliminated early on.

Powerline Variation - This variation would follow CL&P's Stevenson-Devon double circuit 115 kV transmission lines which generally parallel Iroquois' proposed route approximately 1 mile to the east (see figure A-1, sheets 52 and 53 of 57). We evaluated this variation to determine if the proposed pipeline could be located adjacent to or on the existing transmission line. The powerline route variation would begin at MP 317.5, extend east on new right-of-way, cross Boys Halfway River, and join the CL&P powerline about 1,500 feet east of Cottage Street. From this point, it would follow the CL&P powerline for 4.7 miles before rejoining Iroquois' proposed route at MP 323.7. The total length of this variation would be 5.6 miles compared with the corresponding 6.2 mile length of Iroquois' proposed route. Based on aerial and ground reconnaissance and review of detailed plans and profile drawings provided by CL&P we determined this route would not be feasible. The existing right-of-way is 100 feet wide and includes two transmission lines with 50 feet between the centerlines. The lattice-type towers are about 20 feet wide at their bases, further reducing the amount of available space in the right-of-way. The area surrounding the transmission line at MP 1.7 to MP 2.3 and MP 2.7 to MP 3.6 is substantially developed. Homes physically abut the right-of-way, with yards and accessory buildings encroaching into the right-of-way. In these areas, the powerline crosses steep slopes with outcrops of rock which would require removal through blasting or other means. Deviations to avoid homes are not feasible. Having concluded that the pipeline could not be placed along this route without relocations and significant disruptions to residences, we eliminated this variation from further consideration.

Conrail Variation - The Conrail Variation would begin at MP 316.8 and extend southeast, joining the Conrail right-of-way just west of Boys Halfway River. The Conrail right-of-way has one active track and an adjoining area from where a second track was removed. From this point, the route would generally be located on the vacated portion of the railbed for 5.5 miles. South of Indian Well State Park the route would depart from the Conrail tracks cross State Route 110 and rejoin the proposed route at MP 323.7. (see figures A-1, sheets 52, 52A and 53 of 57). The total length of the Conrail Variation would be 7.4 miles.

The Conrail Variation would cross seven streams, none of which are class AA. It would parallel the Housatonic River for the majority of its length. This section of the river is classified "C/B", meaning that the goal is for the river to attain a "B" classification, but it currently supports a "C" classification. The Housatonic supports a significant fishery which includes several anadromous species, such as striped bass, blue fish, winter flounder, and sea-run brown trout. About 2.7 miles of the variation would be within the Housatonic River floodplain. Twenty-three public wells are within 1.5 miles of the route variation, and about 0.5 mile of protected watershed would be crossed.

The variation would cross 0.4 mile of wetland. The majority of this land is linear riparian systems associated with traversed streams. Some were formed by construction of the railbed. No designated significant habitats, unique ecosystems, national areas, significant fisheries, or known locations of species of concern are crossed. Clearing would be required except in the segment of the variation south of Meadow Road. Indian Well State Park, a state-owned year-round day use area, would be crossed, as would the Housatonic and Maples well fields owned and operated by Bridgeport Hydraulic Company (BHC).

3.6.32 Blakeman Variation

During the scoping process, a Fairfield, Connecticut, resident proposed a modified alignment to avoid a condominium development under construction. Iroquois modified the proposed route between MP 323.1 and MP 323.8 (see figure A-1, sheet 53 of 57) to align the route adjacent to a proposed highway and further from existing residences and the condominium development now under construction. The variation avoids steep slopes, river and stream crossings, proximity to public water supplies, and wetlands, and is not within 50 feet of any residences. It is expected to be adjacent to a proposed highway. About 2,300 feet of forest and 625 feet of agricultural land would be crossed.

3.6.33 Carroll Variation

A route variation was suggested by a property owner in Stratford, Connecticut, to shift the proposed pipeline to the opposite side of a CL&P electric transmission right-of-way and provide greater clearance between his property and the proposed pipeline. Iroquois subsequently identified a route variation that incorporated the suggested reroute. The route variation would begin at MP 330.4 on the north side of the existing transmission line, would cross under the lines, continue east along the south side of the transmission line right-of-way, and cross back under the transmission line at Main Street, rejoining the proposed route at MP 330.8 (see figure A-3, sheet 54 of 57). Iroquois has also indicated that the route variation modifies the proposed alignment through the planned Pin Oak Subdivision.

The route variation would be located adjacent to the existing right-of-way and would require 50 feet of additional permanent right-of-way; Iroquois has proposed to use 10 feet of the existing right-of-way and up to 40 feet of temporary workroom, as available, outside their new right-of-way for temporary work room.

Our analysis indicates that the route variation would require at least 50 feet of clearing through an adjacent forested area for a distance of approximately 1,100 feet. The variation would also be within 50 feet of two residences located adjacent to the existing right-of-way along Main Street.

3.6.34 Milford Variation

Iroquois identified a route variation in Milford through discussions with city officials to minimize land use and wetland impact. The State of Connecticut also raised concerns about the route through Milford and suggested an alternative that would run the pipe down the Housatonic River and into Long Island Sound.

Our route variation would diverge from the proposed route at MP 331.1 on the east side of the Housatonic River and continue parallel to an existing CL&P electric transmission line right-of-way, traversing closer to industrial and commercial properties along Bic Drive. After crossing Bic Drive at approximately MP 332, the variation would proceed along the west side of the road, traversing wooded areas and parking lots to the rear of several commercial properties. The variation would then cross West Avenue and proceed to the east across Bic Drive, though the parking lot of Automatic Data Processing, across the Connecticut Turnpike (I-95) and to the rear of the Suisse Chalet Hotel, adjacent to the Beaver Brook wetland. The route variation would then cross the Amtrak rail lines and proceed easterly parallel to the rail lines, rejoining the proposed route at approximately MP 332.8. This 2.1 mile long route variation would replace a 1.7-mile-long portion of the proposed route and would address several concerns raised during scoping, including impact on the Beard Sand and Gravel property, JFK Elementary School, Mondo Ponds, and Beaver Brook (see figure A-1, sheet 54 of 57).

This route variation would parallel the existing electric transmission line for approximately 2,400 feet, and would parallel the Amtrak rail lines for approximately 1,000 feet. Although the route variation would take advantage of existing parking lots to limit the amount of clearing, the route would still traverse approximately 4,560 feet of wooded areas including a 200-foot crossing of a federally designated forested shrub wetland adjacent to West Avenue.

The route variation would cross Beaver Brook approximately 1,000 feet upstream of the Milford Reservoir. The Beaver Brook area, located between the Connecticut Turnpike and the Amtrak rail lines, is managed by the South Central Connecticut Regional Water Authority. The Milford Reservoir is not currently used for public water supplies. The route variation would cross the Beaver Brook area outside of the federally designated scrub shrub wetland.

The route variation would also border an intertidal, emergent wetland for a distance of approximately 1,400 feet along the electric transmission line, adjacent to the Housatonic River.

3.6.35 Route Variations Developed as Wetland Mitigation

The Section 404(b)(1) Guidelines (Guidelines) promulgated pursuant to the CWA (40 CFR 230) require that a permitting authority (i.e., the COE) which is contemplating the granting of a Section 404 permit analyze the use of practicable alternatives that would eliminate or minimize the discharge of dredged or fill material into wetlands or other waters of the United States (40 CFR 230.10). The permitting authority is required to adopt those practicable alternatives that reduce adverse impact on aquatic ecosystems, so long as the alternative does not have other significant adverse environmental consequences (40 CFR 230.10(a)).

For actions subject to NEPA, the Guidelines recognize that the analysis of alternatives required for NEPA documents will in most cases provide the information required for the analysis of practicable alternatives under the Guidelines (40 CFR 230.10(a)(4). Therefore, to facilitate the COE's analysis of practicable alternatives as required by the Guidelines, as well as fulfill FERC's requirement to examine alternatives pursuant to NEPA, we have investigated the use of a number of variations that would minimize or eliminate disruption to wetland areas.

In general, greater consideration was given to avoiding forested wetlands or wetlands containing unique or significant habitat, and particular attention was given to those wetlands that could be avoided without creating other significant adverse environmental consequences.

A total of 34 route variations were evaluated in the DEIS with the sole intention of avoiding or minimizing wetland crossings. These wetland mitigation variations are in addition to wetland variations previously discussed, which involve other resources besides wetlands. Our analysis was based primarily on a review of FWS National Wetland Inventory (NWI) maps and NYDEC regulated wetland maps, along with recent aerial photography. Table 3.6-1 lists the wetland mitigation variations and indicates their location and sponsor.

3.6.36 Route Variations Under Study

Several route variations were under study at the time the DEIS was published. Our evaluation of these variations is contained in section 6.2. These variations, which were identified to solicit public comment, are as follows:

- Line Creek Variation: MP 13.9 to MP 15.5. This route refinement, located in Canton, St. Lawrence County, is proposed in order to minimize impact on wetlands and to avoid a septic sludge disposal area (see figure A-1, sheet 3

TABLE 3.6-1

Wetland Mitigation Variations

Name	County/Town	Location	Figure A-1 Sheet #
Lisbon Wetland	St. Lawrence/Lisbon	MP 8.1 to MP 9.5	2
Eddy Pyrites	St. Lawrence/Canton	MP 23.7 to MP 24.2	5
Justintown Road Wetland		MP 25.3 to MP 25.7	5
DeKalb Wetland	St. Lawrence/DeKalb	MP 27.4 to MP 29	5
Hermon Wetland	St. Lawrence/Hermon	MP 32.2 to MP 35.2	6
Pond Road Wetland		MP 35.9 to MP 36.3	7
Firefall Wetland		MP 38.3 to MP 39.2	7
Wolf Lake Wetland	St. Lawrence/Edwards	MP 39.5 to MP 39.9	7
Mott Creek		MP 47.9 to MP 48.2	8
Route 812 Wetland	St. Lawrence/Pitcairn	MP 52.5 to MP 52.8	9
Route 3 Wetland	Lewis/Diana	MP 54.9 to MP 56.5	9, 10
Hogsback Creek		MP 60.0 to MP 61.9	10
Blanchard Creek		MP 63.3 to MP 63.5	11
Indian River		MP 64 to MP 64.5	11
Punky Swamp	Lewis/Diana, Croghan	MP 66.5 to MP 69	11
Greig Wetland	Lewis/Greig	MP 93.2 to MP 93.7	15
Wingate Swamp	Oneida/Booneville	MP 110.6 to MP 111.7	18
Kent Creek		MP 113 to MP 113.7	19
Kayuta Lake	Oneida/Remsen	MP 117.2 to MP 118.4	19
South Kayuta Lake		MP 119.4 to MP 120	20
Remsen Wetland		MP 120.3 to MP 121.8	20
Cady Brook		MP 123.2 to MP 123.5	20
Trenton Wetland	Oneida/Trenton	MP 124.5 to MP 125.2	20
Big Bill Brook	Herkimer/Norway	MP 138.6 to MP 139.7	23
Mohawk River	Herkimer/Danube	MP 154 to MP 154.5	25
Canajoharie Wetland	Montgomery/Minden	MP 164.9 to MP 165.5	27
Route 162 Wetland	Montgomery/Charleston	MP 182 to MP 183.1	30
Wright Wetland	Schoharie/Wright	MP 195.6 to MP 196.3	32
Woodlawn Cemetery	Albany/Berne	MP 199.0 to MP 200.1	33
Athens Airport	Greene/Athens	MP 228.9 to MP 229.3	38
Brookfield Wetland	Fairfield/Brookfield	MP 301.8 to MP 302	50
Route 133 Wetland		MP 302.9 to MP 303.1	50
Bound Swamp Wetland		MP 305.1 to MP 305.6	50
Lands End Wetland	Fairfield/Newtown	MP 305.6 to MP 306.4	50

of 57). The route refinement would be located a maximum of 800 feet from the original route, and was developed based on the results of field surveys.

- Route 11 Variation: MP 21.45 to MP 23.7. Located in Canton, St. Lawrence County, the purpose of this reroute is to minimize impact on wooded wetlands (particularly those along Church Brook), to avoid several new homes located along O'Hord Road, and to provide a crossing of Route 11 that would align the pipeline farther form existing structures (see figure A-1, sheets 4 and 5 of 57). This proposed revision was identified based on the results of field investigations.

- Route 28 Variation: MP 115.3 to MP 116.6. Located in Booneville in Oneida County, the purpose of this proposed revision is to avoid several new buildings adjacent to Route 28 (see figure A-1, sheet 19 of 57).

3.6.37 Route Variations Considered But Eliminated From Detailed Analysis

3.6.37.1 Independence River

A route variation was suggested during scoping by Mr. George Cataldo, a landowner in Lewis County, New York, to align the proposed pipeline along the NYPA's 765 kV transmission line and avoid the additional crossing of the Independence River (MP 91.1). An alignment of the proposed pipeline along this transmission line was originally considered and rejected by the applicant as part of Alternative 1B. The routing in this area was also specifically discussed during the New York Article VII proceedings and addressed by the New York ALJs (NYPSC, 1989).

The difficulties with aligning the proposed pipeline along the 765 kV transmission line are discussed in detail in section 3.5.1.1. The proposed crossing would not be visible from public roads, and the proposed pipeline has been routed with optimal consideration of the topography. In the absence of any protective status for this portion of the river, we find the proposed crossing of the Independence River to be environmentally acceptable, considering the recommended stream crossing procedures (see section 5.1.3.2).

However, based on public comment and additional information provided in response to the DEIS, we have evaluated a specific route variation between MPs 84.6 and 92.9 that would result in a new crossing location of the Independence River. This route variation is presented in section 6.2.11.

3.6.37.2 New York Central/Conrail Railroad

A potential reroute starting at MP 110 was considered in order to utilize an existing railroad right-of-way which essentially parallels the proposed route about 1 mile to the west. The New York Central/Conrail railroad line in this area runs between Booneville and Remsen in Oneida County, New York. The proposed route could tie into the railroad corridor by following a primitive road at about MP 110.2 and rejoin the route prior to Remsen at about MP 121.2. The reroute would be about 11.8 miles in length, about 0.8 mile longer than the proposed route. No major rivers would be crossed and the same number of minor streams (15) would be crossed as the proposed route. The proposed route would affect approximately 17.8 acres of wetland while the reroute could affect 23 acres. The proposed route does not affect any residences within 50 feet, while the railroad reroute would affect at least two residences within 50 feet based on the USGS 7-1/2 minute quadrangles. Because the reroute would be longer, affect some residences, and potentially cross more wetland areas, the reroute is not considered desirable. Furthermore, an active railroad such as this presents construction and operational constraints. Generally, active railroads require at least a 20-foot setback from the tracks and possible casing of the pipeline due to the stress caused by passing trains. These constraints limit the apparent opportunity of routing along rail lines.

3.6.37.3 Abandoned Railroad Grade

South of Remsen in Oneida County, New York, an abandoned railroad grade generally parallels the proposed route between MPs 122 and 129. We evaluated a potential route variation using the abandoned grade for about 5.3 miles, which would require an additional 2.9 miles in spur segments to connect the proposed route with the railroad grade.

In all, the route variation would be 1.2 miles longer than the 7-mile-long section of the proposed route it would eliminate. In May 1989 we reviewed this potential route variation during a helicopter reconnaissance of the proposed project. The abandoned railroad grade was eliminated from further consideration because of steep terrain, particularly at the West Canada Creek crossing, and potentially more wetland disruption and minor stream crossings. The old railroad grade follows steep side hills in places that would create engineering and slope stability problems. Furthermore, the crossing of West Canada Creek would probably require an aerial crossing because of the deep cut the river makes in this area (the Trenton Chasm). The applicant's earlier routing attempts in this area eliminated the idea of an aerial crossing of the chasm because of potential visual impact. The route variation along the abandoned railroad grade would also involve the crossing of nine minor streams as compared to six along the proposed route. For these reasons, this route variation was eliminated from further consideration.

3.6.37.4 Cranberry Pond

In response to scoping comments and resource concerns, we examined potential route variations between MP 326 and MP 329 in Stratford, Connecticut, to avoid Cranberry Pond. This wetland area is a federally designated scrub-shrub/emergent wetland. Routing in this area is constrained by several large subdivisions and dispersed residential development, industrial developments, State Route 8, and the Farmill River.

The proposed route parallels an existing electric transmission right-of-way between MP 323.7 and MP 326 and again between MP 328.3 and MP 329. We reviewed this existing right-of-way for routing opportunities between MP 326 and MP 328.3. North of Cranberry Pond, the electric transmission line traverses a residential subdivision with houses immediately adjacent to the right-of-way. In addition, the electric transmission lines span an open water area of Cranberry Pond; construction along the existing right-of-way in this location would require crossing the center of the wetland or disruption to residences.

Similarly, potential route variations to the west of the electric transmission line were constrained by residential development and wetlands associated with Black Brook and Cemetery Pond Brook. An existing pipeline right-of-way to the east of the proposed route was also reviewed and was found to have severe limitations to parallel construction of a new pipeline, particularly where the existing right-of-way traverses a large townhouse development. In contrast, the proposed route avoids dense residential developments and would skirt the edge of the Cranberry Pond wetland to the rear of the residences along Warner Hill Road. In view of our recommended mitigation for construction in wetland areas and the serious flaws in alternative routing in this area, we eliminated the route variations in this area from further consideration in the DEIS.

In response to the DEIS, the town of Stratford and the Housatonic Valley Association (HVA) suggested a specific route variation located to the north and west of Cranberry Pond. This route variation is evaluated in section 6.2.65.

3.6.38 Tennessee Pipeline Route Variations

The majority of the facilities proposed by Tennessee consist of pipeline loops or replacement laterals. For these facilities, route variations are usually not appropriate considering the impact of creating a new right-of-way in an area where one already exists.

In most instances, impact associated with construction along existing right-of-way would be minimized by following the specific mitigation that has been recommended in section 5.1.9.2.2 (e.g., restricted additional clearing, construction along a specified side of the existing loop, or use of specific construction techniques through residential areas).

The proposed North Haven Extension and the Lincoln Extension would require new right-of-way, and were evaluated with consideration of route variations. No route variations were necessary for the Lincoln Extension; two route variations were identified along the North Haven Extension. However, since the publication of the DEIS, Tennessee has amended their application and no longer proposes to construct the North Haven Extension. Therefore, the Tennessee route variations considered in the DEIS are no longer relevant.

3.7 ROUTE VARIATIONS AND MODIFICATIONS IDENTIFIED DURING THE DEIS COMMENT PERIOD

A number of route variations along the proposed Iroquois pipeline route were identified subsequent to the publication of the DEIS. These included new route variations, modifications to variations described in the DEIS in sections 3.6 and 6.1, and in several instances, additional analyses of previous variations. These variations and modifications have resulted from comments received during the DEIS comment period from state agencies, citizens, landowners, and from recent field surveys conducted by Iroquois.

Seventy-six route variations to Iroquois' proposed route were addressed in the DEIS. Sixty-eight new variations and modifications resulted from comments on the DEIS. These 68 variations and modifications include 3 route variations that were under study at the time of publication of the DEIS (Line Creek, Route 11, and Route 28); modifications to or reevaluations of 25 previously proposed variations; and 42 new variations. Of the 42 new variations, 24 have been proposed by Iroquois as a result of field study and landowner negotiations. The remaining 18 variations have been proposed by state agencies and/or local citizens.

Table 3.7-1 tabulates each of these variations and modifications and the resource concern. Each are described in section 6.2 along with our recommendation for their incorporation in the final alignment. Variations or modifications identified during the DEIS comment period that we feel did not warrant through detailed evaluations are addressed in Volume III, section 3.5, responses 3.5-27 through 3.5-40.

3.8 COMPRESSOR STATION ALTERNATIVES

Compression facilities are proposed at one new site in Mendon, Worcester County, Massachusetts.

In assessing the impact of developing a new site, we considered alternatives when specific problems were identified at a proposed site. We evaluated the proposed site for principal environmental factors potentially affected by the construction of the new compressor station - proximity to noise-sensitive areas, loss of prime farmland, land use compatibility, and presence of wetlands and wildlife resources - to determine if any conditions exist that would warrant further consideration of an alternative site. At various times throughout the study, we visited the proposed Mendon Compressor Station site to assess the environmental factors.

TABLE 3.7-1

Summary of Route Variations and Modifications Identified During the DEIS Public Comment Period

Section No.	Variation Name	Map No.	County/Town	Resource Concern
6.2.1	St. Lawrence Wetland MP 0.7 to 1.5	1 of 57	St. Lawrence/Waddington	Wetland
6.2.2	Lisbon Wetland Modification MP 7.0 to 9.6	2 of 57	St. Lawrence/Lisbon	Wetland, drainage tiles, planned sugarbush
6.2.3	Dandy Road Wetland Modification MP 12.6 to 14.1	3 of 57	St. Lawrence/Lisbon	Wetland, road crossings, residential
6.2.4	Line Creek MP 13.9 to 15.5	3 of 57	St. Lawrence/Lisbon, Canton	Septic sludge disposal area, residential
6.2.5	Canton Wetland Modification MP 16.1 to 17.2	3-4 of 57	St. Lawrence/Canton	Wetland, agricultural drainage tiles
6.2.6	Grass River MP 17.8 to 19.3	4 of 57	St. Lawrence/Canton	Cemetery, wetland
6.2.7	Route 11 MP 21.3 to 23.7	4-5 of 57	St. Lawrence/Canton	Wetland, residential area
6.2.8	Justintown Road Modification MP 25.3 to 25.7	5 of 57	St. Lawrence/Canton	Wetland, pine tree stand, agriculture
6.2.9	Route 58 Wetland Modification MP 43.2 to 43.7	8 of 57	St. Lawrence/Edwards	Wetland, agriculture
6.2.10	New Bremen Sugarbush Modification MP 76.5 to 78.6	12-13 of 57	Lewis/Crogham	Sugarbush
6.2.11	Anne's Independence River Alternate MP 84.6 to 92.9	14-15 of 57	Lewis/New Bremen, Watson, Greig	Independence River Crossing
6.2.12	Lyons Falls MP 98.1 to 101.3	16-17 of 57	Lewis/Turin, W. Turin	Wetlands, residential including historic residence
6.2.13	Wingate Swamp Wetland Modification MP 109.6 to 111.8	18 of 57	Oneida/Booneville	Wetlands, existing and planned residential development
6.2.14	Route 28 MP 115.1 to 116.6	19 of 57	Oneida/Booneville	Existing and planned residential/commercial development
6.2.15	Kayuta Lake Wetland Modification MP 117.2 to 118.7	19 of 57	Oneida/Remsen	Wetland, residential
6.2.16	Remsen Wetland Modification MP 120.3 to 122.2	20 of 57	Oneida/Remsen	Wetland
6.2.17	Trenton Wetland Modification MP 124.0 to 125.0	20 of 57	Oneida/Remsen, Trenton	Wetland, pond
6.2.18	King Quarry MP 131.9 to 132.5	22 of 57	Herkimer/Russia	Limestone quarry
6.2.19	Rose Valley Landfill Modification MP 132.5 to 135.5	22 of 57	Herkimer/Russia, Newport	Natural springs, sugarbush, agriculture
6.2.20	Fairfield MP 141.0 to 142.5	23 of 57	Herkimer/Fairfield	Community water supply properties

TABLE 3.7-1 (cont'd)

Section No.	Variation Name	Map No.	County/Town	Resource Concern
6.2.21	Manheim MP 148.1 to 150.8	24-25 of 57	Herkimer/Manheim	Landowner (springs, planned building lots)
6.2.22	Route 5 MP 151.2 to 153.2	25 of 57	Herkimer/Manheim	Landowner (wetland, drainage tiles, cemetery)
6.2.23	Minden MP 160.6 to 164.3	26-27 of 57	Montgomery/Minden	Landowner (Otsquago Creek crossing, woodlot, cemetery),
6.2.24	Deflection No. 10 MP 167.5 to 171.4	28 of 57	Montgomery/Canajoharie	NYDAM (agriculture)
6.2.25	Flat Creek MP 174.2 to 175.6	29 of 57	Montgomery/Root	NYDAM (agriculture)
6.2.26	Route 146 MP 192.0 to 194.8	32 of 57	Schoharie/Wright	Residential
6.2.27	Wright Wetland MP 195.6 to 196.3	32 of 57	Schoharie/Wright	Wetland
6.2.28	Eight Mile MP 208.3 to 209.0	34-35 of 57	Albany/Westerlo	Landowner (residential, horse trails)
6.2.29	Westerlo MP 210.9 to 211.7	35 of 57	Albany/Westerlo	Landowner (springs, terrain)
6.2.30	Greenville MP 217.3 to 218.0	36 of 57	Greene/Greenville	Landowner (springs, road crossing)
6.2.31	Route 81 MP 221.6 to 222.0	37 of 57	Greene/Coxsackie	Residential
6.2.32	Athens MP 225.1 to 225.9	37 of 57	Greene/Athens	Landowners (residential, septic systems)
6.2.33	Athens Airport Wetland Modification MP 228.8 to 230.0	38 of 57	Greene/Athens	Wetland, landowner concerns
6.2.34	Leeds Road MP 231.0 to 231.5	38 of 57	Greene/Athens	Existing and planned residential
6.2.35	Mt. Merino I MP 232.4 to 232.7	38-39 of 57	Columbia/Greenport	Historic house
6.2.36	Mt. Merino II MP 232.4 to 232.9	38-39 of 57	Columbia/Greenport	Historic house
6.2.37	Greenport Ravine MP 233.2 to 234.5	39 of 57	Columbia/Greenport	Landowner, terrain (ravine)
6.2.38	Greenport Quarry Modification MP 236.3 to 237.0	39 of 57	Columbia/Greenport	Terrain (gully)
6.2.39	Livingston MP 241.2 to 241.6	40 of 57	Columbia/Livingston	Quarry
6.2.40	Milan MP 252.3 to 253.6	42 of 57	Dutchess/Milan	Planned residential

TABLE 3.7-1 (cont'd)

Section No.	Variation Name	Map No.	County/Town	Resource Concern
6.2.41	ROW Alignment MP 255.3 to 255.8	42 of 57	Dutchess/Milan	Terrain
6.2.42	Silver Lake Wetland Modification MP 255.6 to 256.1	42 of 57	Dutchess/Milan	Wetland, side slope
6.2.43	Little Wappinger Creek Modification MP 257.7 to 258.4	43 of 57	Dutchess/Clinton	Residential, wetland
6.2.44	Maple Lane MP 259.1 to 259.5	43 of 57	Dutchess/Clinton	Landowner (ravine)
6.2.45	State Route 55 MP 282.9 to 286.6	47 of 57	Dutchess/Dover	Residences, wetlands, landowners
6.2.46	Dover/Sherman MP 282.4 to	47-48 of 57	Dutchess/Dover	State and citizen (use of existing rights-of-way)
6.2.47	Route 55/Route 39 MP 286.6 to 287.9	47-48 of 57	Fairfield/Sherman	Residential subdivision, Wimisink Sanctuary
6.2.48	Wimisink Brook MP 287.7 to 287.9	47-48 of 57	Fairfield/Sherman	Wimisink Sanctuary
6.2.49	Stilson Hill MP 289.0 to 290.5	48 of 57	Litchfield/New Milford Fairfield/Sherman	Residential, Weatinogue Land Trust
6.2.50	East Stilson Hill MP 288.9 to 292.9	48 of 57	Litchfield/New Milford	Residential, Weatinogue Land Trust
6.2.51	Kimberly-Clark MP 291.1 to 292.5	48 of 57	Litchfield/New Milford	Landfill, Pine Knob/Candlewood Mountain
6.2.52	Route 7 MP 293.0 to 301.0	48-50 of 57	Litchfield/New Milford, Bridgewater, Brookfield	Landfill, Still River Preserve and crossing, school, church
6.2.53	New Milford MP 294.5 to 297.7	49 of 57	Litchfield/New Milford	Landfill, golf course, Still River Meanders, school, church, aquifer
6.2.54	Brookfield Variation #1 MP 300.4 to 300.9	50 of 57	Fairfield/Brookfield	Still River gorge
6.2.55	Brookfield Variation #2 MP 301.8 to 302.8	50 of 57	Fairfield/Brookfield	Tree farm, wetlands
6.2.56	Brookfield Variation #3 MP 303.6 to 303.8	50 of 57	Fairfield/Brookfield	Cemetery
6.2.57	Newtown Conrail MP 305.4 to 308.9	50-51 of 57	Fairfield/Brookfield	Use of existing right-of-way
6.2.58	Old Farm Hill Subdivision MP 308.3 to 310.1	50-51 of 57	Fairfield/Newton	New residential subdivision
6.2.59	Newtown Subdivision MP 312.2 to 315.2	51 of 57	Fairfield/Newton	New residential subdivision
6.2.60	Paugussett State Forest MP 315.2 to 315.9	51 of 57	Fairfield/Newton	Residential

TABLE 3.7-1 (cont'd)

Section No.	Variation Name	Map No.	County/Town	Resource Concern
6.2.61	Conrail MP 316.8 to 323.7	52-52A of 57	Fairfield/Monroe	Boys Halfway River, Means Brook wetland, Shelton Land Trust
6.2.62	Forest View Subdivision MP 315.8 to 316.3	51 of 57	Fairfield/Newton	New residential subdivision
6.2.63	Monroe Subdivision MP 316.7 to 318.2	52 of 57	Fairfield/Monroe	New residential subdivision
6.2.64	Shelton Pipeline MP 327.2 to 331.5	53-53A of 57	Fairfield/Shelton	Cranberry bog and pond
6.2.65	Housatonic Valley MP 326.8 to 331.5	53-53A of 57	Fairfield/Shelton New Haven/Milford	Cranberry bog and pond, Farmill River, residential
6.2.66	Cranberry Pond MP 327.6 to 328.3	53 of 57	Fairfield/Shelton	Cranberry bog and pond
6.2.67	United Illuminating ROW MP 328.3 to 330.8	53-54 of 57	Fairfield/Shelton	Use of existing right-of-way
6.2.68	Carroll MP 330.4 to 330.8	54 of 57	Fairfield/Stratford	Residential
6.2.69	Milford Landfall MP 333.9 to 336.6	55 of 57	New Haven/Milford	Transient anchorage, shellfish, Silver Sands State Park
6.2.70	South Commack Terminus MP 369.0 to 369.4	57 of 57	Suffolk/Smithtown	Residential

Tennessee's Mendon Compressor Station would be located off Thayer Road in Mendon, Massachusetts. The approximately 2.1-acre site would be developed for the compressor building and related facilities. In response to our June 22, 1989 data request, Tennessee indicated it had considered an alternative site adjacent to but across the pipeline right-of-way from the proposed site. This site was found to be technically and environmentally comparable to the proposed site. Our review indicated no environmental advantage of the alternative site. The proposed site would not have a significant effect on noise-sensitive areas, land use, wetlands, or wildlife resources.

Our assessment indicated that Tennessee has taken reasonable care in site selection and facility design to protect the environment. We believe that no alternative would be environmentally superior to the site proposed. Further site-specific analysis of the impact of the proposed compressor station follows in section 4.0, "Affected Environment" and section 5.0, "Environmental Consequences."

4.0 AFFECTED ENVIRONMENT

4.1 PROPOSED ACTION

4.1.1 Geology

The geological setting, mineral resources, and potential geologic hazards along the route of the proposed Iroquois/Tennessee Project are summarized in this section. Table 4.1.1-1 shows the major physiographic provinces, topographic conditions, surficial and bedrock geologic units, and the estimated depth-to-rock for each major portion of the proposed facilities.

4.1.1.1 Physiography

The proposed Iroquois route would pass through eight physiographic provinces and subprovinces between the St. Lawrence River in Waddington, New York, and Long Island, New York. Beginning in the St. Lawrence Lowlands and continuing south through the western edge of the Adirondack Highlands, the route would pass through a section of the Erie-Ontario Lowlands along the Black River, then cross the Hudson-Mohawk Lowlands to Otsquago Creek. The route would traverse the Appalachian Uplands to the Helderberg Escarpment, and enter the Hudson River Valley. It would continue through the Taconic Mountains and the Hudson Highlands in Connecticut before entering Long Island Sound. On Long Island, the proposed Iroquois route would traverse part of the Coastal Plain Province before reaching its southern termination point.

Subsurface conditions are controlled primarily by bedrock type and age, faulting and deformational events, and glaciations. The bedrock geology along the proposed Iroquois route is dominated by two general types of rock: Precambrian metamorphic, including gneiss, schist, greywacke, quartzite, marble and amphibolite; and Paleozoic (esp. Cambrian to Middle Devonian) sedimentary, including limestone, dolostone, chert, siltstone, slate, shale, and sandstone. The metamorphic units have been folded extensively and are resistant overall due to a high level of quartzite and silicic intrusives. Topography is generally steeper in the metamorphic units than in regions underlain by the younger sedimentary units, which are relatively undeformed and flat or gently dipping. An exception is the Helderberg Escarpment (MP 228), where steep slopes (15-25 degrees) are found in an area of uplifted limestone and shale.

Physiography and bedrock geology along Tennessee's proposed segments varies greatly, as the segments that would constitute the project are widely scattered. Physiographic provinces that would be crossed by one or more of the route segments include: the Allegheny Plateau, the Hudson Valley and Taconic Highlands, the Lower New England Province, the New England Highlands, and the Seaboard Lowlands.

Subsurface conditions along the proposed Tennessee segments are controlled by bedrock age and type, folding and faulting, and glaciation. Bedrock geologic conditions can be grouped generally into segments underlain by Precambrian and younger metamorphic and granitic rocks, and Paleozoic sedimentary rocks. Gently folded sedimentary rocks of Devonian and Silurian ages, including conglomerates, sandstones, shales, and limestone, underlie the proposed loops in New York. Sedimentary rocks are also present along the proposed segments in Connecticut. Along the proposed Springfield Lateral, bedrock consists

TABLE 4.1.1-1

Geologic Conditions Along the Proposed Iroquois and Tennessee Facilities

Applicant/ Physiographic Province	Bedrock Geology	Surficial Geology	Milepost	Estimated Depth to Rock (ft) a/
IROQUOIS				
St. Lawrence Lowlands	Limestone, dolostone, sandstone, relatively undeformed	Glacial sands, gravel, till, outwash El. 250 - 400	0 - 13.0	>6
			13.0 - 16.5	>5
			16.5 - 20.0	2 - 8
Adirondack Highlands	Gneiss, granite, marble, various metasedimentary and crystalline rocks	Glacial sands, outwash, till, etc., swampy, hummocky El. 400 - 1200	20.0 - 25.0	2 - 8
			25.0 - 71.5	>10 in valleys, <1 on ridges
			71.5 - 76.5	3 - 8
			76.5 - 90.0	>8
Erie-Ontario Lowlands	Metamorphic rock to MP 95, then limestone and shale	Glacial sand, gravel, till, etc. El. 750 - 1200	90.0 - 99.0	>8
			99.0 - 107.0	Varies, generally >10 in valleys, <1 along steep slopes
			107.0 - 125.5	>6
Hudson-Mohawk Lowlands	Flat-lying limestone, shale, dolostone, chert	Glacial deposits & thick alluvium MP 132-136 El. 1100 - 1500	125.5 - 136.0	>6
			136.0 - 143.0	>5
			143.0 - 159.5	>5 on floodplain, exposed on steep slopes
Appalachian Uplands	Sandstone, shale limestone, dolostone, near horizontal beds, minor karst between MP 191 & 196, folded and faulted along eastern margin	Till of variable thickness El. approx. 500 near eastern and western edges, up to 1500 in central area	159.5 - 179.5	>5
			179.5 - 189.0	>6
			189.0 - 191.0	2 - 5
			191.0 - 196.0	0.5 - 5
			196.0 - 198.0	1 on steeper slopes, to 6 in valleys
			198.0 - 216.0	1 - 8
			216.0 - 225.5	>6
			225.5 - 228.0	3 - >10
Hudson River Valley	Sandstone, limestone, shale, dolostone, slate, folded and faulted	Alluvial sand & gravel, silt & clay, occasional glacial till El. 50 - 450	228.0 - 233.0	3 - >10
			233.0 - 248.5	At surface on steep slopes, >40 in lowlying valleys
Taconic/Hudson Highlands	Sedimentary and metasedimentary rock to MP 270, granite, gneiss, schist, and other metamorphic lithologies from MP 270 to 334	Till and other glacial units, alluvial sands and gravels in river valleys	248.5 - 265.5	0 - 3 on hills, >5 in valleys
			265.5 - 271.5	0 - 3
			271.5 - 289.5	0 - 5, on hills, >5 in valleys
			289.5 - 299.0	0 - >10
			299.0 - 307.0	0 - 5
			307.0 - 325.0	0 - 5, >5 in valleys
			325.0 - 331.0	<5
			331.0 - 334.0	Generally >5
Coastal Plain	Crystalline igneous and metamorphic	Glacial outwash: sands and gravels, some clay	334.0 - 369.2	400 - 2,200

TABLE 4.1.1-1 (cont'd)

Applicant/ Physiographic Province	Bedrock Geology	Surficial Geology	Milepost	Estimated Depth to Rock (ft) a/
TENNESSEE				
Allegheny Plateau	Sandstone, shale, limestone, conglomerate	Till, stratified drift El. 800 - 1600	Albany/Schoharie Loop 249-2A-250-2+6.5	0-1.6 on hills, >5 in valleys
Hudson River Valley	Sandstone, limestone, shale, dolostone, slate, folded and faulted	Alluvial sand & gravel, silt & clay, occasional glacial till El. 50 - 450	Columbia/Berkshire Loop 254.0 - 256+8.0	0 to 10 on slopes, gen. > 40 in low lying valleys
Lower New England	Deformed igneous and metamorphic units: granite, gneiss, schist	Glacial deposits: till, stratified drift, etc. El. 50 - 700	Worcester Loop 265.08 - 266+3.3 Haverhill Lateral 270B-302-270B-303	<3 on hills, >5 in valleys <3 on hills, >5 in valleys
Lower New England - Central Lowlands	Sandstone, conglomerate, arkose	Glacial deposits: till, stratified drift, etc.	Wallingford Lateral 345A-201-345A-201+3.2 Springfield Lateral 261B-101+4.11-261B-102	0-3 on hills, >5 in valleys Gen. >5
New England Highlands	Gneiss, granite, schist, phyllite	Glacial deposits: till, stratified drift, etc., w/alluvial deposits	Concord Lateral 270B-103-265E-103	0-4 on hills, >5 in valleys
Seaboard Lowlands	Granite	Till, sand and gravel	Lincoln Ext. 265E-103-265E-103	Gen. >5

a/ Depth to rock estimates based on data provided in applicant's resource reports and data from the USDA Soil Conservation Service.

of arkose, siltstone, sandstone, and shale. Bedrock beneath proposed loops in Massachusetts, New Hampshire, and Rhode Island consists of a wide variety of metamorphic and granitic rocks. These include slate, phyllite, schist, marble, granite, and gneiss. Deformation ranges from none to severe folding and faulting.

The surficial geology along the proposed Iroquois route and the Tennessee segments is largely the result of glaciation and the evolution of postglacial drainage systems and subsequent weathering. Thick deposits of glacial till typically overlie bedrock in valleys and areas of low relief; thinner deposits exist on slopes in areas of more rugged topography. Features associated with glacial retreat are evident above, and sometimes are interspersed with till in many areas. These include fine-grained glaciolacustrine sediments, stratified sands and gravels of glacial outwash plains and kame terrace deposits, and elongated glacial moraines. Rivers have cut deep channels through overburden and bedrock in some areas. Stratified fluvial sediments have settled in the channels and alluvial floodplains of coarser sands and gravels have been deposited.

4.1.1.2 Mineral Resources

Exploitable deposits of sand and gravel are the most prevalent mineral resources found in proximity to the proposed Iroquois and Tennessee routes. Bedrock quarries, though less common, also are present in isolated localities. Table 4.1.1-2 summarizes the identified mining operations that lie in proximity to the proposed Iroquois and Tennessee facilities.

4.1.1.3 Geologic Hazards

Geologic hazards that might affect the proposed pipelines include seismicity; earthquake-induced phenomena such as liquefaction, soil settlement, or slope instability; and unstable ground conditions caused by the presence of karst terrain or steep slopes. Liquefaction is not considered a significant hazard, because there are no widespread areas of soils susceptible to liquefaction along the pipeline route.

Earthquake activity, which can cause pipe failures due to ground vibration, is the most widespread geologic hazard in the area of the proposed pipelines. Though earthquakes are widespread throughout the northeastern United States, and their distribution is far from uniform, there are no known occurrences of surface ground ruptures associated with earthquakes, and no active faults have been identified in the project areas.

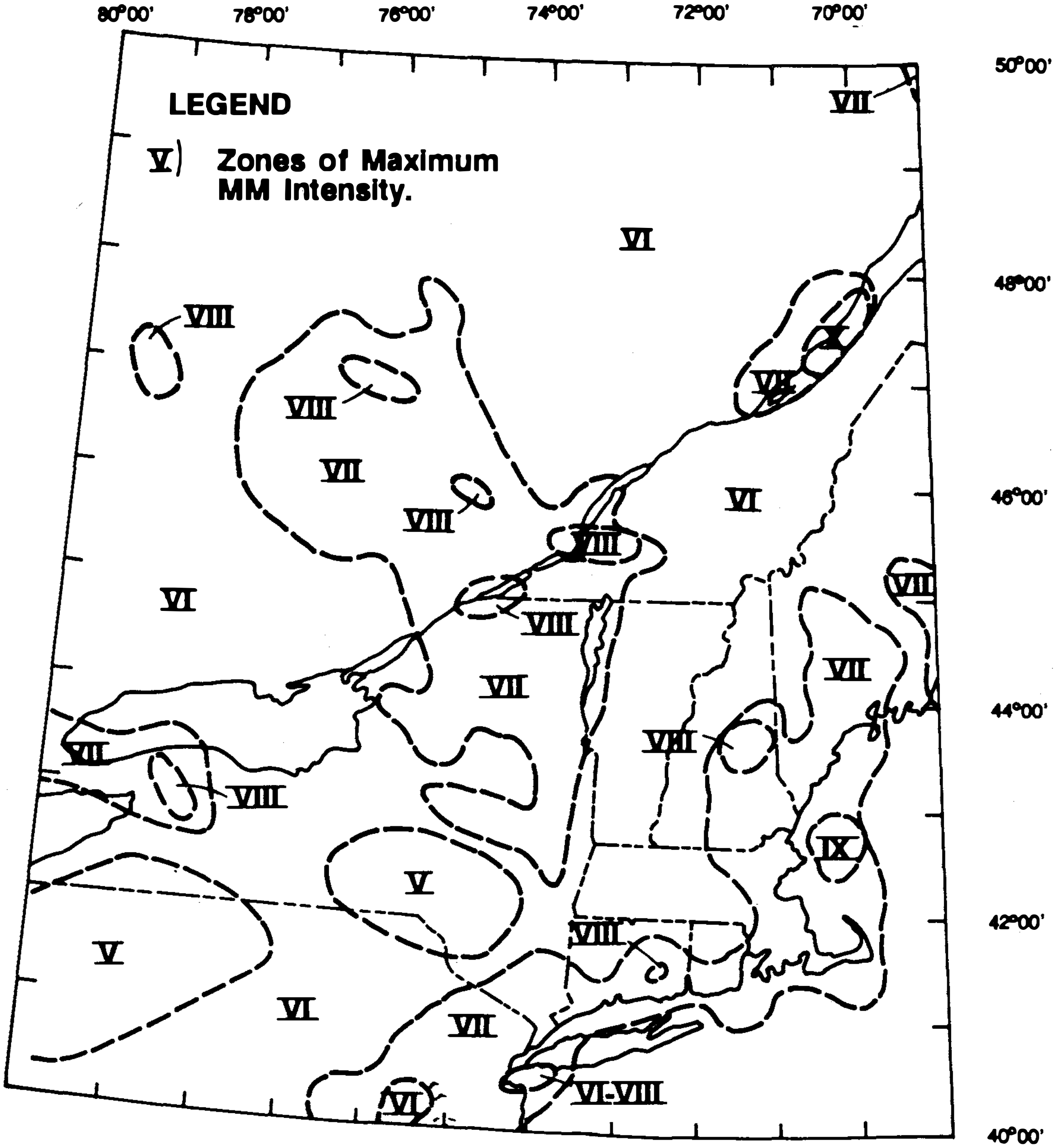
The effect of large earthquakes on the proposed pipelines would depend on the size of the event, the distance of the pipeline from the earthquake source, attenuation of seismic waves due to intermediate and local geological and soil conditions, and the pipeline construction and structural parameters.

Figure 4.1.1-1 is a seismic zonation map of the northeastern United States (Barosh, 1986). As this figure indicates, the only seismic event of Modified Mercalli intensity IX or greater that has been recorded in the northeast was off the east coast of Massachusetts. Intensity VIII events are not reported to have occurred within 100 miles of any planned pipeline segment except at the northern end of the proposed Iroquois route in St. Lawrence and Lewis Counties, New York, and near the Haverhill Lateral in Massachusetts.

TABLE 4.1.1-2

Mining Operations Near the Proposed Iroquois and Tennessee Facilities

Applicant/ Segment	Milepost	Distance (mi)	Direction from Route	Operation	Status
IROQUOIS	40	1	East	Zinc mine	Inactive
	42	0.5	Northwest	Talc mine	Inactive
	43	0.7	Northwest	Talc mine	Active
	57	1	West	Talc mine	Active
	64	1	Northwest	Talc mine	Inactive
	106.5	0.7	East	Limestone quarry	Active
	234	Adjacent	East	Sand and gravel	Active
	236	Adjacent	West	Sand and gravel	Active
	244.5	Adjacent	East	Sand and gravel	Active
	245	Adjacent	East	Sand and gravel	Active
	247.3	0.5	East	Sand and gravel	Active
	247.7	0.5	East	Sand and gravel	Active
	266	Adjacent	West	Sand and gravel	Active
	274	0.5	North	Sand and gravel	Active
	281-282	Adjacent	North	Sand and gravel	Active
	292.7-292.9	Crosses mine prop.	South	Sand and gravel	Active
	296.8	Adjacent	South	Sand and gravel	Active
	300-301	0.4	West	Sand and gravel	Active
	304.3	Adjacent	West	Sand and gravel	Active
	318-319	0.4	West	Pegmatite & marble quarries	Closed
TENNESSEE					
Schoharie/Albany Loop	249-2A+5.6	1.2	North	Sand and gravel	Active
Columbia/Berkshire Loop	254+9.4	0.5	South	Sand and gravel	Active
Worcester Loop	265+2.5-5.0	0.8-2.5	North to South	Sand and gravel	Active
	265+4.8	0.2	South	Sand and gravel	Active
	266+0	0.9	South	Sand and gravel	Active
	266+2.0	0.7	North	Sand and gravel	Active
	266+2.0	0.3	South	Sand and gravel	Active
Concord Lateral	270B-105+14.5	0.1	Southwest	Sand and gravel	Active
	270B-105+14.2	0.1	Southwest	Sand and gravel	Active
	270B-105+10.5 to 270B-105+12.3	1.0-1.5	West	Sand and gravel	Active
Haverhill Lateral	270B-302	0.9	Southwest	Sand and gravel	Active
Wallingford Lateral	345A-201+0.6	1.2	South	Sand and gravel	Active
	345A-201	1.5	Southwest	Sand and gravel	Active



(Source: Barosh, Patrick J., August, 1981. Seismic source zones of the Eastern United States and seismic zoning of the Atlantic seaboard and Appalachian regions. State of the Art for Assessing Earthquake Hazards in the United States - Report No. 21, US Army Corps of Engineers, Misc. Paper S-73-1.)

FIGURE 4.1.1-1

SEISMIC ZONATION MAP OF NORTHEASTERN UNITED STATES

The only portion of the proposed Iroquois route potentially affected by karst conditions is a small region in south-central New York that is underlain by bedded limestone containing karst features. Karst features are more common along the proposed Tennessee loops in New York that traverse areas underlain by carbonate rock units.

Problems associated with surficial stability or landslide hazards are not widespread along either the proposed Iroquois route or the Tennessee segments. Along the Iroquois route, the only section with documented widespread stability problems is in the Hudson River Valley (MPs 232 to 236), which is prone to landsliding due to the presence of fine-grained Lake Albany sediments, relief in excess of 40 feet, and slopes in excess of 12 degrees (Roback and Fickies, 1983).

Along the proposed Tennessee route, no subsidence, slumping, or landsliding has been experienced by existing pipeline segments.

4.1.2 Soils

4.1.2.1 General Soil Conditions

Glaciation has affected virtually the entire project area; most of the soils that would be crossed by the proposed pipelines developed from deposits laid during the last glacial period. The types of materials and how they were deposited are the basis for distinguishing the different soils in the project area. Till, deposited by ice, comprises a heterogeneous mixture of boulders, cobbles, gravel, sand, silt, and clay. Deposited in the form of ground moraines, it is the most common parent material in the project area, and is found from the uplands to the valley bottoms. Another common parent material is outwash, a material deposited by water flowing from melting glaciers. This material is usually well sorted. Fast moving meltwater deposited coarse materials such as cobbles, gravels, and sand in the headwaters of stream systems. Slower moving water deposited finer materials--silt and clay--in the valley bottoms. Some of the coarsest and driest soils in the proposed project area developed from outwash. The last important parent material is lacustrine, or lake deposits. Lacustrine material, usually uniformly sorted fine silts and clays, was deposited at the bottom of glacial lakes and inland seas, which have since drained. Lacustrine is often the parent material of poorly drained, fine-textured soils found in the major valleys of the region.

Soils that have not developed from glacially deposited material occur in some wetlands, where they have developed from partially decomposed plant materials. Other soils have developed from alluvial sediments deposited by modern streams.

4.1.2.2 Soil Groups

The soils of the proposed project area can be categorized into six groups based upon characteristics that are most relevant to pipeline construction, environmental impact, and impact mitigation. These characteristics are terrain, origin, fertility, drainage, stoniness, depth, taxonomic categories, and land use. Table 4.1.2-1 identifies the number of miles of each group that would be crossed by the proposed pipelines.

The first group of soils consists of generally stony soils (Dystrochrepts; lithic, dystric, and aquic Eutrochrepts, and Haplorthods). This is the largest group of soils that would be affected by the proposed pipelines, comprising 52 percent of soils that would be crossed by

TABLE 4.1.2-1

Miles of Soil Groups that Would Be Traversed by the Proposed Iroquois and Tennessee Pipeline a/

Applicant County/State	Group 1 Gently Sloping to Steep Stony Soils b/ (depth to bedrock <60")	Group 2 Level to Sloping Wet Soils c/	Group 3 Gently Sloping to Steep Fertile Soils d/	Group 4 Level, Gentle Sloping, Sandy Soils e/	Group 5 Level, Wet, Organic Soils f/	Group 6 Urban Land g/
IROQUOIS						
St. Lawrence, NY	37.7	8.6	---	6.5	---	---
Lewis, NY	24.7	3.8	5.7	19.7	0.6	---
Oneida, NY	7.2	---	11.2	---	---	---
Herkimer, NY	10.5	15.5	1.4	6.3	---	---
Montgomery, NY	2.6	20.5	0.9	---	---	---
Schoharie, NY	3.0	5.2	3.5	---	---	---
Schenectady, NY	---	2.0	---	---	---	---
Albany, NY	10.1	8.7	---	---	---	---
Greene, NY	4.6	12.0	---	---	---	---
Columbia, NY	---	5.3	1.3	---	---	---
Dutchess, NY	32.0	---	6.9	---	---	---
Litchfield, CT	5.1	0.7	---	5.1	---	---
Fairfield, CT	30.0	2.4	1.8	0.7	0.7	---
New Haven, CT	1.9	0.5	0.6	0.3	---	---
Suffolk, NY	5.9	1.9	—	1.0	---	---
Total	175.3	87.1	33.3	39.6	1.3	
TENNESSEE						
Schoharie/Albany Loop (NY)	0.4	6.9	7.9			---
Columbia/Berkshire Loop (NY/MA)	9.5	0.5	11.6		0.1	---
Worcester Loop (MA)	4.3	0.4	4.7	0.7		---
Concord Lateral (NH)	---	1.5	0.5	2.5		---
Haverhill Lateral (MA)	---	1.6	4.5			---
Wallingford Lateral (CT)	1.8	0.7	0.7			---
Lincoln Extension (RI)	---	---	1.4		0.4	0.5
Springfield Lateral (MA)	---	0.1	—	—	—	—
Total	16.0	11.7	31.3	3.2	0.5	0.5

a/ Overall and individual segment mileage totals do not equal proposed length due to rounding and scaling.
b/ Group 1: Dystrochrepts, infertile Eutrochrepts, Haplorthods. Soil group 1 consists of acid, stony, infertile soils on sloping land.
c/ Group 2: Haplaquepts, Haplaquents, Fragiaquepts, Fragiorthods, Orchraqualfs, Fluvaquents, Udifluvents. Soil group 2 consists of wet soils on floodplains and uplands.
d/ Group 3: Hapludalfs, Eutrochrepts, Dystrochrepts. Soil group 3 consists of well drained, fertile, nearly level soils.
e/ Group 4: Udipsamments, Udorthents, Haplorthods, Dystrochrepts. Soil group 4 consists of sandy, acid, excessively drained soils.
f/ Group 5: Histosols. Soil group 5 consists of level, wet organic soils.
g/ Group 6: Udorthents, areas disturbed by large-scale, urban development.

the Iroquois route (175.3 miles) and 25 percent of soils that would be crossed by the Tennessee segments (16.0 miles). These highly acidic, infertile soils (except for the Eutrochrepts) developed from glacial outwash in gently sloping areas and from bedrock-controlled ground moraine in steep uplands. The Eutrochrepts are slightly acidic to neutral and fertile and require little or no lime. The depth of bedrock is generally less than 5 feet, with outcrops being common in steep areas. These soils are predominantly wooded. However, some of the soils that are in level to gently sloping areas and are not too stony have been converted to pasture and hay lands. They are found throughout the area, but most commonly in the upland areas. The erosion hazard is severe where these soils are on steep slopes.

The second group of soils, comprising 26 percent of all soils that would be crossed by the Iroquois route (87.1 miles) and 19 percent of soils that would be crossed by the Tennessee segments (11.7 miles), includes wet soils (Haplaquents, Fragiaquepts, Fragiorthods, Ochraqualfs, Fluvaquents, and Udifluvents). These level to steep soils developed from lacustrine sediments, ground moraine, and recent alluvium in active floodplains, and are wet most of the growing season because of a high water table at or within 1 foot of the surface. In most of these soils, the high water table is caused by a dense clay subsoil that impedes drainage, although in the Fluvaquents and Udifluvents, the water table is associated with streams and rivers. Because these soils are wet much of the growing season, they are used mostly for pasture, hay crops, and woodland. Where the slope is adequate for drainage structures, some are used for annual crops.

The third group of soils, comprising about 10 percent of all soils that would be crossed by the proposed Iroquois route (33.3 miles) and 50 percent of soils that would be crossed by the proposed Tennessee segments (31.3 miles), includes the deeper fertile soils (Hapludalfs, Eutrochrepts, and Dystrochrepts). These are generally well drained, fertile, nearly level soils derived from ground moraine. They typically have gravelly subsoil, but have a low gravel content within the topsoil. The water table can range from 1 foot to more than 5 feet from September through May, but does not pose a severe limitation to cultivation during the growing season. Drainage measures are often used where these soils are cultivated. Most of the cultivated soils crossed by the proposed pipelines are within this group.

Sandy soils comprise the fourth group of soils, representing 12 percent of all soils that would be crossed by the Iroquois route (39.6 miles) and 5 percent of soils that would be crossed by the Tennessee segments (3.2 miles). These soils are sandy, strongly acidic, excessively drained soils that are primarily Udipsamments, Udorthents, some Haplorthods, and some Dystrochrepts. These soils developed primarily from glacial outwash. Udipsamments are mostly sandy soils, and the other soils have substantial gravel content. They are found on level to gently-sloping terrain. Because they are dry, their use is limited to pasture or forest, unless they are located on floodplains where the water table is high. These soils are subject to wind erosion when the vegetative cover is removed.

Organic soils or Histosols, the fifth group, comprises a small proportion of all soils that would be crossed, less than one percent of soils that would be affected by both Iroquois (1.3 miles) and Tennessee (0.5 mile) alignments. Small amounts of these soils are found throughout the project area in low-lying wet areas, but the amounts are too small to have been mapped in the soil surveys used in this analysis. These soils are saturated most of the year, have a low-bearing capacity, and subside when drained.

The sixth group of soils, accounting for less than one percent (0.5 mile) of soils that would be crossed by portions of the Tennessee route, includes soils that have been drastically altered by urban development. These would mostly be affected by the Lincoln Extension in the Providence, Rhode Island, area. These soils have lost their original horizonation and structural characteristics but are suitable for pipeline construction because of generally good drainage and a bedrock depth of more than 5 feet.

4.1.2.3 Surface Facilities

Table 4.1.2-2 identifies characteristics and agricultural status of soils at proposed compressor and metering stations. Other surface facilities would be constructed within the pipeline right-of-way in a variety of soil conditions.

4.1.3 Water Resources

4.1.3.1 Groundwater

Groundwater resources in the area of the proposed Iroquois and Tennessee alignments include: water table aquifers in shallow, unconsolidated sediments; confined or artesian aquifers in both bedrock and unconsolidated sediments; and unconfined bedrock aquifers in sedimentary, metamorphic, and crystalline rock. Virtually all portions of the proposed alignments have groundwater yields that permit the development of single domestic-use wells, which are defined as those of 10 gallons per minute (GPM) capacity or less. Unconsolidated sand and gravel or bedrock aquifers are present along portions of the alignments and in many areas have been developed for community water-supply systems.

Table 4.1.3-1 provides a summary of the principal aquifers that would be traversed by the proposed Iroquois and Tennessee Projects. A total of 54 aquifers would be crossed by the Iroquois alignment. Forty-one of these are located in New York and 13 are located in Connecticut. Twenty-nine additional aquifers would be traversed by the proposed Tennessee segments. The average yields of the aquifers range from 10 to 35 GPM for properly constructed wells in till or rock, to as much as 250 GPM in some sands and gravels. The thickness of the water-producing zone units, is typically a few tens of feet for the sand and gravel units to several hundred feet for wells in rock. Water quality along the alignment is generally good. Some aquifers, particularly near the Canadian border, have high sulfate content, and elevated levels of hydrogen sulfide are common to areas of the alignment where water is drawn from shale bedrock.

Several hundred municipal, community or private water wells are located within 1.5 miles of the proposed alignments. However, less than seven would lie within 0.1 mile of the alignments. Table 4.1.3-2 lists municipal water wells within 1.5 miles of the proposed routes, the number of wells and approximate population served, and the distance of the wells from the proposed pipelines.

Iroquois

Groundwater along the proposed Iroquois route in New York is found primarily in stratified glacial deposits, river valley deposits, and bedrock fractures. Stratified glacial deposits include lacustrine and beach deposits of clay, silt, and sand, and meltwater deposits of sand and gravel, the latter of which typically are more productive aquifers.

TABLE 4.1.2-2

Soils at Proposed Compressor and Meter Station Sites in the Iroquois/Tennessee Project

Applicant/ Proposed Facility	County	Acres	Soil Series	Engineering Considerations	Agricultural Status
IROQUOIS					
Launching/Receiving					
MP 74.3	Lewis	0.6	Ridgebury	High seasonal water table	None
MP 169.1	Montgomery	0.6	Darien	High seasonal water table	Statewide importance
MP 245.9	Columbia	0.6	Nassau	Shallow bedrock depth	None
MP 331.5	New Haven	0.6	Udorthents	Graded, filled site	None
MP 369.4	Suffolk	0.6	Riverhead	High permeability; hazard of water pollution	Prime
Meter Stations					
MP 8.0	St. Lawrence	0.5	Gloucester	Highly corrosive to concrete	None
MP 270.1	Dutchess	0.5	Mansfield	Poorly drained	None
MP 288.6	Fairfield	0.5	Raypol	Seasonal high water table; high frost heave potential; corrosive to steel	Statewide importance
MP 324.0	Fairfield	0.5	Hollis	Shallow bedrock depth, highly corrosive to concrete	None
MP 329.9	Fairfield	0.5	Charlton	Highly corrosive to concrete	None
MP 331.5	New Haven	0.5	Udorthents	Graded, filled site	None
MP 369.2	Suffolk		Riverhead	High permeability; hazard of water pollution	Prime
TENNESSEE					
Mendon Compressor	Worcester	2.1	Canton	Stony; high permeability; hazard of water pollution	Statewide importance
Meter Stations					
MP 270C-103+1.0	Essex	0.25	Hinckley	Highly corrosive to concrete	None
MP 265E-103+4.75	Providence	0.25	Udorthents	Graded - filled site	None
MP 251-1+3.50	Albany	0.50	Hudson	Severe frost action	Statewide importance
MP 262+4.00	Hampden	0.50	Walpole	Poorly drained	None
MLV 257	Berkshire	0.50	Amenia	High frost action	Statewide importance
MLV 249-2A	Schoharie	1.00	Darien	Variable foundation conditions	Statewide importance
MP 341+4.90	Fairfield	1.00	Charlton-Hollis	Highly corrosive to concrete	None
MP 266+3.28	Worcester	0.25	Montauk	Extremely stony	None
MP 230B-105+0.57	Niagara		Odessa-Churchville	Wet, high frost action	Statewide importance
MP 344+19.94	New Haven	0.50	Walpole	High frost action, wet	None

TABLE 4.1.3-1

Aquifers Traversed by the Iroquois and Tennessee Alignments

Applicant/ County	Type of Aquifer	Milepost	Thickness (ft)	Avg. Yield (GPM)	Description
IROQUOIS					
St. Lawrence	Carbonate	0.0 to 15.0	10-300	35	Sulfate can be >300 mg/l
	Sandstone	15.0 to 30.0	3-280	18	Excessive iron
	Crystalline	30.0 to 53.0	N/A	11	
	Sand & gravel	50.8 to 51.7	1-10	10-100	Oswegatchie River Valley
Lewis	Carbonate	53.0 to 55.0	10-300	35	Sulfate can be >300 mg/l
	Sand & gravel	52.5 to 57.0	1-10	10-100	Excessive iron
	Crystalline	55.0 to 93.0	N/A	11	Low yield
	Sand & gravel, Till	76.5 to 77.5	1-10	10-100	Black River Basin
	Sand & gravel, Till	79.5 to 80.3	1-10	10-100	Black River Basin
	Sand & gravel, Till	84.0 to 87.2	1-10	10-100	Black River Basin
	Till & drift	93.0 to 103.0	10-300	30	
	Metamorphic	103.0 to 107.0	10-500	11	Low yield
Oneida	Sand & gravel	109.0 to 115.0	1-10	10-100	Black River Basin
	Carbonate	107.0 to 125.5	10-300	35	Sulfate can be >300 mg/l
	Sand & gravel	117.0 to 119.0	1-10	10-100	Black River Basin
		121.0 to 121.5	1-10	10-100	Mohawk River Basin
Herkimer	Alluvium	132.7 to 136.3	3-200	200	Excessive iron and/or manganese
	Carbonate	125.5 to 136.0	10-300	35	Hard water
	Shale	136.0 to 144.0	10-1,000	5	Contains hydrogen sulfide gas
	Sand & gravel	145.0 to 147.2	1-10	10-100	
	Sand & gravel	149.0 to 150.5	1-10	10-100	
	Carbonate	144.0 to 155.0	10-300	35	Hard water
	Shale	155.0 to 160.0	10-1,000	5	
	Alluvium	152.0 to 155.5	3-200	200	Mohawk River Valley
Montgomery/	Shale	160.0 to 189.0	10-1,000	5	Contains hydrogen sulfide
Schoharie	Sand & gravel	161.2 to 161.6	10-100	200+	Otsquago Creek
	Sand & gravel	186.5 to 187.7	10-100	200+	Schoharie Creek
Schenectady/	Carbonate	189.0 to 199.0	10-300	35	Hard water
Albany	Shale	199.0 to 231.5	10-1,000	5	Contains hydrogen sulfide gas
	Sand & gravel	199.0 to 199.5	10-100	200+	Fox Creek
Greene/Columbia	Sand & gravel	217.0 to 224.0	1-10	10-100	
	Sand & gravel	241.0 to 249.0	10+	100+	
	Sand & gravel	231.5 to 232.5	8-600	200+	Hudson River Valley
	Shale	232.5 to 249.0	15-1,200	16	Contains hydrogen sulfide gas

TABLE 4.1.3-1 (cont'd)

Applicant/ County	Type of Aquifer	Milepost	Thickness (ft)	Avg. Yield (GPM)	Description
IROQUOIS (cont'd)					
Dutchess	Shale	249.0 to 265.0	15-1,200	16	Contains hydrogen sulfide gas
	Sand & gravel	253.5 to 253.8	1-10	10-100	
	Sand & gravel	265.4 to 266.5	1-100	10-100	Wappingers River
	Carbonate	265.0 to 269.0	35-1,270	22	
	Shale & Schist	269.0 to 281.0	15-1,200	16	High sulfate shale contains hydrogen sulfide gas
	Sand & gravel	281.0 to 286.5	Unknown	N/A	
Suffolk	Sand & gravel	360.0 to 369.0	100-400+	10-250	Upper Glacial Aquifer
Litchfield	Schist & gneiss	286.5 to 289.5	N/A	44	
	Granite & Schist gneiss	289.5 to 294.0	N/A	10	Along fractures
	Carbonate	294.6 to 299.0	N/A	166	
	Sand & gravel	294.6 to 298.8	50-70	250	Stratified, Still River Valley
Fairfield	Carbonate	299.0 to 304.4	N/A	166	Many springs
	Sand & gravel	303.0 to 304.1	60-70	1-200	Still River Valley
	Schist, granite & gneiss	304.4 to 332.0	N/A	12	Low yield
	Sand & gravel	311.0 to 313.5	50-110	250	Stratified, Pootatuck R. Valley
	Sand & gravel	319.3 to 321.5	1-10		Means Brook Valley
	Sand & gravel	329.1 to 331.0	N/A	250	Stratified
New Haven	Amphibolite, schist, granite & gneiss	332.0 to 334.1	N/A	12	In fault and fracture zones
	Sand & gravel	331.0 to 331.5	70	250	Housatonic River Valley
	Sand & gravel	332.0 to 333.0	Unknown	N/A	
TENNESSEE					
Schoharie/	Sand & gravel	249-2A to 249-2A+1.0	N/A	>100	Unconfined, very transmissive
Albany Loop	Sand & gravel	249-2A+7 to 249-A8	N/A	10-100	
Columbia/	Sand & gravel	254+0.0 to 254+0.1	Unknown	10-100	Kinderhook Creek Valley
Berkshire Loop	Sand & gravel	254+9.2 to 255+0.0	Unknown	10-100	
	Gravel	254+7.0 to 254+8.2	Unknown	10+	
	Carbonate	255+2.9 to 256+1.0 256+3.0 to 256+5.7 256+7.0 to 256+8.0	N/A	1-1400	>300 ppm dissolved solids
	Schistose rock	256+5.8 to 256+7.0	N/A	1-30	Good quality
Worcester Loop	Sand & gravel	265+7.1 to 265+7.3	N/A	250	Blackstone River Area
	Sand & gravel	266+1.5 to 266+1.8	N/A	100	Warren Brook
	Till	265+0.8 to 265+7.1 265+7.3 to 266+1.5 266+1.8 to 266+3.8	N/A	<5	
	Igneous/Meta.	265+0.8 to 266+3.8	N/A	5	

TABLE 4.1.3-1 (cont'd)

Applicant/ County	Type of Aquifer	Milepost	Thickness (ft)	Avg. Yield (GPM)	Description
TENNESSEE (cont'd)					
Concord Lateral	Till & bedrock	270B-105+15.0 to 270B-105+10.53	N/A	Low	
Haverhill Lateral	Stratified drift	270B-302+0.0 to 270B-302+0.5 270B-302+2.2 to 270B-302+2.6 270B-302+3.0 to 270B-302+3.4	15-30	100	Near creeks/brooks
	Till	270B-302+0.5 to 270B-302+2.2 270B-302+2.6 to 270B-302+3.0 270B-302+3.4 to 270B-302+6.0	25	1-5	GWL = 15-30'
Wallingford Lateral	Till	345A-201+0.4 to 345A-201+1.3 345A-201+1.9 to 345A-201+3.0		1-100	
	Stratified	345A-201+0.0 to 345A-201+0.4 345A-201+1.3 to 345A-201+1.9	>10	50-500	Coarse grained
Springfield Lateral	Sand bed	261B-101+4.1 to 261B-102+0.0	N/A	<25	Groundwater flows west to east
Lincoln Extension	Till	265E-103+2.4 to 265E-103+4.6	5-10	<2	Unreliable
	Stratified drift	265E-103+4.6 to Meter Sta. M-7	10-25	1-10	

TABLE 4.1.3-2

Public Water Supply Wells Along the Proposed Iroquois and Tennessee Pipelines

Applicant/ State/County/Town	Milepost	Distance & Direction from Route (mi)	Approximate Population Served	No. of Wells	Community Water System/User
IROQUOIS					
New York					
St. Lawrence					
Canton	21.5	0.8 E	141	2	Peter's Park
Hermon	27.7	0.4	500	4	Hermon Village
Lewis					
Diana	53.8	0.2	950	2	Harrisville Village
Greig	93.8	0.2	25	1	Higby Trailer Park
Lyonsdale	106.7	1.2 E	27	1	Maple Lane Mobile Home Park
Oneida					
Remsen	124.0	0.7 W	650	2	Remsen Village
Trenton	126.0	1.2 W	391	3	Barneveld Village
	125.5	0.5 W	362	2	Prospect Village
Herkimer					
Manheim	153.5	0.2 E	84	1	Kuyrkendall Court Mobile Homes
	153.5	0.7 W	137	2	Homestead Trailer Park and Sales
Schoharie					
Esperance	190.5	0.2 W	16	1	Oak Hill Mobile Home Park
	192.0	1.5 SW	982	2	Schoharie Village
Albany					
Westerlo	209.7	0.7 NE	130	1	Northside Water District
	215.4	0.5 SW	30	3	Mapletree Apartments
Greene					
Athens	228.4	0.2 N	180	2	Twin Ponds Apartments
Columbia					
Greenport	235.0	0.5	3,800	3	Greenport Water District #1
	240.8	0.3 E	200	1	Adventist Nursing Home
	235.0	0.8 W	120	2	Stone Bridge Farms Mobile Manor
	234.0	0.8 E	25	1	Nack Trailer Park
Livingston	243.2	0.3 E	105	2	Livingston Mobile Home Park
	243.0	0.1 E	147	2	Maple Lane Mobile Estates
Dutchess					
Clinton	257.3	0.1 W	45	1	Rhinebeck Lodge
Pleasant Valley	267.5	1.2 W	200	2	Cedar Hollow Mobile Home Park
	267.5	1.2 W	101	2	Maynard's Mobile
	267.5	0.9 W	24	1	Lake Lodges Apartments
	269.0	0.2 W	27	3	Palmer Apartments
Union Vale	272.5	1.0	16	1	Parkway Apartments
Dover	283.6	0.5 SW	110	1	Schreiber Water Works
	283.0	0.6 E	31	1	Cedar Lane Mobile Home Park #2
	285.0	1.3 N	23	1	Lake Ellis Mobile Home Park
	285.4	1.5 N	25	1	East Mountain Trail Park
Suffolk					
Northport	361.0	0.4 E	30	2	Crab Meadow Beach
	362.0	0.2-0.8 E	900,000	5	Suffolk County Waste Authority
	363.7	0.6 W	3,500	4	Northport VA Hospital
Greenlawn	366.0	0.1-1.3 E	40,000	5	Greenlawn Water District
Connecticut					
Litchfield					
New Milford	291.5	0.3 SW	162	3	West Falls Mobile Homes
	291.5	0.3 NW	195	1	Lord's Mobile Home
	293.4	0.5 E	44	1	River View Court Associations
	293.4	0.6 E	7,400	2	New Milford Water Company
	294.0	0.9 E	400	1	New Milford Heights

TABLE 4.1.3-2 (cont'd)

Applicant/ State/County/Town	Milepost	Distance & Direction from Route (mi)	Approximate Population Served	No. of Wells	Community Water System/User
Connecticut (cont'd)	294.1	0.5 W	270	2	Forest Hills Estate
	294.5	0.8 NE	7,400	3	New Milford Water Company
	294.9	0.2 E, 0.7 E	36	2	Sunny Valley Farms
	295.0	0.7 W	120	2	Candlewood Spring Association
	295.8	0.6 W	280	4	Birch Grove Association, Inc.
	296.1	0.6 W	320	5	Candlewood Trails Association
	296.1	0.3 E	270	2	Lone Oak Water Company
	296.2	0.3 W	600	5	Mill Brook Water Company
	296.6	0.4 W	200	4	Hi-Vu Water Company
	296.6	0.6 E	136	1	Harrybrooke Condominiums
	297.8	0.6 W	216	1	Candlewood Lake Condominiums
	296.2	1.5 E	216	2	Indian Ridge Water Company
	299.0	1.1 W	240	3	Candleterrace Estates Water Company
Fairfield					
Brookfield	300.6	0.4 W	43	1	Brookfield Elderly Housing
	301.9	0.3 E	220	1	Rural Water Co., Inc., Brook Acres
	302.1	0.7 E	100	1	Silvermine Manor
	302.1	1.2 W	120	2	Candlewood Acres Holding Corporation
	302.3	0.8 E	132	4	Newbury Crossing
	302.6	0.7 E	96	3	Ledgewood Association
	303.4	0.6 W	300	3	Dancon Corporation Brookwood
	303.6	1.0 E	128	4	Dancon Corporation Butternut Ridge
	303.7	0.2 W	880	1	Rollingwood Condominiums
	304.1	0.5 W	424	2	Sandy Lane Village
	304.6	0.7 S	108	2	Brookfield Hills Condominiums
	301.3	1.0 W	876	10	Rural Water Co., Inc., Brookfield Div.
	305.0	0.7 S	486	4	Stony Hill Village
	306.1	0.8 N	124	1	Cedarbrook Apartments
Newtown	306.2	0.3 N	564	1	Greenridge Inc., Water Division
	310.6	0.8 S	3,372	1	Newtown Water Co.
	311.5	0.6 S	700	3	Fairfield Hills Hospital
	313.2	0.6 N	282	4	Olmstead Water Supply Co., Inc.
	314.7	0.8 N	72	1	Lake Zoar
Shelton	323.9	0.8 N	30,300	2	Ansonia Derby Water Company
TENNESSEE					
Massachusetts					
Columbia/Berkshire	255+0.0	0.1 S	220	1	Berkshire Farm Center
Loop	255+2.8	0.3 N	50	1	Gilchrist Spring
	256+2.22	0.9 WSW	250	Unknown	Richmond
	256+4.1	0.9 E	1,109	Unknown	Stockbridge
	256+6.0	0.5 E	1,109	Unknown	Stockbridge
	256+7.26	0.7 NE	1,109	Unknown	Stockbridge
	256+8.0	0.7 SE	2,140	Unknown	Town of Lee
		1.2 SE	2,140	Unknown	Town of Lee
		1.3 SE	2,140	Unknown	Town of Lee (Mitchel Spring/Wells)
Worcester Loop	265+7.0	0.3 N	1,520		Town of Grafton
	266+1.68	0.9 S	1,500		Town of Upton
New Hampshire					
Concord Lateral	Whole length	<1.0	103,400	3	Merrimack County
Connecticut					
Wallingford Lateral	345A-201+1.3	0.04 S	5,722	2	South Central CT Regional Water Authority
	345A-201+1.4	0.4 NNE	5,722	1	South Central CT Regional Water Authority
	345A-201+1.4	1.4 N	80	1	Mansion House Apartments

Valley fill deposits of thick sand and gravel generally underlie floodplains and terraces along rivers and occupy preglacial or glacial valleys, producing locally confined aquifers. The stratified glacial drift usually overlies till and forms unconfined, shallow aquifers. Of the bedrock formations, only the sandstones and carbonates (including limestone, dolomite, and marble) yield significant quantities of water. Aquifers in carbonates are typically unconfined; most aquifers in sandstone are confined.

The proposed Iroquois route would cross a total of 41 aquifers in New York. Twenty-three of these aquifers are located in unconsolidated surficial deposits, while the remaining 18 draw water from bedrock fracture systems. Yields for most wells in unconsolidated glacial and alluvial formations are between 10 and 100 GPM. Where surface water bodies are located in proximity to wells in the unconsolidated zone, pumping-induced recharge may result in higher yields. Yields for bedrock wells range from 5 GPM or less to 40 to 50 GPM.

A total of four community water-supply wells lie within 0.1 mile of the proposed Iroquois alignment in New York. These wells supply part or all of the towns of Livingston, Clinton, and Greenlawn, with a total population of approximately 40,200. Sixty-six additional community water wells are located between 0.1 and 1.5 miles of the proposed alignment.

Groundwater in the vicinity of the proposed Iroquois route in Connecticut comes from wells drilled in crystalline metamorphic bedrock and from unconsolidated glacial and alluvial deposits. The proposed route would cross a total of 13 principal aquifers. Of these, six draw water from fracture zones in bedrock, while seven draw water from unconsolidated surficial deposits. Stratified drift aquifers are the most productive. Yields, which range from 10 to 250 GPM, are dependent on thickness, extent, and permeability of aquifer materials, as well as proximity to and flow of adjacent streams that are sources of recharge. Crystalline metamorphic aquifers underlie much of the proposed route. The more structurally competent granular rocks, such as gneiss, are usually more productive than schists, but well yield is strongly affected by proximity of fault zones and the presence of overlying saturated stratified drift. Bedrock aquifers are the principal source of water for domestic and community use. Approximately 95 community water wells lie within 1 mile of the proposed alignment in Connecticut.

The Pootatuck Aquifer, located in Newtown, is a sole-source aquifer (SSA) that would be traversed by the proposed Iroquois route (MP 311 to 313). The Pootatuck was designated a SSA by the EPA in March 1990. The major criterion for the sole-source designation is that the aquifer provide 50 percent or more of the drinking water for the aquifer service area and that the volume of water that could be provided by alternative supplies is insufficient to meet demand.

On Long Island, the proposed pipeline would be placed in the Upper Glacial Aquifer, which consists of unconsolidated outwash deposits of sand and gravel. The water table is typically deeper than 5 feet and most municipal water supplies are drawn from aquifers at depths of several hundred feet beneath the surface. The proposed route would cross approximately 9 miles of the Nassau/Suffolk Aquifer, which was designated by the EPA as a SSA on June 21, 1978. The Nassau/Suffolk SSA area is delineated by the boundaries of Nassau and Suffolk Counties.

Tennessee

Due to the dispersed nature of Tennessee's proposed segments, groundwater resources along each project segment are described separately.

The first mile of the proposed Schoharie/Albany Loop (New York) would be underlain by a highly transmissive unconfined sand and gravel aquifer that yields more than 100 GPM (Bugliosi, Trudell, and Casey, 1988; Miller, 1988). From MP 249-2A+7.0 to +8.0, this loop would traverse a sand and gravel aquifer yielding 10 to 100 GPM. The segment from MP 249-2A+4.0 to +6.0 would cross sand and gravels of undetermined thickness and high potential yield. Till and bedrock beneath the remainder of the proposed segment yield little water. No known community wells would be within 1.5 miles of the alignment.

The proposed Columbia/Berkshire Loop (New York, Massachusetts) would span an unconsolidated sand and gravel aquifer from MPs 254+7.0 to 255 with an unknown saturated thickness and potential yield of up to 100 GPM. The remainder of the loop would be underlain by till up to 90-feet thick, which is a poor water source except for domestic needs of less than 10 GPM. A bedrock carbonate aquifer underlies the till, except near Richmond and Stockbridge, where the aquifer is in schistose rocks. The carbonate unit yields from 1 to 1,400 GPM, and averages 9 GPM. The high yields are due to localized fractures. However, groundwater from the schistose rocks is generally of better quality and yields are of 1 to 30 GPM. One community water-supply well is located within 0.1 mile of the proposed pipeline segment.

The proposed Worcester Loop (Massachusetts) would be predominantly underlain by till that yields less than 5 GPM of water; however, isolated zones of higher water yields are present. More productive wells in the sand and gravel aquifers near the Blackstone River have yields of 250 GPM and wells in stratified sand and gravel drift near Warren Brook have average yields of 100 GPM. Wells that tap the crystalline igneous and metamorphic aquifers yield about 5 GPM. No community water wells are located within 0.1 mile of this proposed loop.

The proposed Concord Lateral (New Hampshire) would cross a floodplain underlain by silts and silty clay for a distance of 0.6 mile. Cotton (1976) believes this area is drawing from a sand and gravel aquifer, supporting its high potential yield. The remaining portion of the lateral, to MLV 270B-106, would traverse till and bedrock of low potential yield. Three identified wells that serve communities are near this proposed lateral.

The proposed Haverhill Lateral (Massachusetts) would lie in the Merrimack River Basin. The initial portion of the proposed route would be underlain by till that yields only a few gallons per minute. At Hawks, West Meadow Creeks, and Fishnet Brook, the pipeline would encounter stratified glacial drift that can yield as much as 100 GPM. No community water wells are located in this area.

Most of the proposed Wallingford Lateral (Connecticut) would overlie deposits of till and stratified drift that yield from 1 to 100 GPM. The proposed pipeline right-of-way would pass over aquifers that generally comprise coarse-grained, stratified drift underlain by fine-grained, stratified drift, with a total saturated thickness of 10 feet or greater. These deposits typically yield between 50 and 550 GPM. Community water-supply wells are situated less than 1 mile from this proposed lateral. The South Central Connecticut Regional Water

Authority owns a wellfield located adjacent to the proposed pipeline right-of-way at MP 345-201+3.1. Two wells are located approximately 200 feet from the proposed route.

The proposed Springfield Lateral (Massachusetts) would traverse stratified drift deposits, lake bottom sediments, and widespread sand deposits. Near-surface sand beds yield up to 25 GPM while the lake sediments yield little to no water. Sand and gravel deposits are also present beneath the lake sediments. A surface waste facility is located 1 mile north of the proposed site. No community water-supply wells are present near the proposed Springfield Lateral.

The major portion of the proposed Lincoln Extension (Rhode Island) would be underlain by deposits of till. Wells in the till generally have a saturated thickness of between 5 and 10 feet and yield less than 2 GPM. The till is an unreliable water source during dry periods. Water quality is good to excellent. No community wells are located within 1.5 miles of the Lincoln Extension.

4.1.3.2 Surface Waters

Most of the states crossed use an alphabetical classification system to denote water quality for each water body. A summary of these classification systems is presented in table 4.1.3-3. In New York, New Hampshire, and Pennsylvania, the water quality classification is an indication of suitable or best uses of the water body, based on existing water quality. In Massachusetts, Connecticut, and Rhode Island, the water quality classification is based on desired use of the water body.

Iroquois

The proposed Iroquois route would cross 11 river drainages in New York and Connecticut. These drainages are part of six major drainage basins: the St. Lawrence, Black, Mohawk, Lower Hudson, Housatonic River Basins, and Long Island Sound coastal drainage system. These major drainage basins are summarized in table 4.1.3-4. The Mohawk River Basin would contain the largest portion of the proposed Iroquois pipeline (86 pipeline miles), with 101 perennial stream crossings. The Long Island Sound coastal drainage system contains the fewest pipeline miles (35.4) and perennial stream crossings (2).

Surface waters that would be crossed by the proposed Iroquois pipeline include rivers and perennial and intermittent streams, which are listed in appendix E by the route milepost at which they would be crossed. Surface water classifications and type of fishery are also presented in this table. The proposed route would cross 397 water bodies: in New York, 277 perennial and 75 intermittent streams would be crossed; in Connecticut, 45 perennial and 2 intermittent streams would be crossed. These numbers include water bodies that would be crossed more than once. Ten of the surface waters that would be traversed by the proposed Iroquois route are greater than 100 feet wide (see table 4.1.3-5).

A summary of water quality classifications of surface water bodies that would be crossed by the proposed Iroquois pipeline is presented in table 4.1.3-6. Of the 322 perennial water bodies that would be crossed by Iroquois in New York and Connecticut, 49.1 percent are good quality (classified C or better). These numbers are useful for regulatory purposes, but may not reflect actual water quality in the affected area. The reason for this is that New

TABLE 4.1.3-3

Summary of State Surface Water Quality Classifications in Proposed Iroquois/Tennessee Project Area

State	Classification	Description
New Hampshire	A	Potentially acceptable for water supply uses after disinfection. No discharge of sewage, wastes, or other polluting substances into waters of this classification. Quality uniformly excellent.
	B	Acceptable for swimming and other recreation, fish habitat, and, after adequate treatment, for use as water supplies. No disposal of sewage or wastes unless adequately treated. High aesthetic value.
	C	Acceptable for recreational boating, fishing, and industrial water supply with or without treatment, depending on individual requirements.
Massachusetts	A	Waters in this class are designated as a source of public water supply.
	B	Waters in this class are designated for the protection and propagation of fish, other aquatic life and wildlife; and for primary and secondary contact recreation.
	C	Waters in this class are designated for the protection and propagation of fish, other aquatic life and wildlife; and for secondary contact recreation.
	SA	Waters in this class are designated for the protection and propagation of fish, other aquatic life and wildlife; for primary and secondary contact recreation; and for shellfish harvesting without depuration in approved areas.
	SB	Waters in this class are designated for the protection and propagation of fish, other aquatic life and wildlife; for primary and secondary contact recreation; and for shellfish harvesting without depuration (restricted shellfish areas).
	SC	Waters in this class are designated for the protection and propagation of fish, other aquatic life and wildlife and for secondary contact recreation.
Connecticut	AA	Known or presumed to meet water quality criteria that support existing or potential public drinking water supply, fish and wildlife habitat, recreational use, agricultural and industrial supply, and other purposes. Recreational uses may be restricted.
	A	Known or presumed to meet water quality criteria that support potential drinking water supply, fish and wildlife habitat, recreational use, agricultural and industrial supply, and other legitimate uses, including navigation.
	B/A	May not be meeting Class A water quality criteria in one or more designated areas. The goal is Class A.
	B	Known or presumed to meet water quality standards that support recreational use, fish and wildlife habitat, agricultural and industrial supply, and other uses, including navigation.
	CB	Presently not meeting Class B water quality criteria for one or more designated uses. The goal is Class B.
	SA	Marine fish, shellfish, and wildlife habitat; shellfish harvesting for direct human consumption, recreation, and all other legitimate uses including navigation.
	SB	Marine fish, shellfish, and wildlife habitat; recreation, industrial, and all other legitimate uses including navigation.
	SC	Certain marine fish, shellfish, and wildlife habitat; recreational boating, industrial, and other legitimate uses, including navigation and swimming; one or more class SB criteria or designated uses impaired; goal is class SB unless a DET and EPA approved use attainability analysis determines certain uses are non-attainable.
	SC/SB	Presently not meeting SB criteria for one or more designated uses. The goal is class SB.

TABLE 4.1.3-3 (cont'd)

State	Classification	Description
Connecticut (cont'd)	ND	Data not available.
Rhode Island	A	Drinking water supply.
	B	Public water supply with appropriate treatment; agricultural uses, bathing, other primary contact recreational activities, fish and wildlife habitat.
	C	Boating, other secondary contact recreational activities, fish and wildlife habitat, industrial processes and cooling.
	D	Migration of fish; good aesthetic value.
	E	Nuisance conditions; uses limited to certain industrial processes and cooling, power, and navigation.
	SA	Bathing and contact recreation, shellfish harvesting for direct human consumption, fish and wildlife habitat.
	SB	Shellfish harvesting for human consumption after depuration; bathing, other primary contact recreational activities; fish and wildlife habitat.
	SC	Boating, other secondary contact recreational activities, fish and wildlife habitat, industrial cooling, and good aesthetic value.
New York	AA	Suitable for drinking, culinary or food processing; treatment may be necessary.
	A	Similar to AA; may require more extensive treatment than AA water.
	B	Primary and secondary contact recreation.
	C	Secondary contact recreation (i.e., fishing, boating)
	D	Secondary contact recreation. Not conducive to fisheries propagation.
	SA	Commercial shellfishing; primary and secondary contact recreation.
	SB	Primary and secondary contact recreation.
	SC	Secondary contact recreation.
	SD	Limited recreational use.
	(T) (Suffix)	Suitable trout habitat
	(S) (Suffix)	Suitable habitat for trout spawning.
	ND	No data available from NYSDEC.
Pennsylvania	TSF	Trout stocking; maintenance of stocked trout from February 15 to July 31 and maintenance and propagation of fish species and additional flora and fauna that are indigenous to a warm water habitat.
	CWF	Cold water fisheries; maintenance and/or propagation of fish species including the family Salmonidae and additional flora fauna that are indigenous to a cold water habitat.
	HQ	High quality waters; a stream or watershed that has excellent quality waters and environmental or other features that require special water quality protection.

Source: Environment Reporter (BNA)

TABLE 4.1.3-4

Major Drainage Basins Traversed by the Proposed Iroquois and Tennessee Pipeline

Drainage Basin	Number of Pipeline Miles in Basin	Number of Perennial Streams Crossed in Basin
IROQUOIS		
St. Lawrence (NY)	60	48
Black (NY)	60	57
Mohawk River (NY)	86	101
Lower Hudson River (NY)	72.5	62
Housatonic		
New York	8	7
Connecticut	47.5	45
Long Island Sound (LI/NY)	35.4	2
TENNESSEE		
Mohawk (NY)	5.0	5
Hudson (NY, MA)	20.4	20
Housatonic (MA)	11.1	9
Blackstone (MA)	11.0	7
Merrimack (NH, MA)	10.6	13
Quinnipiac (CT)	3.2	2
Woonasquatucket (RI)	1.4	2
Connecticut (MA)	0.1	0

York classifies all streams that are too small to support a fishery as D, while Connecticut assumes all unclassified or unsurveyed waters to be Class A.

TABLE 4.1.3-5

Major Water Crossings

Applicant/ State/Segment	Milepost	Water Body	Crossing Width (ft)
IROQUOIS			
New York	0.0	St. Lawrence River	3,100
	15.55 + 18.10	Grass River	200
	41.35	Oswegatchie River	200
	48.25	W. Branch Oswegatchie River	100
	76.80	Beaver River	200
	94.75	Black River	180
	154.20	Mohawk River	390
	231.90	Hudson River	2,500
Connecticut	330.85	Housatonic River	745
Connecticut/New York	334.15	Long Island Sound	26.3
TENNESSEE			
Worcester Loop	266 + 1.03	West River	150
Concord Lateral	270B - 105 + 10.65	Suncook River	250

TABLE 4.1.3-6

Summary of Water Quality Classes Crossed by The Proposed Iroquois and Tennessee Pipeline

Applicant/ State	Classification	No. of Crossings	% of Total Crossings
IROQUOIS			
New York	AA	2	0.7
	A	2	0.7
	B	14	5.0
	C	101	36.5
	D	135	48.8
	Unclassified/ Not determined	23	8.3
	Total	277	
Connecticut	AA	9	20.0
	A	25	55.6
	B/A	1	2.2
	B/C	1	2.2
	C/B	3	6.7
	SC/SB	2	4.4
	Unclassified	4	8.9
	Total	45	
TENNESSEE			
New York	C	4	16.0
	D	21	84.0
	Total	25	
Massachusetts	A	2	8.0
	B	23	92.0
	Total	25	
New Hampshire	B	4	100.0
	Total	4	
Connecticut	AA	1	50.0
	B/AA	1	50.0
	Total	2	
Rhode Island	B	2	100.0
	Total	2	

Major Navigable Water Bodies

St. Lawrence River - The crossing of the St. Lawrence River would occur at the beginning of the proposed Iroquois pipeline. The crossing point would be located 1.5 miles upstream of Waddington, New York; the river width at the proposed crossing is approximately 3,100 feet. The river's water quality classification is A due to the fact that the river serves as an international border. However, a fishing advisory has been posted 2.5 miles downstream of the proposed Iroquois crossing due to alkylated lead pollution from a facility located in Canada (NYDEC, 1989b). The analysis of a sediment sample taken 6 kilometers downstream of the proposed crossing is presented in table 4.1.3-7. Elevated levels of arsenic, cyanide, barium, and total phosphorus were detected in this sample.

Iroquois conducted chemical analysis of sediment samples collected from the Mohawk, Hudson, and Housatonic Rivers and from Long Island Sound. Samples were analyzed for the presence of priority pollutant metals, pesticides, PCBs, volatile aromatic and halogenated

TABLE 4.1.3-7

Summary of Priority Pollutant Metals Analysis of River Sediments at the Four Navigable River Crossings Traversed by the Proposed Iroquois Route

Parameter	RIVER CROSSING			
	St. Lawrence b/	Mohawk	Hudson	Housatonic
Antimony (mg/kg)		<6	<6	<6
Arsenic (mg/kg)	5.5 c/	1.39 - 1.87	0.99 - 2.95	0.5 - 0.63
Beryllium (mg/kg)		<0.5	<0.5	<0.5
Cadmium (mg/kg)	0.50	<0.5 - 1.16	0.95 - 9.26 c/	<0.5 - 0.64
Chromium (mg/kg)	9	7.99 - 10.7	4.62 - 20.8	19.4 - 26.6 c/
Copper (mg/kg)	12	19.6 - 32.0 c/	4.40 - 14.5	36.5 - 68.9 c/
Lead (mg/kg)	14	10.9 - 11.4	2.50 - 16.6	5.3 - 8.56
Mercury (mg/kg)	0.04	<0.1	<0.1	<0.1
Nickel (mg/kg)	10	10.4 - 11.6	5.94 - 10.4	7.22 - 9.81
Selenium (mg/kg)		<5	<5 - <10	<5
Silver (mg/kg)		<1	<1	<1
Thallium (mg/kg)		<0.5	<0.5	<0.5
Zinc (mg/kg)	33	50.7 - 68.9	21.2 - 66.2	58.2 - 64.5
pH		7.40 - 7.53	6.95 - 7.28	7.26 - 7.65
% Solids		63 - 72	43 - 77	70 - 78

a/ Ranges represent 3 samples
b/ The St. Lawrence River sediments also exceeded background levels for cyanide, total phosphorous, and barium.
c/ Indicates elevated above natural background conditions. (USEPA 1977) [E&E Sediment Analysis].

Source: Ecology and Environment Inc., 1987
Beak Consultants, Inc., 1986

hydrocarbons, and polyaromatic hydrocarbons (PAHs). The results of the testing are discussed in the following paragraphs, where appropriate.

Mohawk River - The Mohawk River would be crossed at MP 154.2. The proposed crossing point is located 4.2 miles downstream of Little Falls, New York; the river width at the proposed crossing is 390 feet. The present water quality classification is C. The Mohawk River at the proposed crossing is part of the Erie Canal/New York State Barge Canal and is considered navigable by the COE. Fecal coliform levels in the vicinity of the proposed crossing are consistently high (NYDEC, 1989b). Sediment sample analysis at the proposed point of the crossing (see table 4.1.3-7) indicated elevated levels of copper.

Hudson River - The Hudson River would be crossed at MP 231.9 of the proposed Iroquois route. The crossing point would be 1-mile downstream of Hudson, New York; the river is 2,500-feet wide at the proposed crossing. The present water quality classification is A. The Hudson River is classified by the COE as a navigable river (Krauser, 1986). There are no major water quality concerns in this part of the Hudson, although elevated levels of cadmium (see table 4.1.3-7) have been detected in the sediments. No detectable polychlorinated biphenyls (PCBs) or pesticides have been found at the point of the proposed Iroquois crossing, although PCB contamination occurs in the upper river basin (Ecology and Environment, 1987).

Housatonic River - The Housatonic River would be crossed at MP 330.9, at a point 4.5-miles upstream of Long Island Sound near Milford, Connecticut. The river width at that point is 745 feet and the present water quality classification is SC/SB. The lower Housatonic River has a history of water quality problems, primarily due to high nutrient input from sewage outfalls and industrial sources. However, the main water quality concern is related to the historically consistent PCB contamination of river bottom sediments. Sediment analyses conducted at the proposed Iroquois crossing point (see table 4.1.3-7) showed no PCBs, but chromium and copper were found to be elevated above normal background levels.

Long Island Sound - The proposed Iroquois pipeline would traverse Long Island Sound along a 26.3-mile route starting at Milford, Connecticut (MP 334), and ending at Eaton's Neck, Northport, New York (MP 360.5). The Connecticut landfall for the proposed pipeline would be at Silver Beach, Silver Sands State Park, Milford. In the vicinity of the proposed landfall, water quality is classified as SB, primarily due to an adjacent municipal wastewater treatment plant discharge. Seaward and west of Charles Island, waters are classified SA. At the Northport landfall, the proposed pipeline would approach the LILCO power-generating facility from the northeast. Water quality in the area of Eaton's Neck is classified SA.

Greig and Sennefelder (1985) conducted a study of PCBs, copper, and cadmium levels occurring in blue mussels collected from the Connecticut shoreline of Long Island Sound, including Milford Harbor. In that study, mussels from Milford Harbor were reported to have concentrations of PCBs well below the U.S. Food and Drug Administration (FDA) standards. Levels of copper and cadmium were well below standards set by the National Health and Medical Research Council of Australia. There are no FDA standards for copper or cadmium. The lack of elevated levels of contaminants in the mussels indicates good water quality.

A potential water quality problem in Long Island Sound is hypoxia (oxygen deficiency). Although vertical water mass mixing is usually present in Long Island Sound, during prolonged calm periods (such as late summer), deeper waters can become isolated from surface waters as a result of sharp thermal gradient (thermocline) formation. Surface waters are generally oxygen-rich due to wave action and photosynthesis, while in deeper waters oxygen demand is usually greater than oxygen production. This may result in oxygen-deficient conditions in deeper waters, which can increase the solubility of chemical contaminants in the benthic sediments. These contaminants could then leach into the water column.

Results of the sediment and elutriate testing in Long Island Sound are presented in table 4.1.3-8. The New England River Basins Commission developed a sediment classification scheme for Long Island Sound. Categorization is performed on the basis of oil and grease, total organic carbon, water content, and silt and clay content. Although some of the sediments are designated class II (suitable for disposal only at one of three disposal sites) by their metals analysis, elutriate testing indicated very low levels of potential contaminants, and in most cases, concentrations were below required detection limits.

Municipal Water Supplies

Five municipal surface-water supplies are located downstream of proposed Iroquois stream crossings as shown in table 4.1.3-9. Municipal surface-water supplies in New York are

TABLE 4.1.3-8

Results of Elutriate Tests and Sediment Analyses in Long Island Sound

Parameter	Elutriate Test Results (µg/l)		Milford Landfill (Bore, n=19) (µg/l)		Northport Landfill (Bore, n=9) (µg/l)		Deepwater (Grab, n=27) (µg/l)	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Copper	<10	0.0	10.74	8.37	7.74	9.34	77.64	34.96
Nickel	<10	0.0	6.15	4.41	4.42	5.53	18.91	7.24
Zinc			21.29	17.69	7.50	7.23	126.56	57.16
Mercury	<0.1	0.0	0.027	0.019	0.019	0.002	0.215	0.101
Lead	<10	0.0	4.06	1.82	3.66	1.94	38.65	17.51
Arsenic	<10	0.0	2.06	1.60	1.11	0.35	4.60	1.92
Cadmium	0.41	0.55	0.36	0.21	0.24	0.02	0.98	0.31
Chromium	<10	8.0	11.57	8.36	7.13	9.72	59.37	25.36
PCBs	<0.02	0.0	<0.01	0.00	<0.01	0.00	0.056	0.032
Oil & Grease (wt%)	0.48	0.14	0.011	0.003	0.011	0.003	<0.01	0.00

Source: Enseco (1987)

protected by state law. The regulations provide that owners make their own rules, which are enforced by the state. In Connecticut, there can be no effluent within 100 feet of the high-water mark of any municipal surface-water supply reservoir. Additionally, there can be no effluent within 50 feet of the high-water mark of a water body flowing into a public water-supply reservoir.

Tennessee

The proposed Tennessee loops and laterals would cross eight major river drainage basins in five states. These major drainage basins are summarized in table 4.1.3-4. The combined proposed Tennessee segments would cross a total of 58 perennial water bodies including water bodies that would be crossed more than once. Two of the water bodies that would be traversed by the proposed Tennessee segments are greater than 100-feet-wide (see table 4.1.3-5).

A summary of water quality classifications that would be crossed by the proposed Tennessee pipeline segments is presented in table 4.1.3-6. Of the 58 perennial water bodies that would be crossed by Tennessee, 63.8 percent are good quality (classified C or better in New York, Massachusetts, New Hampshire, Connecticut, and Rhode Island).

Municipal Water Supplies

Municipal surface-water supplies are located downstream of two proposed Tennessee segments as shown in table 4.1.3-9. Municipal surface-water supplies in New York are protected by state law. The regulations provide for owners to make their own rules, which are enforced by the state. In Connecticut, there can be no effluent within 100 feet of the high water mark of any municipal surface water supply reservoir. Additionally, there can be

TABLE 4.1.3-9

Municipal Surface Water Supplies
Located Downstream of Proposed Iroquois/Tennessee Project Crossings

Applicant/ State/Segment	Milepost	Water Supply	Town	Approx. Distance to Water Supply (mi)
IROQUOIS				
New York	144.05	Beaver Creek Reservoir	Little Falls City	1.0
	207.55	Basic Creek Reservoir	Albany	4.0
Connecticut	321.70	Means Brook Reservoir	Bridgeport Hydraulic Co.	1.0
	324.25	Shelton Reservoirs a/	Bridgeport Hydraulic Co.	0.4
	332.60	Beaver Brook Reservoir a/	SCCRWA b/	0.3
TENNESSEE				
Columbia/Berkshire Loop/NY, MA	255+2.10	Reservoir	Richmond	0.39
Worcester Loop/MA	265+4.80	Carpenter Reservoir c/	Northbridge	1.97

a/ Currently inactive as water supplies.
b/ South-Central Connecticut Regional Water Authority.
c/ Intermittent stream crossed.

Source: Iroquois Resource Reports
Tennessee Resource Reports

no effluent within 50 feet of the high water mark of a water body flowing into a public water supply reservoir. Under Massachusetts regulations (310 CMR 22.21), a 400-foot protective radius is designated around public surface-water supplies. In order to undertake construction within this area, the project must be evaluated by the chief water supply engineer of the regional Massachusetts Department of Environmental Protection (MADEP) Office. None of the proposed crossings in Massachusetts would be within 400 feet of a municipal surface-water supply.

4.1.4 Fish and Wildlife

4.1.4.1 Fishery Resources

Four basic fishery resource types exist in the region of the proposed Iroquois/Tennessee Project: coldwater, coolwater, warmwater, and marine or estuarine fisheries. Anadromous fish, which migrate from marine to freshwater to spawn, are also found in the area. A listing of representive fish species known to occur in the project area is presented in table 4.1.4-1. Fisheries may be considered significant for a variety of reasons including heavy recreational use, protected species, or particular state management practices. Streams that would be crossed that support significant coldwater fisheries resources are listed in table 4.1.4-2.

TABLE 4.1.4-1

Representive Fish Species Known to Occur in The Project Area

Coldwater	Coolwater	Warmwater	Marine	Anadromous
Brown trout (R,L) a/	Northern pike (R,L)	Largemouth bass (L)	Summer flounder	Striped bass
Rainbow trout (R,L)	Muskellunge (R,L)	Channel catfish (R,L)	Bluefish	American shad
Brook trout (R,L)	Smallmouth bass (R,L)	Black bullhead (R,L)	Atlantic Mackerel	Blueback herring
Lake trout (R,L)	Yellow perch (R,L)	Brown bullhead (R,L)	Scup	Alewife
	Walleye (R,L)	Redbreast sunfish (R,L)	Winter flounder	Shortnose sturgeon
		Pumpkinseed (L)	Blackfish	Rainbow smelt
		Bluegill (L)	Weakfish	
		Black crappie (L)		

a/ R =Species that are predominantly found in moving waters
L =Species that are predominantly found in still waters

Coldwater fisheries are generally found in upland areas in head water streams, and are characterized by moderate to steep surrounding topography. Currents are swift and flow over substrates composed of boulder, cobble, or gravel material. Water temperatures are low (less than approximately 20°C), and dissolved oxygen concentrations are high (usually saturated or supersaturated), due to aeration of the water from the turbulent flows and elevated solubility of oxygen in cold water. Alternating riffles and pools are also characteristic of cold water environments. Coldwater fisheries are generally more vulnerable to habitat disturbances caused by oxygen depletion, turbidity and siltation, thermal increases, and poor water quality. Reproducing coldwater species include brook, brown, and rainbow trout, all which are supplemented by stocking.

While trout is probably the most important recreational species in New York and Connecticut, the importance of a fishery resource is not necessarily determined by the species in that water body. Heavily used recreational fisheries of any type are considered important by the state agencies as well as the public. Coolwater and warmwater species of importance are also included in table 4.1.4-1.

Iroquois

Water bodies that would be crossed by the proposed Iroquois route, and their fishery resource types, are presented in appendix E. A total of 108 perennial water bodies that would be crossed by Iroquois facilities have water quality classifications higher than Class D, and thus are conducive to fish propagation; 93 (86.1 percent) support either naturally reproducing or stocked trout populations; 13 (12.3 percent) support coolwater fisheries (i.e., smallmouth bass, pike), and four (3.8 percent) support warmwater fisheries (i.e., sunfish, largemouth bass). Anadromous fish (i.e., striped bass, American shad, and blueback herring) may be found in four (7.5 percent) of the water bodies that would be crossed.

Of the 41 important coldwater fisheries that would be crossed by the proposed Iroquois pipeline, 14 support naturally reproducing trout populations. The remaining 29 are stocked with trout by state agencies. These streams attract recreational fishermen and are

TABLE 4.1.4-2

Significant Fishery Resources Crossed By the Proposed Iroquois and Tennessee Alignments

Applicant State/Segment	Milepost	Water Body	Crossing Width (ft)	Fishery Type a/	Fishery Issue b/
IROQUOIS					
New York	0.0	St. Lawrence River	3100 c/	Cl	1,2
	3.20	Sucker Brook	20	Cl	2
	10.55	Brandy Brook	10	Cl	2
	15.55, 18.10	Grass River	150 c/	Cl	1,2
	27.85	Elm Creek		Cd-S	2
	41.35	Oswegatchie River	200 c/	Cl	2
	48.25	W. Branch Oswegatchie River	100 c/	Cl	2
	51.25	Clear Creek	5	Cd-T	2
	65.05	Indian River	2	Cd-T	2
	76.80	Beaver River		Cl	2
	79.55	Murmur Creek	15	Cd-T	2
	80.75	Black Creek	9.5	Cd-S	2
	84.40	Crystal Creek	25	Cd-T	2
	91.05	Independence River	54	Cd-S	2
	92.10	Otter Creek	20-40	Cd-S,T	2
	94.75	Black River		Cl	2
	106.45	Sugar River	40	Cd-S,T	2
	108.35	Mill Creek	15-20	Cd-T	2
	111.35	West Kent Creek	13	Cd-T	2
	113.05	East Kent Creek	15	Cd-T	2
	115.60	Alder Creek		Cd-S	2
	123.10	Cady Brook	5	Cd-T	2
	125.60	West Canada Creek	45	Cd-S	2
	136.20	Hurricane Brook		Cd-S	2
	137.60	Factory Brook	5	Cd-T	2
	139.05, 139.10	Big Bill Brook	12	Cd-T	2
	139.15	Big Bill Brook	12	Cd-T	2
	140.10	Wolf Hollow Creek	1	Cd-T	2
	145.60	Ransom Creek	12	Cd-S	2
	150.15	Crum Creek	7	Cd-S	2
	154.20	Mohawk River	390 c/	Cl/Wm	2,3
	161.30	Ostquago Creek		Cd-S	2
	170.80	Canajoharie Creek		Cd-S	2
	187.50	Schoharie Creek		Cl	2
	203.95	Switz Kill		Cd-S	2
	213.15	Basic Creek	6-12	Cd-S	2
	224.20	Potic Creek	15	Cd-S	2
	231.90	Hudson River	2500 c/	Cl/Wm	2,3
	245.00	Roeliff Jansen Kill	30	Cd-S	2
	257.95	Little Wappinger Creek		CD-S	2
	265.45, 266.25	Wappinger Creek	40-60	Cd-S/Wm	2
	272.55	Sprout Creek		Cd-S	2
	279.90	Coopertown Brook	1-10	Cd-S	2
	281.70	Swamp River	12-30	Cl/Wm	2
	284.20, 285.25	Tenmile River		Cd/S/Cl	2
	286.25	Deuel Hollow Brook	4-12	Cd-S	2
Connecticut	287.80	Wimisink Brook		Cd-S	2
	289.15	Morrissey Brook		Cd-S	2
	291.70	Bullymuck Brook		Cd-S	2
	292.85	Rocky River		Cd-S	2
	306.45	Pond Brook		Cd-S	2
	311.20	Pootatuck River		Cd-S	2
	327.20	Farmill River		Cd-S	2,3
	330.85	Housatonic River	745 c/	Est	2,3

TABLE 4.1.4-2 (cont'd)

Applicant/ State/Segment	Milepost	Water Body	Crossing Width (ft)	Fishery Type a/	Fishery Issue b/
TENNESSEE					
NY/Schoharie Albany Loop	249-2A + 1.98	King Creek		Cd-T	2
	250-2 + 0.55	Fox Creek (T)		Cd-S	2
NY/Columbia/Berkshire Loop	254 + 1.61	Green Brook		Cd-T	2
MA/Worcester Loop	266 + 1.03	West River	150 c/	Cd-S	2
	265 + 7.03	Blackstone River		Wm	2
MA/Haverhill Lateral	270B-302 + 4.88	Little River		Cd-S	2
NH/Concord Lateral	270B-105 + 10.65	Suncook River	250 c/	Cd-S	2
	270B-105 + 14.36	Suncook River (T)		Cd-S	2
	270B-105 + 14.92	Suncook River		Cd-S	2
CT/Wallingford Lateral	345A-201 + 0.32	Willow Brook		Cd	2
	345A-201 + 1.56	Mill River		Cd-S	2
RI/Lincoln Extension	265E-103 + 3.44	Harris Brook (T)		Cd-S	2
	265E-103 + 4.71	Crookfall Brook (T)		Cd-S	2

a/ Fisheries Type Codes
Wm - Warmwater
Cl - Coolwater
Est - Estuary
Cd-T - Coldwater-Trout Spawning
CD-S - Coldwater-Stocking

b/ Fisheries Issue Codes
1 = Protected Species
2 = Significant Recreational Fishery
3 = Anadromous Fishery

c/ Major stream crossing

Source: Schiavone 1989; Elliot 1989; Moulton 1989; Abraham 1989; Hyatt 1989 usually heavily fished. Some of the more heavily fished trout streams include Crystal Creek (MP 84.4), West Canada Creek (MP 125.6), Roeliff Jansen Kill (MP 245.0), a high quality trout stream, Sprout Creek (MP 272.5), Swamp River (MP 281.7), Tenmile River (MP 284.2 and MP 285.2), and Morrissey Brook (MP 289.1).

The proposed Iroquois route would cross mostly coolwater fisheries for the northernmost 45 miles. Coolwater fisheries are generally found in upland, moderately flowing streams. The coolwater streams in this area are typically more than 10-feet wide, have substrates of gravel, and have clear, cool water. Representative streams of this type include the St. Lawrence River (MP 0.0), Sucker Brook (MP 3.2), Brandy Brook (MP 10.5), and the Grass River (MP 15.5 and 18.1). Representative coolwater fish species include northern pike, muskellunge, smallmouth bass, yellow perch, and walleye.

From MP 45 to approximately MP 150, the streams that would be crossed support predominantly coldwater and coolwater fisheries. Representative coolwater streams that would be crossed by this section of pipeline include West Branch Oswegatchie River (MP 48.2), Beaver River (MP 76.8), and Black River (MP 94.7). Representative coldwater streams include Clear Creek (MP 51.2), Balsam Creek (MP 75.6), and Mill Creek (MP 98.2).

The southern portion of the proposed Iroquois route, south of MP 150, would cross water bodies that contain mostly warmwater fisheries. These fisheries are characteristic of lowland streams, where topography is generally flatter, and currents are slower than in coldwater or coolwater streams. Substrates in this environment are more likely to be composed of finer particulate matter such as silt, sand, and organic material. The higher maximum temperatures, lower dissolved oxygen concentrations, and higher turbidities associated with warmwater streams are generally unsuitable for coldwater fish species for any extended period of time. Representative streams of the warmwater type include Fox Creek (MP 199.3), the Hudson River (MP 231.9).

Major Navigable Water Courses

St. Lawrence River - The St. Lawrence is an important coolwater fishery, supporting smallmouth bass, northern pike, walleye, muskellunge, lake sturgeon (a state-listed threatened species), and most panfish. Muskellunge is known to spawn in Whitehouse Bay; the proposed St. Lawrence crossing is at the entry to this bay. Suitable spawning habitat for rock bass, bluegill, and smallmouth bass also exists in the vicinity of the proposed pipeline crossing, but sport fishing in that area is minimal, according to the NYDEC (Schiavone, 1989).

Mohawk River - The Mohawk River would be crossed by the proposed Iroquois pipeline at MP 154.2. At that point, the Mohawk River is an important cool/warmwater fishery that supports tiger muskellunge, northern pike, walleye, smallmouth bass, and blueback herring (an anadromous fish).

Hudson River - The Hudson River would be crossed at MP 231.9, 1 mile downstream of Hudson, New York. The Hudson River is an important anadromous fishery resource. Anadromous fish species potentially occurring at this location include striped bass, American shad, alewife, blueback herring, and shortnose sturgeon (a Federal-listed endangered species). Smallmouth and largemouth bass are also important fisheries at this proposed crossing location.

Housatonic River - The Housatonic River would be crossed by the proposed Iroquois pipeline at MP 330.8, 4.5 miles upstream of Long Island Sound near Milford, Connecticut. The Housatonic River is an estuary at the proposed crossing point, and the principal fisheries include striped bass, bluefish, winter flounder, and searun brown trout.

Long Island Sound - The proposed Iroquois route would traverse Long Island Sound for a distance of 26.3 miles, starting at Milford, Connecticut (MP 334), and ending at Eaton's Neck, Northport, New York (MP 360.5). The estuarine/marine waters of Long Island Sound support a variety of finfish and shellfish, several species of which are recreationally and/or commercially important. The bulk of the summer commercial fishery consists of scup, butterfish, striped bass, weak fish, summer flounder, and menhaden. The winter flounder and window pane flounder support the winter trawl fishery in Long Island Sound. Bottom trawling activities occur during the summer months in the area of the proposed Iroquois pipeline crossing.

Important shellfish (decapod crustaceans and bivalve mollusks) existing in Long Island Sound include the American lobster (the single most economically significant and active fishery in the Sound), blue crab, red crab, green crab, clams, conchs, oysters, and scallops. The Iroquois route would cross areas where lobster fishing occurs. Additionally, in the nearshore area off Milford, the proposed route would traverse 10,000 feet through oyster/clam lease areas.

Tennessee

Water bodies that would be crossed by the proposed Tennessee facilities and their fishery resource types are listed in appendix E. Four of the 25 perennial water bodies in New York that would be crossed by the proposed Tennessee loops are designated as suitable trout habitats, with two of these capable of supporting naturally reproducing trout populations.

Of the 25 perennial water bodies in Massachusetts that would be crossed by the proposed Tennessee loops, 20 are designated coldwater fisheries that are capable of supporting year-round trout populations, and 2 of these are stocked. In addition, the proposed Worcester Loop would cross the Blackstone River, which supports a warmwater recreational fishery.

Four perennial water bodies would be crossed by the proposed Concord Lateral in New Hampshire. These include the Soucook River and the Suncook River; both of these rivers are stocked with trout.

Of the two water bodies in Connecticut that would be crossed by the proposed Wallingford Lateral, both are considered important because they support fish, have recreational value, or have species with threatened or endangered status. Coldwater fisheries (including brook, brown, and rainbow trout) may be supported by Willow Brook.

The proposed Lincoln Extension in Rhode Island would cross two water bodies. One of the proposed crossings is a tributary to Harris Brook (MP 265E-103+3.44), which is classified as a seasonal coldwater fishery. The proposed Lincoln Meter Station (MP 265E-103+4.71) would border a stream (Crookfall Brook) that is classified as a seasonal coldwater fishery.

4.1.4.2 Wildlife Resources

Wildlife species occurring in the five-state area associated with the proposed Iroquois/Tennessee Project are diverse and characteristic of northeastern forested and agricultural habitats. The applicants have determined that a total of 94 mammalian species, 328 avian species, 33 amphibians, and 37 herpitiles potentially inhabit the proposed project area on a year-round or seasonal basis (Ecology & Environment, 1988a). Specific animal assemblages are characteristic of the various plant communities found along the proposed route (see section 4.1.6).

Forest mammals typically present in the proposed project area include the red-backed vole, red and gray squirrels, eastern chipmunk, gray fox, coyote, and white-tailed deer (which are abundant throughout the area). Mammals characteristic of the more northern and remote sections of the proposed route include the snowshoe hare, porcupine, fisher, martin, bobcat, and black bear. Among the many songbirds commonly found are various warblers, vireos, thrushes, and woodpeckers. The wild turkey, ruffed grouse, and ovenbird are common avian species of the forest floor. Common raptors include the barred owl, great-horned owl, and red-shouldered and broad-winged hawks. Wooded tracts associated with several large rivers (Hudson, Housatonic, and Merrimack) may provide winter roosting habitat for bald eagles. A wide variety of snakes, turtles, small mammals, and amphibians also occur in the eastern forest complex. Rock outcrops and ledges within forested areas provide nesting or denning habitat for turkey vulture, porcupines, and a number of snake species.

Numerous wildlife species are characteristic of agricultural/old field habitats and the ecotone between these habitats and forested land. These species include white-tailed deer, red fox, woodchuck, short-tailed weasel, eastern cottontail, meadow vole, American kestrel, red-tailed hawk, barn owl, and ringed-neck pheasant. In addition, numerous amphibians, reptiles, and small mammal species are common in agricultural habitats throughout the entire project area, and some also utilize forest habitats.

A variety of forested, scrub-shrub, emergent, and open water, freshwater wetland habitats occur along the proposed route (see section 4.1.7). These habitats typically exhibit high wildlife value and also provide significant benefits to the ecological and human environments. Muskrat, beaver, river otter, mink, raccoon, and weasel are important furbearers typically supported by wetlands. Numerous amphibian herpitile and small mammal species also inhabit wetlands. In addition, wetlands provide breeding, migration, and wintering habitat for many species of songbirds, waterfowl, and shorebirds.

Approximately 7 percent of the area traversed by the proposed pipeline is urban/suburban residential habitat. Species present include the common crow, pigeon, European starling, common grackle, a wide variety of songbirds, and many commensal mammals that benefit from an association with humans (skunk, raccoon, opossum, gray squirrel, and various species of rodents).

The proposed Iroquois pipeline would also cross the intertidal coastal habitats associated with Long Island Sound. Marine coastal zones typically possess a high wildlife value and provide breeding, migration, and wintering habitats for numerous songbirds, shorebirds, waterfowls, and raptors. Peregrine falcons are common migrants along the coastal areas of both New York and Connecticut.

On occasion, whales and seals are sited in the Long Island Sound. Seals also occur infrequently in the Housatonic River near its mouth. These sitings are relatively rare and usually occur during the winter months. During the months of August through November, Kemp's Ridley sea turtles migrate into the Long Island Sound to forage on crustaceans, mollusks, and jellyfish (Miller, 1989). Numerous crustaceans, mollusks, and other aquatic invertebrates also inhabit the array of coastal and marine communities associated with Long Island Sound.

A diversity of game species exists along the proposed pipeline route and can be found in all of the habitat types encountered there. Big game species include black bear and white-tailed deer. The proposed project crosses several habitats in New York, known as DWAs, that are critical to deer survival. These areas provide essential cover during severe winters and consist of dense stands of conifers or a mixture of evergreen and hardwood trees located on southwest facing slopes. The proposed Iroquois route would cross six DWAs, as identified by the NYDEC. These are shown in table 5.1.4-2.

Among the many small game species present are the eastern cottontail, woodchuck, and gray and fox squirrels. Furbearers of particular economic importance include coyote, bobcat, red and gray fox, muskrat, beaver, and raccoon. Game birds include wild turkey, a number of waterfowl species, ring-necked pheasant, ruffed grouse, American woodcock, and bobwhite quail.

Nongame species also provide recreational value in that they can be photographed, observed, and fed. Migratory birds, including raptors, waterfowl, shorebirds, and passerines, are the most common nongame wildlife species "utilized" for recreational purposes in the project area.

4.1.5 Endangered and Threatened Species

The Endangered Species Act of 1973, as amended, requires FERC to determine if federally listed endangered and threatened species and/or their designated critical habitats, occur in the vicinity of a proposed project. We have consulted with and received information from the U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS).

Information concerning the known and potential locations of endangered and threatened species was obtained from the Natural Heritage Program Databases or Natural Resource Inventories maintained by each state, as well as from the state regional offices responsible for conservation or protection of fish, wildlife, and plant species. Similar correspondence was implemented by the applicants.

The following sections contain information on the endangered, threatened, and rare species that may occur within the area. This information is based upon the above-mentioned consultations, coupled with pertinent referenced literature. Where known, the exact location of each occurrence is omitted to prevent further disturbance and degradation of these sites.

4.1.5.1 Fish and Wildlife

Federal- and state-listed species known to occur in the immediate vicinity of the proposed Iroquois and Tennessee alignments and their ancillary facilities are listed in table

4.1.5-1. In addition to species listed in table 4.1.5-1 and discussed below, the federally endangered peregrine falcon may occur in the vicinity of the proposed project as an occasional transient. Because it is not known to breed within the vicinity of the proposed project, and would occur only for short periods during migration, the peregrine falcon would not be affected by this project. No further discussion of the peregrine falcon is included in this EIS. No threatened or endangered species are known to occur in the vicinity of the proposed route in Rhode Island.

Bald Eagle (Federal - Endangered)

The bald eagle is a Federal- and state-listed endangered species that breeds in undisturbed forested and open areas generally located near large bodies of water with abundant fish populations. During winter months, bald eagles congregate at night roosts and feeding areas located near ice-free waters that allow ready access to fish. A non-nesting pair of bald eagles has been reported in the vicinity of the proposed Iroquois pipeline in Albany County, New York (NYDEC, 1989a). In addition, winter roosts occur in the general vicinity of the proposed pipeline in St. Lawrence and Greene Counties, New York; Fairfield County, Connecticut; and Merrimack County, New Hampshire.

Piping Plover (Federal Threatened)

Within its eastern range, this shorebird occurs along coastal sand beaches and tidal flats. It requires undisturbed sand beaches for breeding, and development and recreational pressure on breeding habitats limit its breeding success. This species is known to nest on the Connecticut and New York shorelines of Long Island Sound. There are known active breeding sites located approximately 2.5 miles from both the proposed Connecticut and New York landfalls.

Shortnose Sturgeon (Federal - Endangered)

The shortnose sturgeon is a Federal- and state-listed endangered species found in the vicinity of the proposed Hudson River crossing. The area near Kingston, New York, has been identified as the overwintering grounds for the species. As the water temperature rises in the beginning of May, the shortnose sturgeon migrate north to the Albany area. Spawning takes place in mid-May, depending on water temperature, between Coxsackie and Troy, New York (Davel, 1979; 1989). A smaller population of shortnose sturgeon is also found in the tidally influenced portion of the Housatonic River.

Kemp's Ridley Sea Turtle (Federal - Endangered)

The Kemp's Ridley sea turtle is a tropical species that is known to nest along the shores of the Gulf of Mexico and Atlantic Ocean in the southern portion of the United States. Many turtles follow the warm waters of the Gulf Stream and travel as far north as New England. During the years 1985-88, 107 juvenile turtles were recorded in Long Island Sound (Burke et al., unpublished manuscript). This species migrates into the Sound during the months of August through November to forage on crabs, especially the spider crab (Standora et al., 1989) and mollusks and jellyfish (Miller, 1989). The Kemp's Ridley sea turtle is a Federal- and state-listed endangered species.

TABLE 4.1.5-1

Endangered and Threatened Species Occurring in the Vicinity of the Proposed Iroquois and Tennessee Pipeline

Applicant/Segment Species	Status a/	Location
IROQUOIS		
Bald eagle	FE	St. Lawrence County, NY Albany & Greene Counties, NY Fairfield County, CT
Lake sturgeon	NT	St. Lawrence County, NY
Panic grass (*Panicum flexal*) b/	NT	St. Lawrence County, NY
Ram's head lady's slipper	NT	St. Lawrence County, NY
Swamp birch	NR	St. Lawrence County, NY
Slender marsh bluegrass	FC2, NE	Lewis County, NY
Schweinitz's sedge b/	NR	Oneida County, NY
White lady's slipper	NE	Oneida County, NY
Shortnose sturgeon	FE	Greene County, NY New Haven County, CT
Kidney-leaf mud plantain	NR	Greene County, NY
Heartleaf plantain	FC2, NT	Columbia County, NY
Swamp beggar's tick (*Bidens bidentoides*)	NT	Columbia County, NY
Parker's pipewort b/	FC2	Columbia County, NY
Green milkweed b/	NR	Columbia County, NY
Blandings turtle	NT	Dutchess County, NY
Timber rattlesnake	NT	Dutchess County, NY
Bog turtle	FC2, NE	Columbia County, NY Dutchess County, NY
Side-oats grama grass	CR	Litchfield County, CT
Lizard's tail	CR	Fairfield County, CT
Sickle-leaved golden aster	CR	New Haven County, CT
Beach needle grass	CR	New Haven County, CT
Piping plover	FT	New Haven County, CT Huntington County, NY
Kemp's Ridley sea turtle	FE	Huntington County, NY
TENNESSEE		
Schoharie/Albany Loop		
Ram's head lady's slipper	NT	Albany County, NY
Columbia/Berkshire Loop		
Hill's pondweed	NT	Columbia County, NY
Hill's pondweed	MR	Berkshire County, MA
Drooping bulrush	MR	Berkshire County, MA
Fringed gentian	MR	Berkshire County, MA
Worcester Loop		
Wood turtle	MR	Worcester County, MA
Concord Lateral		
Bald eagle	FE	Merrimack County, NH
Eastern hognose snake	HSC	Merrimack County, NH

a/ F = Federal; C = Connecticut; H = New Hampshire; M = Massachusetts; N = New York; C2 = Federal Candidate Status 2 Species; E = Endangered; T = Threatened; R = Rare; SC = Special Concern

b/ Historic Record

Source: Connecticut Natural Diversity Data Base
Massachusetts Natural Heritage Program
New Hampshire Fish & Game
New Hampshire Natural Heritage Program
New York Division of Fish & Game
New York Natural Heritage Program

Bog Turtle (Federal-C2, NY - Endangered)

The bog turtle is a Federal candidate status 2 species and a state-listed endangered species for New York. This turtle is found in wet sedge meadows with shallow water (1 to 4 inches) interspersed with tussock grass. The bog turtle rarely leaves the wetland and is often difficult to find because of its secretive nature; it is generally concealed by vegetation. It nests on sedge hummocks and hibernates communally in abandoned muskrat lodges/tunnels and along the root systems of dead trees. Confirmed occurrences of this turtle have been documented for Columbia and Dutchess Counties, New York (NYNHP, 1989; Vance, 1989).

Lake Sturgeon (NY - Threatened)

The Lake Sturgeon is reported to occur in several water bodies along the proposed Iroquois pipeline route (Schiavone, 1989). This species spawns in the vicinity of the crossings of the St. Lawrence River (MP 0.0) and the Grass River (MP 15.5 and MP 18.1). Lake sturgeon are confined to larger lakes and rivers where they prefer clean sand, gravel, or rocky substrate. Spawning occurs at ice breakup (Smith, 1985).

Blanding's Turtle (NY - Threatened)

Blanding's turtle is primarily an aquatic species and typically is found in shrubby loosestrife/buttonbush swamps with open water. This turtle nests in open upland, generally in sandy or gravelly areas, and hibernates in mud. Blanding's turtles are a state-listed threatened species and have been confirmed as occurring in the proposed project vicinity in portions of Dutchess County, New York (NYNHP, 1989).

Timber Rattlesnake (NY - Threatened)

The timber rattlesnake, a state-listed threatened species, occurs in Dutchess County, New York (NYNHP, 1989), in the general area of the proposed project. The timber rattlesnake is typically found among rocky outcroppings on forested hillsides, and is generally associated with second growth deciduous or coniferous stands. These snakes are viviparous and hibernate in rocky crevices usually overgrown with dense brush.

Wood Turtle (MA - Rare)

The wood turtle is primarily a terrestrial species found in open deciduous forests. This turtle requires clean running streams for its courtship activities and lays its eggs in sandy soil or gravel. Wood turtles hibernate under decaying vegetation, in sand, on streambottoms or in streambanks, or in abandoned muskrat burrows. This state-listed rare species has been documented as occurring along the proposed Worcester Loop in Worcester County, Massachusetts (Sorrie, 1989).

Eastern Hognose Snake (NH - Special Concern)

The eastern hognose snake has been documented in the immediate vicinity of the proposed Concord Lateral in Merrimack County, New Hampshire. This state-listed special concern snake is commonly found in open woodlands associated with sandy soils. It hibernates under forest floor debris, stumps, and trash piles and may often seek cover by burrowing.

4.1.5.2 Plants

Endangered and threatened plant species that occur in the vicinity of the proposed Iroquois and Tennessee pipelines are listed in table 4.1.5-1. A total of 18 species at 20 locations have been confirmed as occurring within the vicinity of the proposed project. The majority of these rare plants are associated with wetland habitats. None of these plants are federally listed as endangered or threatened, however, three are currently listed as candidates for Federal listing.

Slender Marsh Bluegrass (Federal - C2, NY - Endangered)

Slender marsh bluegrass, a Federal candidate status 2 species and a state-listed endangered species, has been confirmed as occurring in the vicinity of the proposed route in Lewis County, New York (NYNHP, 1989). This plant is found in bogs and wet woods.

Heartleaf Plantain (Federal - C2, NY - Threatened)

Heartleaf plantain, a Federal candidate status 2 species and a state-listed threatened species, occurs in the vicinity of the proposed route in Columbia County, New York (NYNHP, 1989). This plant is restricted to marshes or shallow fresh water.

Parker's Pipewort (Federal - C2)

Parker's pipewort, a Federal candidate status 2 species, occurs in the vicinity of the proposed route in Columbia County, New York (NYNHP, 1989). This pipewort is found most commonly in shallow water habitats, tidal flats, and muddy shores.

Panic Grass (NY - Threatened), Ram's Head Lady's Slipper (NY - Threatened), Swamp Birch (NY - Rare)

Panic grass (*Panicum flexal*) and ram's head lady's slipper (both state-listed threatened) and swamp birch (state-listed rare) occur in the vicinity of the proposed project in St. Lawrence County, New York (NYNHP, 1989). Panic grass, primarily an upland species, prefers moist or dry soils in open woods. Ram's head lady's slipper occurs in moist, usually acid, soils in coniferous woods. Swamp birch, a low growing upright shrub, occurs in acid bogs. Ram's head lady's slipper also occurs in the vicinity of the proposed Ontario/Seneca Loop in Seneca County, New York.

Schweinitz's Sedge (NY - Rare), White Lady's Slipper (NY - Endangered)

Schweinitz's sedge occurs in the proposed project vicinity in Oneida County, New York, where it is state-listed rare. Schweinitz's sedge is an obligate wetland species and is found in swamps and wet soils. White lady's slipper, another obligate wetland species, is state-listed endangered and is also found in the vicinity of the proposed route in Oneida County, New York. This orchid prefers calcareous soils of marly bogs and open swamps.

Kidney-leaf Mud Plantain (NY - Rare), Swamp Beggar's Tick (NY - Threatened), Green Milkweed (NY - Rare)

Kidney-leaf mud plantain is found in the vicinity of the proposed route in Green County, New York, where it is a state-listed rare species. This obligate wetland plant is usually found submerged, floating or creeping in mud. Swamp beggar's tick (*Bidens bidentoides*) is found in the vicinity of the proposed route in Columbia County, New York, and is a state-listed threatened species. Another obligate wetland species, swamp beggar's tick, occurs on muddy shores. Green milkweed, an upland state-listed rare species, occurs in the vicinity of the proposed route in Columbia County, New York (NYNHP, 1989). Green milkweed occurs in dry upland woods, prairies and barrens, and prefers sandy soils.

Side-oats Grama Grass, Lizard's Tail, Sickle-leaved Golden Aster, Beach Needle Grass (CT - Rare)

The following four species occur in the vicinity of the proposed route in Connecticut and are all state-listed rare species. Side-oats grama grass, a dry woods species, occurs in dry sandy soils within the vicinity of the proposed project in Litchfield County. Lizard's tail occurs near the proposed route in Fairfield County. This obligate wetland species occurs in swamps and marshes, along margins of streams and ponds, and in low woodlands. Sickle-leaved golden aster and beach needle grass, which both inhabit dry sandy soils, are found near the proposed route in New Haven County, Connecticut.

Hill's Pondweed (NY - Threatened, MA - Rare)

Hill's pondweed occurs in the vicinity of the proposed project in both Columbia County, New York (Columbia Loop), where it is a state-listed threatened species, and in Berkshire County, Massachusetts, where it is a state-listed rare species. This obligate wetland species is found in shallow water habitats.

Drooping Bulrush, Fringed Gentian (MA - Rare)

Drooping bulrush and fringed gentian occur in the vicinity of the proposed route in Berkshire County, Massachusetts; both are state-listed rare species and are obligate wetland species. Drooping bulrush is found in shallow water habitats, usually in marshes, swamps, and along pond margins. Fringed gentian is found in low woodlands, wet meadows, and along brook banks.

4.1.6 Vegetation

The major vegetative types occurring in the vicinity of the proposed Iroquois and Tennessee Project include forest, agriculture, old field, wetlands (refer to sections 4.1.7 and 4.1.9 for a detailed discussion), and ornamental plantings. Agricultural/old field, and forested land are the most abundant cover types that would be traversed by the proposed pipeline (Iroquois: 48 percent and 37 percent, respectively; and Tennessee: 38 percent and 50 percent, respectively). In the seven states that the proposed project traverses, two major eastern forest cover types predominate (Eyre, 1980): maple-beech-birch (northern hardwoods) and oak-hickory (central hardwoods). Four additional cover types occur with limited and somewhat localized distributions. These include elm-ash-cottonwood, aspen-birch, spruce-fir, and white-red pine cover types. Differences in forest cover types are generally attributable to changes in climate and soil conditions.

In New York, forest cover consists predominantly of northern hardwoods (typically sugar maple, American beech, yellow birch, black cherry, and red maple), which occur in most of the north and central sections of the state; and oak-hickory (northern red; black, white, scarlet, and chestnut oak; and bitternut, mockernut, pignut, and shagbark hickories), which occur in the Hudson Valley region. The elm-ash-cottonwood cover type is found along the St. Lawrence River in the most northern region of the proposed pipeline, and pockets of aspen-birch, spruce-fir, and white-red pine forests are scattered along the northern half of the proposed route (Eyre, 1980; Brooks, 1981). Understory species throughout this region include saplings and seedlings of the canopy species, as well as striped maple, hobblebush, flowering dogwood, and choke cherry. The shrub strata consists of blueberries, huckleberries, honeysuckles, laurels, and various viburnums.

Approximately 60 percent of the total land surface of New York is forested (Brooks, 1981); and of this, 85 percent (15,485,000 acres) is commercial forestland. Forests that would be affected by the proposed project are second or third growth. Additionally, sugar maples are an important resource for New York, which produces over 25 percent of all maple syrup products in the United States. Effort has been made by Iroquois to avoid these sugar maple stands or "sugar bushes." Iroquois obtained maps of commercial maple stands from local sugar bush associations and the Lewis County Planning Department, and used these maps in planning route variations.

In Connecticut, the major forest cover types include central hardwoods (oak-hickory) and a transition zone containing hardwoods of both northern and central forests. Typical species include oaks (white, black, and northern red) and hickories (shagbark, bitternut, and mockernut) as well as sugar and red maple, American beech, yellow birch, and black cherry. Here, northern hardwoods are usually found at the higher, wetter north-facing elevations and the central hardwoods at the lower, drier elevations.

For the Tennessee loops and new facilities, the major cover types that would be traversed by the proposed pipeline are forested land (50 percent) and agricultural/open field (38 percent). In the five states that the facilities would cross, oak-hickory forests are most common. For the proposed New York and western Massachusetts loops, northern hardwoods predominate. In eastern Massachusetts, Connecticut, and Rhode Island, oak-hickory characterizes the forest cover. Forest cover in New Hampshire consists of mixed northern hardwoods and conifers.

Agricultural land most commonly found along the route of the proposed facilities includes pasture for dairy cattle, hay, cash crops (corn, wheat, soybeans), apple orchards, and Christmas tree plantations. Old field occurs in various stages of succession and vegetation characteristically includes numerous grasses, annual and perennial forbs, blackberries, raspberries, multiflora rose, smilax, Japanese honeysuckle, eastern red cedar, white pine, and aspen.

Vegetation in residential areas consists of a mosaic of native vegetation, typically oaks and maples, and ornamental plantings that include various flowering trees and shrubs. Plant cover here may be contiguous or isolated. These corridors and islands provide important habitat for wildlife species in urban/suburban environments.

4.1.7 Wetlands

Wetlands perform a number of important functions, including water quality improvement, flood and stormwater control, erosion control, recreation, and fish and wildlife habitat. Wetlands help maintain good water quality through the removal and retention of nutrients, the processing of organic and chemical wastes, and the reduction of sediment load. In their natural undisturbed condition, wetlands act as a temporary storage area for storm flood waters, protecting downstream areas from flood damage. The abundant vegetation associated with wetlands acts as the primary erosion deterrent; root systems bind sediments and reduce wave action and current velocity.

Both consumptive and nonconsumptive activities are associated with wetlands. Hunting and fishing are common sports that take place in and around wetlands. Nonconsumptive activities in wetlands include hiking, canoeing, bird watching, and photography. Coastal and inland wetlands provide breeding, migratory, and winter habitats for a number of birds, mammals, and fish. Many of the rare animal and plant species that would be encountered along the proposed route are associated with wetlands.

The COE and the EPA define wetlands as:

> *Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.* (COE, 33 CFR 328.3; EPA, 40 CFR 230.3).

The U.S. Department of Agriculture Soil Conservation Service (SCS) and the FWS have similar definitions. The FWS definition includes vegetated and nonvegetated areas. All four agencies' definitions of wetlands are conceptually the same and include three basic parameters for identifying wetlands: hydrology, vegetation, and soils (Federal Interagency Committee for Wetland Delineation, 1989).

In the five states that would be crossed by the proposed facilities, wetland definitions are similar, but not all states require the three parameters mentioned above to determine wetlands. In Massachusetts, Rhode Island, New York, and New Hampshire, definitions of wetlands rely heavily on vegetation and hydrology. In addition, New York maps only wetlands that are 12.4 acres or larger. Connecticut defines wetlands based primarily on soil types (poorly drained, very poorly drained, alluvial, and floodplain) as designated by the National Soils Survey.

On a regional basis, wetlands, primarily palustrine, compose from 5 to 10 percent of the land surface of the five states that would be affected by the pipeline construction. In New York and New Hampshire, less than 5 percent of the land surface is wetlands. Wetlands comprise from 5 to 15 percent of the land surface in Connecticut, Massachusetts, and Rhode Island (Tiner, 1985). Wetland crossings totaling 25.4 miles occur along the proposed routes and would be affected by construction of the Iroquois/Tennessee Project (see table 4.1.7-1). Wetlands that would be crossed include emergent, scrub-shrub, forested, tidal flats, open water, and gravel beaches.

TABLE 4.1.7-1

Wetlands Crossed by the Proposed Project a/

Applicant State	Beginning MP	NWI Classification b/	Length of Crossing (ft)	New or Existing Right-of-Way c/
IROQUOIS				
New York	0.00	L1OWHh	1790	N
	0.34	L2OWHh	310	N
	0.81	PFO1E	1630	N
	3.20	R2OWHh	50	N
	4.40	PEM5E	50	N
	5.21	PEM5E	150	N
	5.80	PSS1E	150	N
	5.86	PEM5E	50	N
	8.42	PFO1E	1160	N
	8.65	PFO1E	840	N
	10.53	PSS1E	520	N
	10.76	PSS1E	370	N
	11.71	PFO1E	790	N
	12.06	PFO1E	330	N
	12.31	PSS1E	1350	N
	12.70	PFO1E	730	N
	12.84	PFO1E	1900	N
	13.75	PSS1E	100	N
	14.10	PFO1E	420	N
	14.45	PEM5zb	730	N
	15.63	R3OWH	150	N
	15.70	PFO1E	470	N
	16.96	PSS1E	260	N
	17.90	PSS1	210	N
	18.42	PEM5C	50	N
	18.50	PFO1E	310	N
	21.40	POWzb	1370	N
	21.96	PEM5E	100	N
	22.05	PEM5E	100	N
	22.29	PEM5E	100	N
	22.35	PEM5E	370	N
	23.50	PEM5E	150	N
	23.85	PEM5E	1210	N
	24.16	PFO1E	150	N
	25.07	PFO1C	470	N
	25.60	PFO1E	470	N
	27.78	PEM5A	150	N
	27.83	R3OWH	50	N
	28.42	PEM5E	50	N
	28.65	PEM5A	470	N
	29.99	PEM5E	100	N
	30.10	PSS1/EM5E	100	N
	30.19	PEM5E	150	N
	30.40	PEM5E	50	N
	32.50	PFO1E	420	N
	32.93	PFO/SS1Eb	680	N
	33.83	PFO5/OWFB	370	N
	34.80	PSS1/EM5Eb	150	N
	35.10	PSS1/EM5Eb	630	N
	36.15	PEM5E	150	N
	36.33	PEM5E	210	N
	37.20	R3OWH	50	N
	37.64	PFO1E	310	N
	37.75	PFO1E	790	N
	38.00	PFO1E	420	N
	38.55	PFO5Fb	50	N
	38.59	PFO1E	150	N
	38.70	PFO1E	210	N

TABLE 4.1.7-1 (cont'd)

Applicant State	Beginning MP	NWI Classification b/	Length of Crossing (ft)	New or Existing Right-of-Way c/
	38.76	PFO1E	470	N
	39.41	PFO1E/5Fb	100	N
	39.64	PFO1E	150	N
	41.01	PEM5E	100	N
	41.60	R3OWh	150	N
	42.77	R3OWH	50	N
	43.08	PSS1/EM5C	150	N
	43.25	PSS1/EM5C	310	N
	43.40	PFO/SS1E	470	N
	44.06	PSS1C	730	N
	46.50	PFO5/SS1Eb	420	N
	48.00	PFO4B	210	N
	48.15	PSS1E	50	N
	48.25	R2OWH	100	N
	49.10	PSS1/EM5E	150	N
	50.31	PFO1A	50	N
	50.90	PSS1/EM5E	150	N
	51.30	PSS1/EM5E	370	N
	51.80	PFO/SS1A	50	N
	52.51	PEM5A	50	N
	52.61	PFO4B	950	N
	53.55	PSS1E	150	N
	54.01	PFO/SS1E	470	N
	54.46	PSS1/EM5E	150	N
	55.02	PSS1E	100	N
	55.21	PSS1A	50	N
	55.30	PFO1E	470	N
	55.80	PSS1E	370	N
	56.15	PFO6/4E	890	N
	56.21	PSS1E	470	N
	56.50	PEM5Bd	310	N
	57.10	PFO4B	790	N
	57.55	PFO1E	470	N
	58.98	PSS1E	470	N
	60.25	PFO1E	100	N
	60.36	PFO1E	950	N
	60.94	PSS1E	420	N
	61.31	PFO1E	370	N
	61.65	PFO1E	150	N
	63.36	PFO4B	470	N
	63.59	PSS1E	520	N
	64.19	PSS1E d/	260	N
	65.05	PSS1/EM5E d/	420	N
	66.02	R3OWH	50	N
	66.21	R3OWH	50	N
	66.49	PEM5Eb d/	730	N
	66.85	PSS1/EM5E	50	N
	66.86	PFO4/6B d/	580	N
	67.36	PFO1E	100	N
	67.49	PFO1E	50	N
	68.45	PFO1E	210	N
	68.74	PFO1E	150	N
	69.66	PFO1E	100	N
	71.55	PSS1/EM5E	310	N
	73.70	PFO1	470	N
	83.75	PSS1	150	N
	87.00	PSS1	50	N
	88.10	PFO1	50	N
	89.80	PFO1	210	N
	91.05	ROWH	260	N
	92.07	ROWH	210	N

TABLE 4.1.7-1 (cont'd)

Applicant State	Beginning MP	NWI Classification b/	Length of Crossing (ft)	New or Existing Right-of-Way c/
	93.40	ROWH	100	N
	93.53	PSS1	890	N
	94.15	PSS1	50	N
	94.45	PFO1	630	N
	94.57	PSS1	840	N
	94.73	ROWH	260	N
	94.78	PSS1	310	N
	95.02	PSS1	50	N
	97.12	PFO1	50	N
	97.70	PSS1	50	N
	99.07	PSS1	50	N
	99.87	PSS1	210	N
	100.90	PSS1	50	N
	101.31	PSS1	50	N
	102.01	PSS1	100	N
	106.43	PFO/SS1	150	N
	106.46	ROW1	150	N
	108.28	PFO1	260	N
	110.85	PFO1	2790	N
	112.90	PSS1	210	N
	112.99	PFO/SS1	370	N
	113.31	PFO/SS1	370	N
	114.80	PSS1	420	N
	115.30	PFO1	50	N
	116.65	PSS1	210	N
	116.80	PFO1	310	N
	117.49	PSS1	950	N
	117.75	PSS1	1370	N
	118.78	PSS1	210	N
	119.56	PFO1	1100	N
	121.06	PFO1	1260	N
	121.33	PFO1	1580	N
	123.37	PFO1	370	N
	124.20	PSS1	210	N
	124.76	PFO1	520	N
	127.08	PFO1	100	N
	129.33	PFO1	260	N
	130.67	PFO1	100	N
	131.26	PSS1	210	N
	136.84	PFO1	260	N
	137.60	PFO1	50	N
	139.21	PFO1	420	N
	140.02	PFO1	370	N
	143.66	PEM1	370	N
	144.06	PFO1	50	N
	144.09	PFO1	370	N
	144.40	PSS1	260	N
	145.05	PSS1	310	N
	145.57	PSS1	370	N
	146.10	PSS1	370	N
	154.22	ROWH	520	N
	154.31	PSS1/EM	630	N
	155.55	ROWH	50	N
	161.30	PFO1	310	N
	162.35	PSS1	50	N
	164.00	PSS1	50	N
	165.30	PEM	150	N
	165.35	PSS1	50	N
	166.00	PSS1	50	N
	174.55	PFO1	210	N
	175.65	PFO1	50	N

TABLE 4.1.7-1 (cont'd)

Applicant State	Beginning MP	NWI Classification b/	Length of Crossing (ft)	New or Existing Right-of-Way c/
	180.52	PSS1	260	N
	182.49	PFO/SS1 d/	260	N
	183.60	PSS1	210	N
	183.64	PFO1	680	N
	185.95	PFO1	50	N
	187.45	ROWH	420	N
	193.75	PFO1	50	N
	195.91	PFO1	210	N
	198.05	PSS1	260	N
	199.33	PSS1	50	N
	199.57	PSS1	50	N
	199.60	PSS1	1050	N
	203.90	PFO/SS1	310	N
	207.52	PSS1	150	N
	211.60	PSS1	310	N
	212.37	PFO1	210	N
	213.15	PFO1	50	N
	213.59	PFO1	630	N
	216.80	PFO1	50	N
	218.25	PFO1	50	N
	219.03	PFO1	210	N
	222.25	PFO1	730	N
	223.50	PFO1	370	N
	224.45	PFO1	50	N
	225.55	PSS1/EM	210	N
	226.76	PFO1	790	N
	227.85	PFO1	260	N
	228.99	PSS1 d/	730	N
	229.64	PFO/SS1 d/	1050	N
	231.55	PFO1	260	N
	231.63	PSS1/EM	1790	N
	231.95	ROWH	2640	N
	232.98	PSS1 d/	730	N
	233.20	PSS1	1050	N
	235.20	PFO1	50	N
	236.92	PFO1	2790	N
	238.89	PSS1	370	N
	238.97	PFO1	310	N
	240.63	PFO1	1050	N
	243.00	PFO1	150	N
	245.00	PFO1	210	N
	247.90	PFO1	310	N
	255.47	PFO1	50	N
	256.00	PSS1	1050	N
	257.60	PFO1	150	N
	257.82	PFO1 d/	1260	N
	261.50	PFO1	310	N
	261.75	PFO1	520	N
	262.50	PFO1	470	N
	265.45	PFO1	100	N
	266.25	PFO1	50	N
	266.38	PFO1	50	N
	267.12	PSS1	100	N
	269.69	PFO1	370	N
	269.90	PFO1	840	N
	270.09	PSS1	210	N
	275.75	PFO1	260	N
	276.99	PFO/SS1	370	N
	279.87	PFO1	50	N
	284.22	ROWH	50	N
	285.25	ROWH	50	N

TABLE 4.1.7-1 (cont'd)

Applicant State	Beginning MP	NWI Classification b/	Length of Crossing (ft)	New or Existing Right-of-Way c/
	286.30	PFO1	50	N
	286.58	PSS1	370	N
Connecticut	287.9	PEME	400	N
	289.15	PSS1/EME	50	N
	289.87	PFO1E	50	N
	291.66	PFO1E	50	N
	292.95	PFO1E	50	N
	297.01	PEME	50	N
	297.27	POWH	50	N
	297.51	R2OWH	420	N
	297.69	POWH	100	N
	298.47	POWH	210	N
	298.68	POWH	210	N
	301.56	PFO1E	50	N
	302.11	PFO1E	50	N
	302.41	PFO1E	520	N
	302.51	PSS1F	260	N
	304.86	PFO1E	50	N
	305.09	PFO1E	50	N
	305.26	PFO1E	520	N
	305.40	POWH	260	N
	305.60	POWH	50	N
	306.16	PEME	50	N
	306.18	PEME	630	N
	306.30	PFO1E	420	N
	306.48	R3OWH	50	N
	306.68	PSS1/EME	150	N
	307.19	POWh	100	N
	308.11	PSS1/EME	50	N
	308.20	PEME	100	N
	308.48	PSS1/EME	100	N
	308.68	PSS1/EME	150	N
	311.19	R2OWH	50	N
	311.33	POWh	100	N
	311.44	PEME	50	N
	312.54	PFO1E	50	N
	312.72	PSS1/EME	50	N
	312.76	PEME	100	N
	313.08	PSS1E	260	N
	313.40	PFO1E	50	N
	313.98	PFO1E	50	N
	314.17	PSS1E	50	N
	314.96	PFO1E	50	N
	315.05	PFO1E	50	N
	315.16	PFO1E	50	N
	315.50	PFO1E	210	N
	316.93	R3OWH	50	N
	318.22	PFO1E	100	N
	318.30	PFO4E	50	N
	318.85	PFO1E	50	N
	318.97	PFO1E	50	N
	319.29	PFO1E	630	N
	319.60	PFO1E	580	N
	320.03	PFO1E	2210	N
	320.26	PFO1/EME	50	N
	320.76	PSS1/EME	50	N
	321.66	PFO1E	50	N
	321.81	PFO1E	50	N
	322.07	PFO1E	50	N
	322.14	PFO1E	50	N
	322.56	PSS1	50	N

TABLE 4.1.7-1 (cont'd)

Applicant State	Beginning MP	NWI Classification b/	Length of Crossing (ft)	New or Existing Right-of-Way c/
	323.14	PFO1E	150	N
	323.76	PFO1E	50	N
	324.10	PSS1F	150	N
	324.25	PSS1/EME	50	N
	324.42	PFO1E	50	N
	324.53	PFO1E	210	N
	324.83	PFO1E	100	N
	324.87	PFO1E	520	N
	325.20	PFO1E	100	N
	325.35	PFO1E	50	N
	325.40	PFO1E	1050	N
	325.77	PFO1E	50	N
	326.27	PEME	50	N
	326.84	PFO1E	50	N
	327.29	R3OWH	50	N
	328.39	PFO1E	150	N
	328.49	PFO1E	470	N
	329.15	PFO/SS1E	300	N
	329.48	PFO/SS1E	50	N
	329.60	PFO1E	50	N
	329.70	PFO1E	50	N
	329.85	PSS1E	260	N
	330.52	PFO1E	50	N
	330.91	E1OWL3	730	N
	332.10	PFO1E	50	N
	332.62	PFO4Ex	50	N
	332.64	PSS1/5F	1050	N
	333.55	PSS5/OWH	100	N
	333.99	PEMEx	470	N
	334.19	E2BBP	100	N
	334.21	E2FLN	520	N
New York	360.15	E2FLM	790	N
	360.30	E2FLN	580	N
	360.41	E2BBP	100	N
	360.50	PEM1F	630	N
	360.62	E1OWLx	950	N
	360.80	PEMWF	520	N
	361.25	PFO/SS1A d/	730	N
	361.39	PEM5E	370	N
	365.37	PFLAx	370	N
	365.75	PFLAx	630	N
TENNESSEE				
Schoharie/Albany	MP250-2 + 0.52	PFO1	150	E
New York	MP250-2 + 1.26	PFO1	100	E
	MP250-2 + 1.67	PFO1/PSS/POW	210	E
	MP249-2A + 6.17	PSS5/PEM/POW	520	E
Columbia	MP254 + 3.18	PFO/SS	370	E
New York	MP254 + 3.77	PFO/SS1	470	E
	MP254 + 4.04	PSS1	210	E
	MP254 + 7.93	PFO1	20	E
	MP254 + 8.07	PFO/SS1	580	E
	MP254 + 9.09	PFO/SS1	150	E
Berkshire	MP255 + 3.34	PSS1	20	E
Massachusetts	MP255 + 3.42	PSS1	20	E
	MP256 + 0.10	POW	130	E
	MP256 + 0.18	POW	130	E
	MP256 + 1.10	PFO4/SE	420	E
	MP256 + 2.38	PFO1E	20	E
	MP256 + 3.36	PFO6E	420	E

TABLE 4.1.7-1 (cont'd)

Applicant State	Beginning MP	NWI Classification b/	Len th of Crossing (ft)	New or Existing Right-of-Way c/
	MP256 + 4.88	R2OWH	100	E
	MP256 + 5.26	PFO1E	150	E
	MP256 + 5.42	PFO1E	210	E
Worcester	MP265 + 1.00	PSS1	260	E
Massachusetts	MP265 + 1.35	POW	100	E
	MP265 + 1.47	PFO1	100	E
	MP265 + 2.26	PFO1	420	E
	MP265 + 4.72	PFO/SS1	100	E
	MP265 + 5.28	PFO1	310	E
	MP265 + 7.00	R2OW	150	E
	MP265 + 7.03	PSS1	310	E
	MP266 + 1.03	L1OW	150	E
	MP266 + 1.84	PFO1	20	E
Concord Lateral	MP270B-105 + 12.89	PFO1	150	E
New Hampshire	MP270B-105 + 13.14	PFO1	890	E
Haverhill Lateral	MP270B-302 + 0.48	PSS/EM1	370	E
Massachusetts	MP270B-302 + 0.67	PSS/EM1	210	E
	MP270B-302 + 0.73	PFO/SS1	50	E
	MP270B-302 + 0.76	PEM	310	E
	MP270B-302 + 2.10	PSS/EM1	2,160	E
	MP270B-302 + 3.02	PEM	10	E
	MP270B-302 + 4.08	PEM	520	E
	MP270B-302 + 4.46	PSS/EM1	790	E
	MP270B-302 + 4.66	PFO/SS1	520	E
	MP270B-302 + 5.26	PSS1/EM	150	E
	MP270B-302 + 5.58	PFO/SS1	210	E
	MP270B-302 + 5.82	PSS1/EM	260	E
Wallingford Lateral	MP345A-201 + 0.14	PFO/EME	840	E
Connecticut	MP345A-201 + 2.45	PSS1E	20	E
	MP345A-201 + 1.56	PSS1E	20	E
	MP345A-201 + 2.86	PEME	20	E
Lincoln Extension	MP265E-103 + 2.48	PFO1	20	N
Rhode Island	MP265E-103 + 2.76	PFO1	260	N
	MP265E-103 + 3.18	PFO1	260	N
	MP265E-103 + 3.27	PFO1	210	N
	MP265E-103 + 3.50	PFO1	210	N
	MP265E-103 + 4.14	PFO1	210	N
Meter Station M7 Rhode Island	N/A	PFO1/SS	.34 ac	N

a/ As determined from FWS NWI maps and/or N DEC Freshwater Wetlands Maps and corroborated against route alignment shown on aerial photogrpahs.
b/ Classification as per FWS NWI map "Wetland Legend".
c/ Indicate whether proposed pipeline at wetland crossing is new right-of-way (N) or parallel and adjacent to existing right-of-way (E).
d/ New York Class I wetland.

TABLE 4.1.7-2

Summary of Wetland Areas Crossed by the Proposed Project

Applicant State	NWI Classification a/	Number of Each Wetland Type Crossed b/	Wetland Area in Construction Right-of-Way (acres) c/	Wetland Area in New Permanent Right-of-Way (acres) c/
IROQUOIS				
New York	E1OW	1	2.18	0.00
	E2BB	1	0.24	0.00
	E2FL	2	3.15	0.00
	L1OWHh	1	4.12	0.00
	L2OWHh	1	0.73	0.00
	PEM	1	0.36	0.00
	PEM1	2	2.30	0.00
	PEM5	24	13.94	0.00
	PEMW	1	1.21	0.00
	PFLA	2	2.30	0.00
	PFO1	96	95.27	0.00
	PFO1E/5Fb	1	0.24	0.00
	PFO4	4	5.58	0.00
	PFO4/6	1	1.33	0.00
	PFO5	1	0.12	0.00
	PFO5/OW	1	0.85	0.00
	PFO5/SS1	1	0.97	0.00
	PFO6/4	1	2.06	0.00
	PFO/SS1	12	12.24	0.00
	POW	1	3.15	0.00
	PSS1	64	48.27	0.00
	PSS1/EM	3	6.06	0.00
	PSS1/EM5	12	8.12	0.00
	R2OW	2	0.36	0.00
	R3OW	7	1.33	0.00
	ROW1	1	0.36	0.00
	ROW	10	10.55	0.00
	Subtotal	254	227.42	0.00
Connecticut	E1OW	1	1.70	0.00
	E2BB	1	0.24	0.00
	E2FL	1	1.21	0.00
	PEM	9	2.13	0.00
	PFO1	44	21.82	0.00
	PFO1/EME	1	0.12	0.00
	PFO4	2	0.24	0.00
	PFO/SS1	2	0.82	0.00
	POW	8	2.55	0.00
	PSS1	6	2.42	0.00
	PSS1/5	1	2.42	0.00
	PSS1/EM	8	1.58	0.00
	PSS5/OW	1	0.24	0.00
	R2OW	2	1.09	0.00
	R3OW	3	0.36	0.00
	Subtotal	90	39.95	0.00
	Iroquois Total	344	267.37	0.00
TENNESSEE				
Schoharie/Albany New York	PFO1	2	0.30	0.15
	PFO1/PSS/POW	1	0.24	0.12
	PSS5/PEM/POW	1	0.61	0.30
	Subtotal	4	1.15	0.58
Columbia New York	PFO1	1	0.04	0.02
	PFO/SS	1	0.51	0.30
	PFO/SS1	3	1.67	0.98
	PSS1	1	0.33	0.19
	Subtotal	6	2.55	1.48
Berkshire Massachusetts	PFO1E	3	0.44	0.26
	PFO4/SE	1	0.48	0.28
	PFO6E	1	0.48	0.28
	POW	2	0.30	0.18
	PSS1	2	0.05	0.03
	R2OWH	1	0.11	0.07
	Subtotal	10	1.86	1.10

TABLE 4.1.7-2 (cont'd)

Applicant State	NWI Classification a/	Number of Each Wetland Type Crossed b/	Wetland Area in Construction Right-of-Way (acres) c/	Wetland Area in New Permanent Right-of-Way (acres) c/
TENNESSEE (cont'd)				
Worcester Massachusetts	L1OW	1	0.22	0.13
	PFO1	4	1.20	0.70
	PFO/SS1	1	0.15	0.08
	POW	1	0.15	0.08
	PSS1	2	0.80	0.47
	R2OW	1	0.22	0.13
	Subtotal	10	2.73	1.59
Concord Lateral New Hampshire	PFO	2	0.61	0.24
	Subtotal	2	0.61	0.24
Haverhill Lateral Massachusetts	PEM	3	0.49	0.20
	PFO/SS1	2	0.42	0.17
	PSS1/EM	7	2.30	0.92
	Subtotal	12	3.22	1.29
Wallingford Lateral Connecticut	PEM	1	0.02	0.00
	PFO/EM	1	0.48	0.00
	PSS1	2	0.03	0.00
	Subtotal	4	0.52	0.00
Lincoln Extension Rhode Island	PFO1	6	0.68	0.27
	PFO/SS1	1	0.34	0.34
	Subtotal	7	1.02	0.61
	Tennessee Total	55	13.66	6.89
	Project Total	399	281.03	6.89

a/ Classification as per FWS NWI map "Wetland Legend".

b/ Number of wetlands crossed was determined from FWS NWI maps and/or NYDEC Freshwater Wetland Maps and corroborated against route alignment shown on ae al photograph .

c/ Wetland area in construction and permanent right-of-way was estimated by multiplying crossing lengths (from table 4.1.7-1) by proposed ROW widths. Proposed widths for Iroquois are 100 feet for construction. Permanent ROW will not be maintained in wetlands. Proposed width for the Tennessee Facilities vary and are presented in table 5.1.6.2.2-1. Acreage estimated for new permanent ROW assumes construction will occur outside of existing ROW in some cases. If construction is restricted existing ROW, no new permanent ROW would be cleared.

Forested wetlands are the most abundant wetland type that would be encountered along the proposed route (see table 4.1.7-2) and are vegetated with deciduous and/or coniferous species. These wetlands are characterized by wooded vegetation taller than 20 feet. Common deciduous tree species found include red maple, slippery and American elm, ash, cottonwood, and willow, with a shrub layer that commonly contains dogwood, arrow-wood, spice-bush, and elderberry. Common evergreen species found in forested wetlands include northern white cedar, black and red spruce, and balsam fir, with a shrub layer of sweet bay and swamp azalea.

Scrub-shrub swamps are dominated by woody vegetation less than 20 feet in height. Common species include silky and redpanicled dogwood, alder, willow, leatherleaf, and buttonbush. Along with forested wetlands, scrub-shrub swamps are the most common wetlands found along the proposed route.

Emergent wetlands contain persistent and nonpersistent grasses, rushes, sedges, and forbs. They often occur in association with seasonal or permanent standing water and are considered the most valuable wetland type for wildlife (Weller, 1978). Vegetation found here includes cattails, purple and swamp loosestrife, arrow-heads, common reed, bur reeds, bulrushes, wildrice, and arrow-arum.

Tidal flats associated with the Hudson and Housatonic Rivers and Long Island Sound usually consist of mud areas that are regularly or intermittently exposed. Vegetation varies with the degree of salinity; common species include grasses, reeds, and forbs.

4.1.7.1 Iroquois

The proposed Iroquois facilities would cross wetlands at 344 locations, as identified on FWS National Wetland Inventory (NWI) maps and NYDEC Freshwater Wetlands maps. The most common type that would be crossed (158 locations) are broad-leaved deciduous forest (PF01) or deciduous-forest-dominated (PF01/5, PFO/EME, PFO/SS1). These occur with equal frequency throughout the project area. Scrub-shrub or scrub-shrub-emergent wetlands would be crossed at 95 locations. This wetland type occurs with nearly the same frequency along the entire route. Seven needle-leaved evergreen forest wetlands (PF04) and evergreen-dominated wetlands (PF04/6) occur almost exclusively along the northern third of the proposed route with two occurring in Connecticut (MP 318.3, MP 332.6). Drowned forest wetlands would be crossed at MP 33.8, MP 38.5, and MP 46.5. Other wetland types that would be crossed include emergent (36), riverine (14), lacustrine (25), estuarine (7), and open water (9).

Large forested or shrub wetlands complexes (greater than 0.25 mile) would be crossed in the vicinity of MP 1, MP 13, MP 110, MP 117, MP 121, MP 231, MP 236, and MP 320. However, route variations to significantly reduce the length of wetland crossing have been recommended for the wetlands located at MP 13, MP 110, MP117, and MP 121. Several significant wetlands, as determined by the NYDEC, would also be crossed. Bonaparte Swamp and Black Ash Swamp in Lewis County, New York, contain rare or state-listed plant species or a concentration of plant species unique to the area.

Several New York State class I wetlands would be crossed by the proposed route as well. These occur at MP 64.2, MP 182.5, MP 228.9, MP 232.9, MP 257.8 and MP 361.3.

Class I is the highest classified category. A wetland is categorized as a class I if it meets any one of the following conditions:

- Classic kettlehole bog
- Resident habitat for an endangered or threatened plant or animal species
- Supports an animal species in abundance or diversity unusual for the region or state
- Flood-retention capabilities for a substantially developed area
- Adjacent or contiguous to a reservoir or other water body or connected to an aquifer used as a primary public water supply
- Contains four or more class II characteristics

The Connecticut Department of Environmental Protection (CTDEP) identified several significant wetlands that would be affected by the Connecticut portion of the proposed Iroquois route. Wetlands in New Milford (MP 299), Newtown (MPs 306 and 308), Shelton (MP 319-321, MP 324, and MP 329), and Milford (MP 332-333) are designated as being significant based on size, flood-control capacity, contribution to city open space, uniqueness, and wildlife value. An additional wetland associated with the Wimisink Valley Sanctuary and containing habitat for numerous wildlife and plant species would be crossed in New Milford, Connecticut.

4.1.7.2 Tennessee

The proposed Tennessee segments would result in the crossing of 55 wetlands, the majority of which are small forested or shrub swamps. The most common wetland types that would be crossed are broad-leaved deciduous forest (PF01) and deciduous-forest-dominated (PFO/SS1, PFO/EM) wetlands. These occur along all of the seven loops, laterals, or extensions that cross wetlands. One forested needle-leaved evergreen wetland would also be crossed by the Columbia/Berkshire Loop (MP 256+1.1). Scrub-shrub wetlands would be the second most common wetland type crossed, occurring along seven of the eight segments. Other wetland types crossed include emergent (1), riverine open water (2), palustrine open water (3), and lacustrine open water (1).

Two wetland complexes would be crossed by the Columbia/Berkshire Loop in Massachusetts. Both are considered significant and one, Kampoosa Bog (an alkaline fen), is considered to have extraordinarily high value due to the rarity of this type of wetland and the unusually high concentration of species for its size.

A large forested wetland is located at the eastern end of Tennessee's proposed Lincoln Extension. The proposed meter station (M7) associated with this extension pipeline would be located within this wetland area.

4.1.8 Air Quality and Noise

4.1.8.1 Air Quality

Air quality can be affected by both pipeline construction and the operation of compressor stations. During pipeline construction, a temporary reduction in local ambient air quality could result from fugitive dust and emissions generated by construction equipment. This short-term impact would occur only in proximity to the pipeline right-of-way. As construction is completed, the fugitive emissions would subside; thus, the length of time any one area would be exposed to concentrations is limited. After the pipeline is built, nitrogen oxide (NO_x) would be the primary air pollutant emitted by the compression facilities. Tennessee proposes to construct additional compression facilities in New York and Massachusetts; a new compressor station is proposed in Mendon, Massachusetts.

4.1.8.1.1 Regulatory Requirements

Ambient air quality is protected by Federal and state regulations. The EPA has developed ambient standards for certain criteria air pollutants. These standards are referred to as the National Ambient Air Quality Standards (NAAQS). The primary and secondary NAAQS for NO_2 emissions are both 100 $\mu g/m^3$ (micrograms per cubic meter). Air quality standards for each state cannot be less stringent than the NAAQS. For the proposed Iroquois/Tennessee Project, only Massachusetts has established an air quality standard different from the NAAQS. In addition to the NAAQS annual standard for NO_2, Massachusetts has established a 1-hour NO_2 guideline of 320 $\mu g/m^3$.

Existing ambient air quality is also protected by EPA's Prevention of Significant Deterioration (PSD) regulations. These regulations are intended to preserve the existing air quality in areas where pollutant levels are below the NAAQS. PSD regulations impose specific limits to which new or modified stationary sources may contribute to existing air quality levels. An air-pollutant point-source subject to PSD review is required to submit a review of existing air quality; use modeling analyses to demonstrate compliance with the NAAQS and applicable increments; apply the best available control technology (BACT); and include an analysis of the general impact on the environment.

4.1.8.1.2 Ambient Air Quality

Massachusetts

Massachusetts operates an air quality monitoring network to measure ambient concentrations of the NAAQS criteria pollutants. The proposed Tennessee project components are located almost exclusively in the rural regions of this state. These regions meet all the NAAQS except for ozone. Ozone nonattainment is a regional problem and EPA is researching the situation to develop effective control measures. The rural nonindustrial regions through which the Tennessee facilities would pass are not the focus of any of these control measures. The NO_2 pollutant emitted from the Mendon Compressor Station would be above significant levels and subject to the PSD review.

The proposed pipeline and compressor stations are or would be located in rural areas where the air quality, except for ozone, meets Federal and state standards. Compressor Station 261 in Agawam, Massachusetts, and the proposed station in Mendon, Massachusetts, would require BACT analysis under Massachusetts regulations, regardless of Federal PSD status.

New York

New York operates an air quality monitoring network to measure ambient concentrations of the NAAQS criteria pollutants. The Iroquois facilities would be located almost exclusively in the rural regions of this state. These regions are considered to be in attainment for all the NAAQS except ozone (O_3). Ozone nonattainment is a regional problem and EPA is researching the situation to develop effective control measures. The rural nonindustrial regions through which the Iroquois pipeline would pass are not the focus of any of these control measures.

The pipeline and compressor stations are located in rural areas where the air quality, except for ozone, is within Federal and state standards. Tennessee's Compressor Stations 245 and 254 would emit pollutant levels of NO_x above EPA significant levels, and would subsequently be subject to EPA PSD requirements.

4.1.8.2 Noise

At any location, both the magnitude and frequency of environmental noise may vary considerably over the course of the day and throughout the week. This variation is caused in part by changing weather conditions and the effects of seasonal vegetative cover. Two measures commonly used by Federal agencies to relate the time-varying quality of environmental noise to its known effect on people are the 24-hour equivalent sound level (Leq_{24}) and the day-night sound level (Ldn). The Leq_{24} is the level of steady sound with the same total (equivalent) energy as the time-varying sound of interest, averaged over a 24-hour period. The Ldn is the Leq_{24} with a 10 decibel (dBA) weighting applied to nighttime sound levels between the hours of 10 p.m. and 7 a.m., to account for people's greater sensitivity to sound during nighttime hours.

Noise associated with pipeline construction activities would be intermittent and brief at any single location. Neighbors may sometimes hear the construction noise, but the overall impact would be temporary. Therefore, it is unnecessary to provide an analysis of the existing ambient sound levels along the pipeline rights-of-way. During project operation, the noise impact would be limited to the vicinity of the proposed new and additional compression facilities.

Tennessee proposes to install additional compression facilities at three existing stations and to construct one new compressor station. The existing sound levels at the noise-sensitive receptors in the vicinity of each compressor station are listed in table 4.1.8-1. As described in the DEIS, these proposed facilities included: a 2,100-hp reciprocating engine/compressor unit for station 245; a 3,500-hp reciprocating engine/compressor unit for station 254; a 3,300-hp turbine-driven centrifugal compressor unit for station 261; and a 1,000-hp reciprocating engine/compressor unit at a new station site near Mendon, Massachusetts. Tennessee recently amended its application and now proposes to install an 1,850-hp (was 3,300 hp) compressor addition at Station 261 and a 1,200-hp (was 1,000 hp) compressor addition at its Mendon Station 266A. Tennessee also amended its application to install a 3,500-hp turbine engine compressor, rather than a 3,500-hp reciprocating engine, at its Station 254, for the purpose of reducing projected noise levels. The changes in horsepower at Station 261 and Mendon 266A are expected to result in no significant increases in projected noise levels. It is expected that the change from a reciprocating unit to a turbine unit for Station 254 could result in lower projected noise levels.

Station 245 is an existing 11,316-hp compressor station located approximately 1 mile southeast of West Winfield, New York, at the intersection of Burgess Road and Woods Corner Road. The station is located in a rural agricultural area with scattered nearby residences. The compressor station is currently the major noise source in the area. The

TABLE 4.1.8-1

Noise-Sensitive Receptors Near Tennessee Compressor Stations

Receptor	Distance From Existing Compressor Building a/ (feet)	Estimated Existing Ldn Sound Levels (dBA)
Station 245		
Residence (SE)	1,300	37
Residence (W)	1,450	51
Residence (W)	1,750	*
Station 254		
Residence (SW)	700 b/	60
Residence (SW)	1,200 b/	48-60
Subdivision (S)	1,000 b/	54-58
Station 261		
Residence (W)	650	*
Condominiums (N)	700	65
Condominiums (NW)	1,100	*
Mendon		
Residence (NW)	1,500 c/	46
Residence (NE)	2,000 c/	46

* Data Not Available
a/ Approximate distance from existing compressor building to residence.
b/ Based on distances to noise measurement locations in Stone & Webster, February 1989 report.
c/ No existing compressor -- distance to site of proposed compressor building.

Sources:
U.S. Environmental Protection Agency, "Community Noise," NTID300.3, Office of Noise Abatement and Control, Washington, D.C., December 31, 1971.
U.S. Environmental Protection Agency, "Population Distribution of the United States as a Function of Outdoor Noise Level," 550/9-74-009, June 1974.
Tennessee Gas Pipeline Company

nearest noise-sensitive receptor is a residence located approximately 1,300-feet southeast of the existing compressor building (see figure 4.1.8-1). Two other residences are located 1,450 and 1,750 feet to the west. Sound measurements taken by Tennessee in February 1973 recorded an existing Ldn sound level of 37 dBA at the nearest residence located 1,300-feet southeast and 51 dBA at the residence located 1,450-feet west. Lower noise levels at the nearest residence appear to be due to local topographic shielding.

Station 254 is an existing 9,216-hp compressor station located approximately 1 mile northeast of Malden Bridge, New York, along the east side of New York Highway 66. The station is located in a wooded area with open land to the south. The compressor station is currently the dominant noise source in the area and causes complaints from nearby neighbors. The nearest noise-sensitive receptor is a residence located approximately 700-feet southwest of the existing compressor building (see figure 4.1.8-2). Another residence is located approximately 1,200-feet southwest and a small residential subdivision is located from 1,000- to 1,200-feet south. As a result of community noise complaints, Tennessee engaged the services

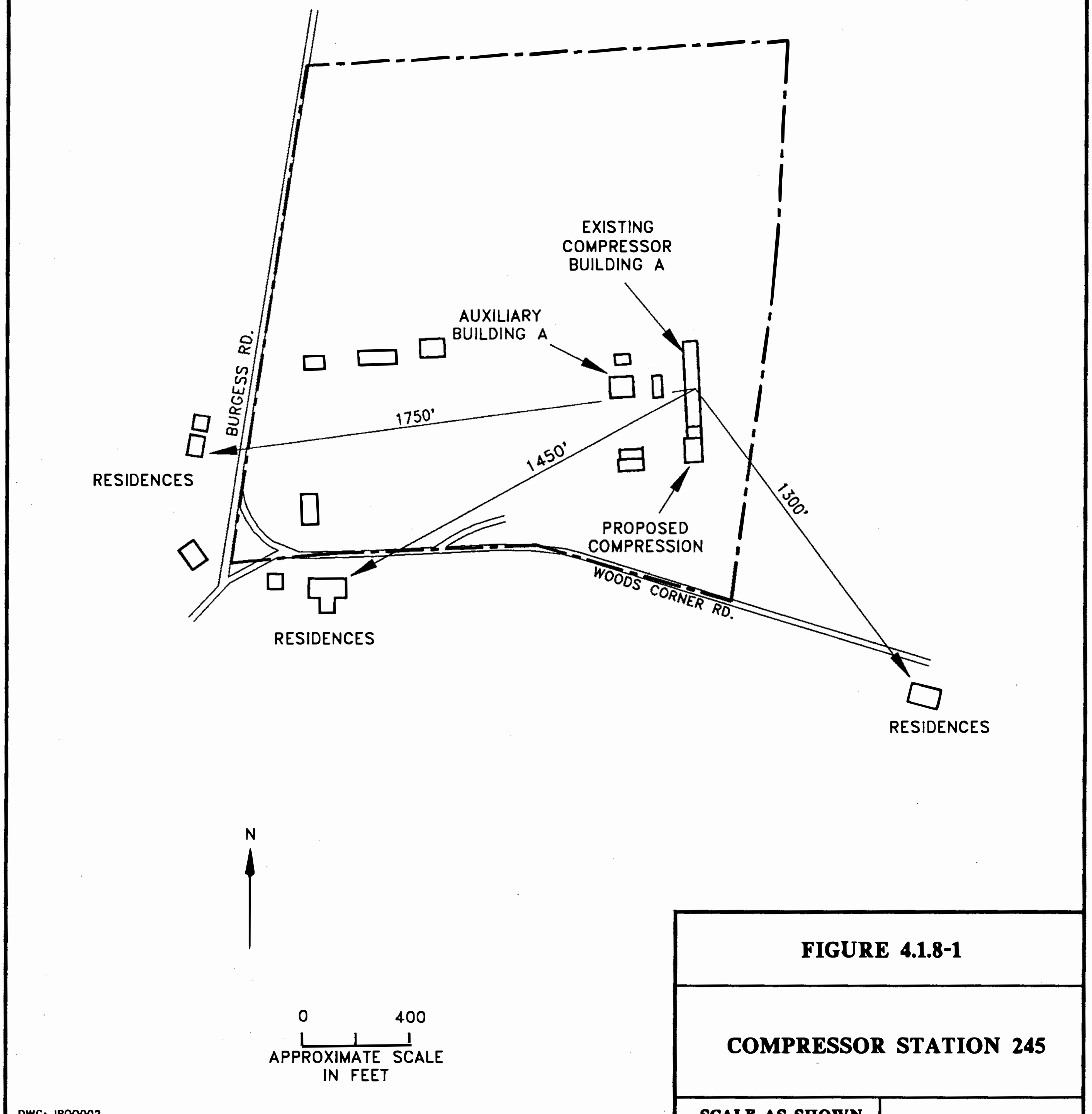


FIGURE 4.1.8-1

COMPRESSOR STATION 245

SCALE AS SHOWN

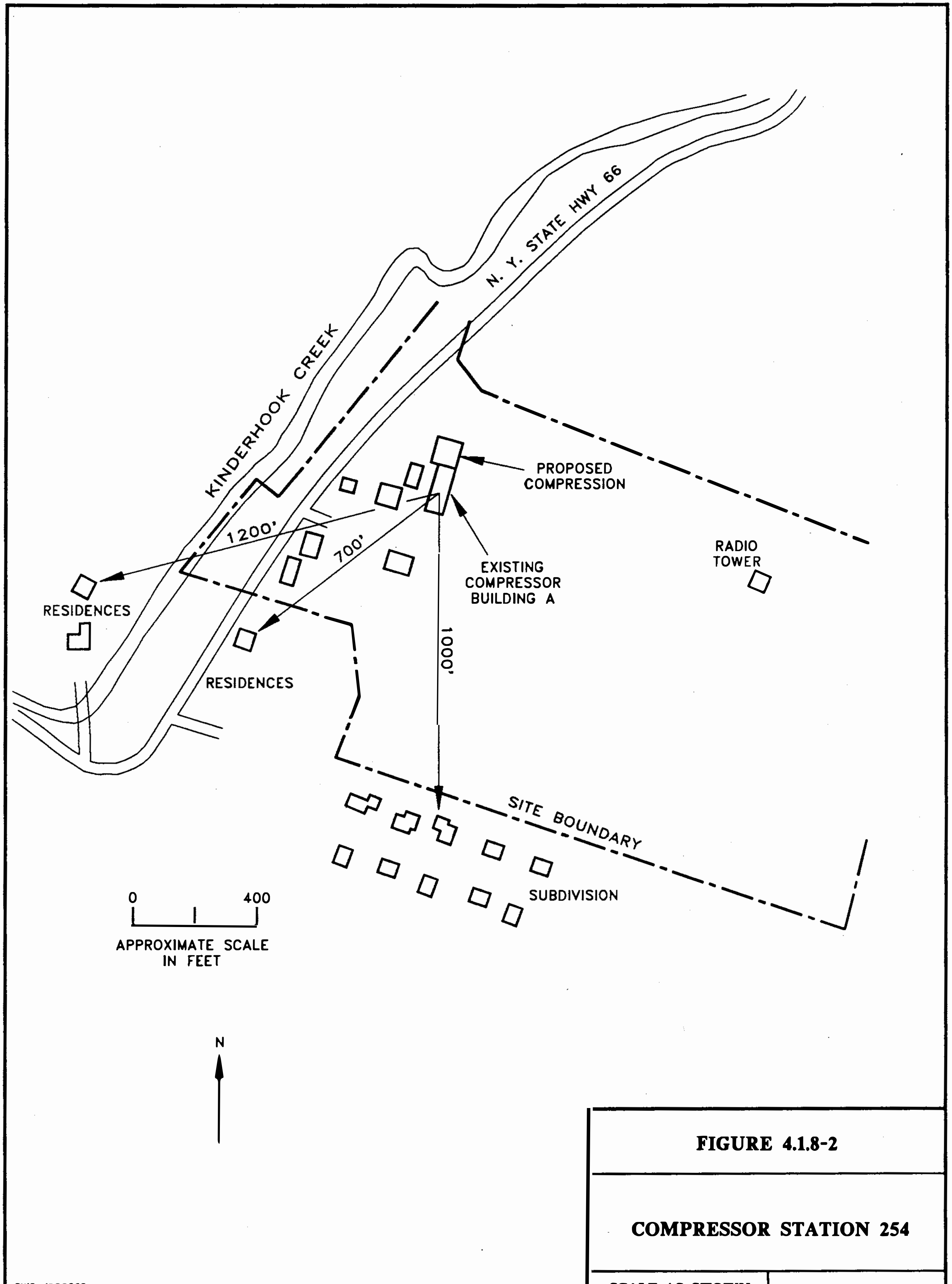


FIGURE 4.1.8-2

COMPRESSOR STATION 254

SCALE AS SHOWN

of Stone & Webster Engineering Corporation to perform a noise assessment of the station. During the summer of 1988, Tennessee replaced the exhaust silencers, installed inlet silencers, and insulated the turbocharge casings. As a result of these changes, exhaust noise was reduced by 14 dBA, and turbocharger inlet noise was reduced by 13 dBA. Noise radiated by the compressor building is now the loudest source, followed by noise from the cooling fans.

Stone & Webster conducted a followup sound survey to determine if the noise abatement measures had achieved their design goal -- reduce sound levels from 50 dBA (based on baseline measurements) to 40 or 45 dBA at nearby residences. This goal is equivalent to an Ldn of 46 to 51 dBA. However, measurements to quantify the improvements in community noise levels were hindered by differences in atmospheric conditions which existed during baseline and postmodification measurements. The resulting differences in community noise measurements have been attributed to the presence or absence of sound shadow zones providing excess attenuation of compressor station noise. As a result, table 4.1.8-1 presents a range of background noise levels for the more distant receptors, with the lower levels reflecting the excess attenuation caused by a sound shadow. Table 4.1.8-1 shows that additional noise abatement of the remaining noise sources would be required to achieve the design goal.

Station 261 is an existing 5,500-hp compressor station located approximately 2 miles south of West Springfield, Massachusetts, east of State Route 75 near the Connecticut border. The station is in a rural, agricultural area and is currently the dominant noise source in the area. The nearest noise-sensitive receptors are two residences located approximately 650-feet west of the existing compressor buildings (see figure 4.1.8-3). Other noise-sensitive receptors include condominiums located 700-feet north and 1,100-feet northwest. Sound measurements taken by Tennessee in May 1987 recorded an existing Ldn sound level of 65 dBA at the nearest condominiums. However, compressor station noise levels are expected to decline as a result of Tennessee's plans to: a) replace the exhaust silencer on the existing 3,860-hp Solar Centaur turbine with a higher attenuating unit, and b) retire the three existing 550-hp reciprocating compressors.

Tennessee's proposed 1,000-hp Mendon Compressor Station would be located approximately 3 miles southeast of Mendon, Massachusetts, in a rural area where the Algonquin and Tennessee pipelines would cross. An existing Algonquin meter station is located adjacent to the southwest corner of the proposed site. The nearest-noise sensitive receptor is a residence located approximately 1,500-feet northwest of the proposed station site (see figure 4.1.8-4). Several other residences are located from 2,000-feet to 2,300-feet northeast of the site. Measurements taken by Algonquin at the site of a proposed but now cancelled compressor station (located 1,500-feet northeast of the proposed Tennessee site) recorded an existing ambient Ldn sound level of 46 dBA. This sound level might be typical of the existing ambient sound level at Tennessee's proposed location.

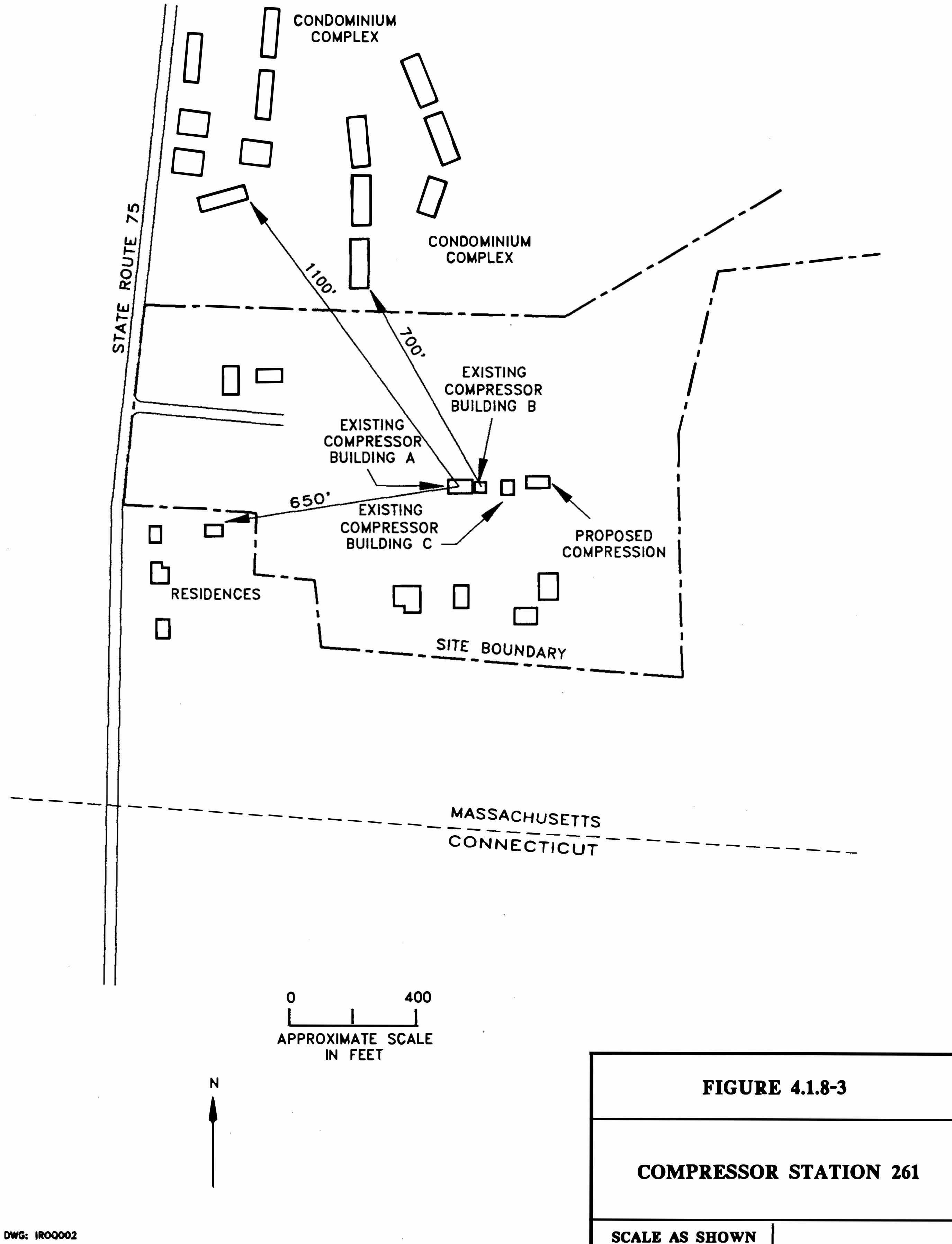


FIGURE 4.1.8-3

COMPRESSOR STATION 261

SCALE AS SHOWN

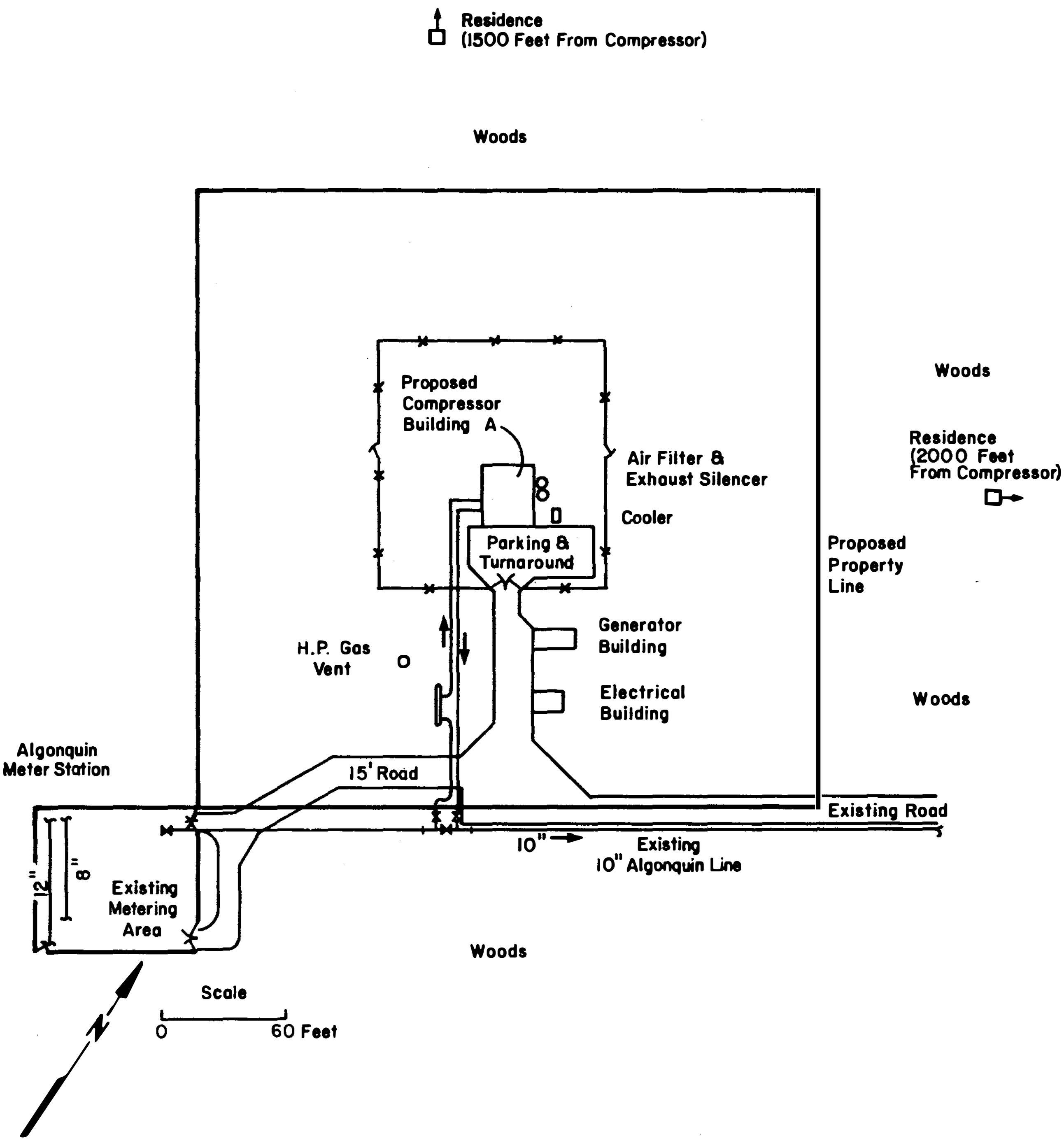


FIGURE 4.1.8-4

**MENDON
COMPRESSOR STATION**

SCALE AS SHOWN

4.1.9 Land Use, Recreation, and Visual Resources

4.1.9.1 Land Use

4.1.9.1.1 Pipeline Facilities

The proposed Iroquois facilities would consist of 369.4 miles of new pipeline, of which approximately 20 percent (74.3 miles) would parallel existing rights-of-way. The proposed Tennessee facilities would consist of 8 segments totaling 62.8 miles, of which approximately 96 percent (60.5 miles) would be adjacent to or within existing rights-of-way. The proposed Tennessee facilities would include mainline loops (46.6 miles), lateral loops and replacement pipe (13.8 miles), and new lateral extensions (2.3 miles). Tables 2.1.1-1 and 2.1.2-1 summarize the type, location, and length of pipeline segments.

The land uses that would be crossed by the proposed Iroquois route vary significantly. From St. Lawrence County to Albany County, New York, the areas that would be traversed are generally agricultural, open spaces, or wooded. South of Albany County, the area that would be traversed is more developed. Densely populated areas would be crossed in Connecticut and on Long Island.

Tennessee's proposed Schoharie/Albany Loop in New York would traverse mostly agricultural areas. The predominant land use that would be traversed by the Springfield Lateral in Massachusetts and the Wallingford Lateral in Connecticut is residential. The remainder of the Tennessee segments would traverse mainly forestland and small residential areas. Table 4.1.9-1 identifies the types of land uses that would be traversed by the proposed projects.

Agricultural areas and open space would be the predominant land use traversed by all of the proposed pipelines. A total of 196.3 miles of agricultural and open land would be crossed by the proposed Iroquois and Tennessee pipeline rights-of-way. Agricultural lands that would be crossed include orchards, cropland, and pastures. Orchards or nurseries would be crossed by the Iroquois route in Columbia, Dutchess, and Suffolk Counties, New York, for a total of 2.7 miles. Under the New York Agricultural District Law, agricultural districts can be formed by land owners to provide agricultural value assessments and protection from restrictive local ordinances. The proposed pipeline routes would cross 47 agricultural districts in 10 counties.

About 172.1 miles of woodlands consisting of forests, forested wetlands, and sugarbush would be traversed by the pipelines, accounting for 40 percent of the proposed route. Twelve known areas of sugarbush, are in Lewis County, New York, would be crossed.

Developed residential areas would be crossed in New York, Connecticut, and New Hampshire. Approximately 29.1 miles (7 percent) of the proposed routes would traverse residential areas. Table 4.1.9-1 includes the number of residences within 50 feet of the proposed pipeline. Table 4.1.9-2 lists planned residential developments identified during scoping by Iroquois or through our analysis of the proposed route.

Three school properties would be traversed or adjacent to the proposed rights-of-way. In Connecticut, the proposed Iroquois pipeline would be located near the Hill and Plain Elementary School (New Milford) and JFK Elementary School (Milford). Tennessee's

TABLE 4.1.9-1

Land Use Characteristics of the Proposed Iroquois and Tennessee Facilities

	Length not Adjacent to Existing ROW a/		LAND USES CROSSED: Woodland b/		LAND USES CROSSED: Agriculture & Open Space c/		LAND USES CROSSED: Residential d/		LAND USES CROSSED: Commercial/ Industrial e/		LAND USES CROSSED: Open Water		Number of Homes Within 50 feet of Proposed Right-of-Way
	Miles	%	Miles	%	Miles	%	Miles	%	Miles	%	Miles	%	
IROQUOIS													
New York													
St. Lawrence County	50.3	95	23.2	44	28.6	54	0.3	1	0.0	0	0.7	1	2
Lewis County	51.0	93	28.1	51	25.6	47	0.5	1	0.0	0	0.3	1	10
Oneida County	18.3	100	6.6	36	11.3	61	0.3	2	0.0	0	0.1	1	2
Herkimer County	33.9	100	6.8	20	26.0	77	0.5	1	0.4	1	0.2	1	2
Montgomery County	23.9	100	5.4	23	16.3	68	2.1	8	0.0	0	0.1	1	0
Schoharie County	11.7	100	2.6	22	8.3	72	0.7	5	0.0	0	0.1	1	1
Schenectady County	2.0	100	.2	10	1.6	80	0.1	5	0.0	0	0.1	5	0
Albany County	18.8	100	4.0	21	13.8	74	1.0	5	0.0	0	0.0	0	0
Greene County	15.3	93	8.0	49	5.2	32	2.0	12	1.0	6	0.1	1	2
Columbia County	7.0	45	4.3	28	10.1	65	0.5	3	0.4	3	0.2	1	2
Dutchess County	3.9	10	18.2	46	15.3	39	4.1	11	1.2	3	0.1	1	13
Suffolk County	0.0	0	1.0	11	2.7	32	4.0	45	1.0	(1	0.1	1	1
Connecticut													
Litchfield County	6.9	63	6.1	56	3.5	32	1.0	9	0.3	3	0.0	0	15
Fairfield County	22.5	67	21.8	65	6.2	18	5.3	15	0.1	1	0.1	1	29
New Haven County	2.9	100	1.1	38	1.1	41	0.3	10	0.2	7	0.1	3	2
Long Island Sound	26.7	100	0.0	0	0.0	0	0.0	0	0.0	0	26.7	100	0
IROQUOIS SUBTOTAL	295.1	80%	137.4	37%	175.7	48%	22.7	6%	4.6	1%	29.0	8%	81
TENNESSEE													
Schoharie-Albany Loop	0	0	4.5	30	10.4	68	.3	2	0.0	0	0.0	0	2
Columbia-Berkshire Loop	0	0	14.9	70	4.7	22	1.8	8	0.2	1	0.1	1	9
Worcester Loop	0	0	7.0	69	2.0	20	.9	9	0.1	1	0.1	1	13
Concord Lateral	0	0	1.9	42	1.4	31	.9	20	0.2	5	0.1	2	16
Haverhill Lateral	0	0	3.5	57	1.0	16	1.0	16	0.6	10	0.0	0	16
Wallingford Lateral	0	0	1.3	41	.4	12	1.5	47	0.0	0	0.0	0	42
Lincoln Lateral	2.3	100	1.6	71	.7	29	0	0	0.0	0	0.0	0	0
Springfield Lateral	0	0	0	0	.0	22	.01	88	0.0	0	0.0	0	2
TENNESSEE SUBTOTAL	2.3	4%	34.7	55%	20.6	33%	6.41	10%	1.1	2%	.3	.5%	100
TOTAL	297.4	(69%)	172.1	(40%)	196.3	(45%)	29.1	(7%)	5.7	(1%)	29.3	(7%)	181

a/ Pipeline right-of-way adjoining existing utility (e.g., electric transmission, railroad, roadways, gas pipelines, telephones) right-of-way.
b/ Includes mature, deciduous or coniferous stands of at least one-half acre.
c/ Includes pasture, cropland, orchards and nurseries.
d/ Includes single and multi-family residences and yards.
e/ Includes retail/wholesale areas, manufacturing, transmission line substations and quarries.

TABLE 4.1.9-2

Known Proposed Developments On or Near The Proposed Pipeline a/

Applicant	County, State	Milepost	Project or Owner's Name
IROQUOIS			
	St. Lawrence, NY	0.3	Whitehouse Bay
	Albany, NY	206.7	Midstate Investors, Inc.
	Greene, NY	230.2	Whippoorwill Knolls
	Columbia, NY	232.6	Camelot Heights
	Dutchess, NY	265.5	Kara Estate
		270.0	JMR Custom Homes
		270.5	Trillium Gardins
	Fairfield, CT	287.3	Smoke Ridge Farm
		287.7	Clover Ridge
		290.8	Sirocco Sunrise Farm
		292.8	R. Sherman Industrial Park
		296.8	Properties Investors
		309.0	Old Farm Hill
		309.2	Teachers Ridge
		309.4	River View Ridge
		312.3	Contemporary Estates
		312.5	Bridge Road
		312.9	Feather Meadow
		313.3	Deer Ridge
		313.5	Mt. Manor Estates
		313.7	Cobbler's Mill Phase II
		313.8	Green Ridge Estates
		314.2	Trout Run
		314.5	Bernard Green Trustee
		315.0	Sutherland Woods
		315.4	Osbourne Hill Estate
		316.0	Forest View
		317.1	Whispering Pines Estate
		317.5	Buckhill Estates
		319.2	Woodland Commons
		320.0	Monty Blakeman
		321.2	Crown Tool and Dye
		322.8	Rock Ridge
		323.7	Summerfield Farm
		325.3	Beachtree Commons
		328.6	Horsehollow North
		328.8	Horsehollow South
		329.0	Oronoque West
		330.5	Pin Oak Manor Subdivision

a/ Planned developments identified through scoping by Iroquois or through state analysis.

proposed pipeline right-of-way would border the Berkshire Farm for Boys in Canaan, New York. Eight cemeteries are adjacent to the proposed rights-of-way, but none would be traversed.

4.1.9.1.2 Aboveground Facilities

No compression facilities are proposed by Iroquois. Proposed new auxiliary facilities for Iroquois would include 22 MLVs, 5 pig launcher/receivers (which are sited at valve locations), 7 sales metering stations, and 3 interconnection points. The MLVs would be constructed entirely within the permanent right-of-way. However, the pig launcher/receivers, sales metering stations, and interconnection points would require additional land. Based on typical layouts, these proposed auxiliary facilities would require a total of approximately 5 acres of land in addition to the permanent right-of-way.

The proposed Tennessee aboveground facilities include additional horsepower at three existing compressor stations and a new compressor station at Mendon, Massachusetts. No additional land would be required at the existing compressor stations. However, the Mendon Compressor Station would require approximately 2.1 acres. Tennessee also proposes to modify five existing sales metering stations, which would require no additional land, and to construct 6 new metering stations, each of which would require approximately 0.5 acre of land. The land requirements and adjacent land uses for each of the proposed associated facilities are presented in table 4.1.9-3.

4.1.9.2 Recreational and Public Interest Areas

Table 4.1.9-4 shows recreational and public interest areas that would be crossed or are in proximity to the proposed pipelines. These areas include state forests and parks, trails, rivers, preserved open spaces, designated scenic areas, waste sites, and areas of significance as identified during the scoping sessions and public comment period.

State Forests

Three state forests would be traversed or bordered by the proposed pipelines. The 1,935-acre Paugussett State Forest Reserve in Newtown, Connecticut, would be bordered for a distance of 0.7 mile by the proposed Iroquois pipeline between MPs 315.1 and 315.8. The forest borders a single-family residential development in the vicinity of the proposed right-of-way. The Upton State Forest in Massachusetts would be traversed for approximately 0.5 mile and bordered for 0.1 mile by Tennessee's proposed Worcester Loop.

State Parks

One state park would be traversed by the proposed pipeline rights-of-way. In Milford, Connecticut, the Silver Sands State Park would be traversed between MPs 333.5 and 334.3 for approximately 0.8 mile and would be the landfall for Iroquois' proposed Long Island Sound crossing. The state-owned site is a former landfill. It has been closed since 1979, and the state is in the process of capping the landfill with fly ash. Although it has been claimed that illegal dumping took place at the landfill, the CTDEP has not found any evidence of hazardous material. The state had planned to grade, cap, and seed the site by the fall of 1989 in order to prepare it for use as a state park (England, 1989). The master plan for the 223-acre park divides the development of the park into Phase I (landfill closure

TABLE 4.1.9-3

Area Requirements and Surrounding Land Uses at Aboveground Facilities

Applicant/ Facility	Milepost or Segment	County/State	Additional Permanent Land Area Required	Current Surrounding Land Uses
IROQUOIS				
MLV 1	1.2	St. Lawrence, NY	18' x 40'	Agricultural. Near Seaway Trail
MLV 2	20.7	St. Lawrence, NY	18' x 40'	Reverting field
MLV 3	42.0	St. Lawrence, NY	18' x 40'	Pasture
MLV 4	57.3	Lewis, NY	18' x 40'	Pasture
MLV 5	74.3	Lewis, NY	NA	Agricultural
MLV 6	90.3	Lewis, NY	18' x 40'	Forested
MLV 7	108.8	Oneida, NY	18' x 40'	Agricultural
MLV 8	128.7	Herkimer, NY	18' x 40'	Agricultural
MLV 9	149.1	Herkimer, NY	18' x 40'	Agricultural
MLV 10	169.1	Montgomery, NY	NA	Agricultural
MLV 11	189.6	Schoharie, NY	18' x 40'	Agricultural
MLV 12	209.4	Albany, NY	18' x 40'	Agricultural
MLV 13	229.9	Greene, NY	18' x 40'	In scenic area. Agricultural
MLV 14	245.9	Columbia, NY	NA	Forested
MLV 15	264.8	Dutchess, NY	18' x 40'	Agricultural
MLV 16	277.2	Dutchess, NY	18' x 40'	Forested
MLV 17	293.1	Litchfield, CT	18' x 40'	Open field near trail & residences
MLV 18	304.1	Fairfield, CT	18' x 40'	Forested
MLV 19	317.2	Fairfield, CT	18' x 40'	Residential
MLV 20	331.5	New Haven, CT	NA	Industrial
MLV 21	360.5	Suffolk, NY	18' x 40'	Shoreline. Industrial
MLV 22	369.4	Suffolk, NY	NA	Commercial (flood plain)
MS 1	8.0	St. Lawrence, NY	100' x 200'	Forested
MS 2	270.1	Dutchess, NY	100' x 200'	Forested. Taconic State Parkway.
MS 3	296.8	Litchfield, CT	100' x 200'	Forested
MS 4	324.4	Fairfield, CT	100' x 200'	Forested
MS 5	329.9	Fairfield, CT	100' x 200'	Residential. Scenic area
MS 6	331.5	New Haven, CT	100' x 200'	Industrial
MS 7	369.4	Suffolk, NY	100' x 200'	Industrial
IP 1	152.3	Herkimer, NY	100' x 200'	Agricultural
IP 2	192.5	Schoharie, NY	100' x 200'	Agricultural
IP 4	328.5	Fairfield, CT	100' x 200'	Forested
PL/R 1	74.3	Lewis, NY	120' x 210'	Agricultural
PL/R 2	169.1	Montgomery, NY	120' x 210'	Agricultural
PL/R 3	245.9	Columbia, NY	120' x 210'	Forested
PL/R 4	331.5	New Haven, CT	120' x 210'	Industrial
PL/R 5	369.4	Suffolk, NY	120' x 210'	Industrial
TENNESSEE				
CS 245	Herkimer-Otsego	Herkimer, NY	NA	Agricultural
CS 254	Columbia-Berkshire	Columbia, NY	NA	Residential
CS 261	South of Springfield	Hampden, MA	NA	Residential
Mendon(CS)	Blackstone	Worcester, MA	2.1 acres	Wooded
MS 1	-	Essex, MA	100' x 100'	Residential
MS 2	-	Fairfield, CT	NA	Residential
MS 3	-	Fairfield, CT	NA	Residential
MS 4	-	Litchfield, CT	NA	Residential
MS 5	-	Hartford, CT	NA	Wooded
MS 6	-	Hartford, CT	NA	

TABLE 4.1.9-3 (cont'd)

Applicant/ Facility	Milepost or Segment	County/State	Additional Permanent Land Area Required	Current Surrounding Land Uses
MS 7	Lincoln	Providence, RI	100' x 100'	Wooded
MS 8	-	Albany, NY	100' x 100'	Open field
MS 9	-	Hampden, MA	100' x 100'	Wooded
MS 11	Schoharie-Albany	Schoharie, NY	100' x 100'	Agriculture
MS 12	-	Fairfield, CT	100' x 100'	Wooded

NOTE: MS = Metering station
CS = Compressor station
IP = Interconnection point
PL/R = Pig launcher/receiver site

TABLE 4.1.9-4

Recreational and Public Interest Areas Crossed or Near the Proposed Pipelines

Applicant/ County, State	Public Interest Area	Milepost	Length of Crossing (mi)	Comments
IROQUOIS				
St. Lawrence, NY	St. Lawrence River	0	.25	Visual corridor
	Seaway Trail/Route 37	1.2	1.80	National recreational/vehicular trail. Scenic area
	Grass River	15.5, 18.1	.18	Other segment of river on NRI a/
	Oswegatchie River	41.4	.04	Other segment of river on NRI (scenic)
	West Branch Oswegatchie River	48.3	.04	This segment of river is on NRI (scenic and recreational)
Lewis, NY	Indian River	65.1	.02	This segment of river on NRI
	Independence River	91.0	.04	The segment of river on NRI (recreational) is 1000' west of ROW
	Otter Creek	92.0	.04	This segment on NRI
	Black River	94.5	.07	This segment of river on NRI
Oneida, NY	North Country Trail	108.5	.01	Proposed hiking trail
	West Canada Creek	125.6	.07	
Herkimer, NY	Rose Valley Landfill	134.5	.30	Closed in 1986. DEC suspected hazardous waste site
	Crystal Springs School	157.0	.02	
Schoharie, NY	Schoharie Creek	187.5	.08	Segment of creek on NRI (Recreational) is nearby
Albany, NY	Berne Town Park	199.2	.19	Runs adjacent to baseball field
Greene, NY	Athens Airport	229.5	Nearby	See recommendation #47
	Hudson River	231.9	.25	Segment of river on NRI is 2,000 feet north of ROW. Entire river is used for recreational boating
Columbia, NY	Mt. Merino	232.5	.75	Prominent landform
Dutchess, NY	Wappinger Creek	265.4,266.2,266.4	.05	These segments of creek on NRI (geologic)
	Mackay Dump	267.5	Nearby	EPA listed hazardous waste site
	Taconic State Parkway	270.2	.03	Scenic highway
	West Mountain	280	1.00	Prominent landform
	Dover/Walter Vincent Landfill	282.3	Nearby	DEC listed hazardous waste site
	Mica Products	282.5	Nearby	EPA hazardous site
Fairfield, CT	Appalachian Trail	286.7	.16	National Trail
	Naromi Land Trust/ Wimisink Brook	287.7	.35	Private land trust
Litchfield, CT	Weantinoge Land Trust/ Morrissey Brook	289.0	.16	Private land trust
	Stillson Road Scenic Area	289.5	1.7	Town-designated scenic road
	Weantinoge Land Trust	289.7	.20	Stilson Hill area
	Housatonic Range Trail/ Candlewood Mt./Pine Knob	291.8	1.00	State/privately owned
	Lynn Deming Park	293.8	Nearby	Swimming beach, picnic grounds
	Kimberly-Clark Corp.	292.2	Nearby	Paper sludge. Waste disposal from manufacturing plant
	New Milford/ Waste Management Landfill	295.5	Borders	EPA listed hazardous waste site
	Hill and Plain School	296.6	.17	
	Candlewood Valley Country Club	297.1	.50	Public golf course
	Harrybrook Park	297.3	Nearby	Passive recreation
Fairfield, CT	Still River Nature Preserve	299.5	.38	Part of Weantinoge Land Trust
	Silvermine Road Open Space	-	Nearby	Municipal ownership
	Paugussett State Forest	315.1	Borders	ROW would border forest
	Pomperaug Trail	318.1	.01	Blue blazed hiking trail
	Boys Halfway River Caves	318.2	.60	Natural area, limestone caves
	Means Brook Valley	320.6	.45	Partially Town-owned natural area
	Hill & Harbor Tourist District	320.0-323.0	2.0	Farms
	Shelton Conservation Land Trust	320.9	.25	Private land trust

TABLE 4.1.9-4 (cont'd)

Applicant/ County, State	Public Interest Area	Milepost	Length of Crossing (mi)	Comments
IROQUOIS (cont'd)				
Fairfield, C	Roosevelt Forest	328.5	.20	220-acre town forest
	Housatonic River	330.8	.40	Segment north of proposed ROW is on Nationwide Study River List
New Haven, CT	City of Milford Open Space	331.2	1.20	Unit 8 of Beaver Brook; Mondo Ponds, state park reserve proposed for development
	Silver Sands State Park Reserve	333.5	.77	
	Silver Sands	334.0	.60	Closed landfill planned for capping
Suffolk, NY	Kirschbaum Park	360.5	.10	South shore of Long Island Sound
	Crabmeadow Park	361.5	.50	County park
	Makamah Park	362.0	.50	County nature preserve
	Meadowlark Park	363.5	.50	Nature study area
	Huntington Landfill	365.0	Nearby	Solid waste
TENNESSEE				
Columbia/ Berkshire Loop				
Columbia, NY	Immaculate Conception Navitiate	256 + 6.75	.42	
	Berkshire Farm for Boys	MLV 255	.19	
Worcester Loop				
Worcester, MA	Blackstone River	265 + 7	.17	
	Upton State Forest	266 + 2.09	.60	
Concord				
Merrimack, NH	Soucook River	270B - 105 + 14.92	.03	This segment on NRI Final List (Historic Atlantic Salmon Fishery)
	Suncook River	270B - 105 + 10.7	.15	Segment on NRI one mile east. White water rapids
	Pleasant Valley Country Club	270B - 105 + 13.47	.32	Golf course
	Athletic Fields	270B - 105 + 10.66	.28	Pembroke Memorial Park
Wallingford				
New Haven, CT	Cheshire Land Trust (Lisa's Meadow)	345A-201+1.5	.20	Private land trust
	Willow Brook + Trail	345A - 201 + .3	.01	Hiking trail along brook
Lincoln				
Providence, RI	Hanton City Hiking Trail	265E + 2.77		City owned trail
		265E + 3.4	.01	

a/ NRI = Rivers on Nationwide Rivers Inventory. NRI rivers are potential wild, scenic and recreational rivers.

and road development) and Phase II. Phase II of the plan is to include the construction of recreational facilities and a boardwalk over the sandbar leading to Charles' Island (Clapper, 1989).

Trails

The proposed pipelines would cross seven trails in eight locations. The trails that would be traversed are the Seaway Trail, AT, North Country Trail, Housatonic Range Trail, Pomperaug Trail, Willow Brook Trail, and Hanton City Hiking Trail.

The Seaway Trail, a National Recreation Trail that links the Thousand Islands and Niagara Falls, would be traversed by Iroquois in Waddington, New York, at MP 1.2. The Waddington town plan identifies the Seaway Trail, a vehicular trail, as a visual corridor.

The AT, a nationally recognized wilderness foot trail extending from Maine to Georgia, would be traversed by Iroquois. The AT would be crossed by Iroquois at MP 286.7 in Sherman, Connecticut. This section, along with most of the AT, is owned by the Federal government. The proposed pipeline would traverse 850 feet of AT property in Sherman.

The North Country National Scenic Trail would be crossed by Iroquois. The proposed route for the North Country Trail would be crossed by Iroquois in Booneville, New York, at MP 108.5. After all lands have been acquired, the trail will extend from New York to North Dakota.

In Connecticut, the Housatonic Range Trail, Pomperaug Trail, and Willow Brook Trail would be crossed by the proposed pipelines. The Housatonic Range Trail and the Pomperaug Trail are part of Connecticut's Blue Blazed Trail System, which are mostly on private property and managed by the Connecticut Forest and Parks Association. The Housatonic Range Trail would be crossed twice by the proposed Iroquois facilities in New Milford. The first crossing (MP 291.9) would be on a privately owned section of the trail (Pine Knob) and the second crossing (MP 292.9) would be near Rocky River Road. The Pomperaug Trail in Monroe (MP 318.1) would be crossed in a wooded area. The existing Tennessee pipeline across Willow Brook Trail, which follows an abandoned railroad right-of-way along Willow Brook, would be replaced by the proposed Wallingford Lateral. An asphalt bike path is planned along the trail. The proposed Lincoln Lateral Extension in Rhode Island would cross the Hanton City Hiking Trail twice in less than 1 mile.

Scenic and Recreational Rivers

Rivers would be crossed in locations that are on the NRI, which is a list of potential rivers to be included in the National Wild and Scenic River System. The rivers are considered under the criteria of the National Wild and Scenic River Act. In New York, the proposed Iroquois route would cross the West Branch Oswegatchie River, Indian River, Otter Creek, Black River, and Wappinger Creek. Segments of the Grass River, Oswegatchie River, Independence River, Schoharie Creek, Hudson River, and Housatonic River are on the NRI, but would not be crossed by Iroquois' proposed route. Tennessee's Concord Lateral would cross the Soucook River and the Suncook River in Merrimack County, New Hampshire. The Soucook River is listed for its historic Atlantic Salmon Fishery. The Suncook River is listed for its recreational whitewater rapids (class II through class IV gradient), however, the segment of river listed on the NRI is 1 mile east of the proposed route.

Hazardous and Solid Waste Sites

A total of 58 hazardous and solid waste sites are located within 1 mile of the proposed rights-of-way. Several sites would be bordered or crossed in New York and Connecticut.

The Rose Valley Landfill in Russia, Herkimer County, New York (MP 134.5), would be traversed in an area containing unidentified wastes. The inactive municipal waste disposal site, which is also known as J&J Trucking, was closed in 1986. The preliminary assessment completed by the EPA recommends that the 59-acre landfill be given a medium priority. The EPA assessment also recommended that a site investigation be performed to determine the potential for the contamination of local water supplies (EPA, 1988b).

In Dutchess County, New York, the three hazardous waste sites of special concern are the Mackay Dump (MP 267.5), Mica Products (MP 282.5), and Walter Vincent Landfill (MP 282.3). These sites would not be traversed but would all be less than 2,000 feet from the pipeline.

In Litchfield County, Connecticut, Kimberly-Clark Corporation's waste disposal site (MP 292.2) would be less than 500 feet from the pipeline. The New Milford Landfill, also in Litchfield County, would be bordered from MPs 295.3 to 295.7. This municipal waste landfill is EPA-listed and is operated by Waste Management, Inc. The pipeline would be upgradient of both sites.

The CTDEP has been in the process of locating ash residue sites for municipal incinerators. The Iroquois pipeline would be adjacent to a potential site for an ash residue disposal area located on the east side of the Housatonic River; this site, however, is not listed as one of the final sites.

In the vicinity of the Huntington Landfill (MP 365), LILCO's right-of-way is approximately 250-feet wide. The pipeline would not be less than 200 feet from the landfill. Existing methane monitoring wells would be kept in place.

Other Public Interest Areas

Active recreational areas that would be traversed by the proposed pipeline include golf courses and three athletic fields. The golf courses are the Candlewood Valley Country Club in Litchfield County, Connecticut, and Pleasant Valley Country Club in Merrimack County, New Hampshire. The length of proposed pipeline that would cross golf courses is approximately 0.82 mile. All of the athletic fields that would be crossed are baseball fields.

Five parks would be either traversed or adjacent to the right-of-way in Huntington, New York. Kirshbaum Park, a beach area, is located at MP 360.5 on the south shore of Long Island Sound. Crabmeadow and Wodaembarc Park/Preserve (MP 361.5), a county park located northeast of the LILCO right-of-way, would be crossed for 0.5 mile. However, the golf course would not be traversed. Makamah Park, a county nature preserve located on the northeast side of the right-of-way, would be bordered for 0.5 mile. Meadowlark Park, a nature study area, would be traversed for 0.5 mile between MPs 363.5 and 364.0. Meadowlark is located east of Northport Veterans Hospital.

In Connecticut, land trusts can be formed to preserve locally important natural areas. Each land trust is an incorporated, nonprofit organization. Land trusts that would be traversed by the proposed Iroquois rights-of-way are Weantinoge, Naromi, Cheshire, and Shelton Land Trusts. There would be six crossings of land trust properties.

The Naromi Land Trust's Wimisink Wildlife Sanctuary in Sherman, Connecticut, would be crossed for approximately 1,500 feet at MP 287.7. The approximately 57-acre tract envelops the largest wetland in Sherman. The land that would be crossed by the proposed route is forested, open meadow, and scrub-shrub vegetation.

Three separate parcels of the Weantinoge Heritage Land Trust consisting of 1,480 acres, would be crossed by Iroquois. The land trust would be first crossed in the vicinity of Morrissey Brook (MP 289), which is part of a 55-acre nature preserve in New Milford. The second crossing would be through the Stilson Hill area at MP 289.7. The third crossing would be through the Still River Preserve (MP 299.5) in Brookfield between a transmission line and a railroad. Both the Morrissey and Still River areas are presently forested. The Stilson Hill area consists of scrub-shrub vegetation. The preserve is open to the public for passive recreation and hunting.

The Shelton Land Conservation Trust, a 32.7-acre tract close to Means Brook, would be crossed by Iroquois at MP 320.9. The land trust's property would be crossed for a distance of approximately 0.25 mile along an access road. The proposed alignment of the pipeline would cross trails in a forested area.

Tennessee's Wallingford Lateral, a replacement line, would cross the Cheshire Land Trust's tract known as Lisa's Meadow. A 40-foot easement for the existing pipeline traverses the land trust for a distance of approximately 1,000 feet. Lisa's Meadow is a wildlife sanctuary but does not provide a habitat for threatened or endangered species.

4.1.9.3 Visual Resources

As a basis for assessing the visual impact of the proposed Iroquois/Tennessee Project, a characterization was made of the natural and manmade features evident in the landscape surrounding the proposed facilities. This characterization defined the landscape along the proposed pipeline in terms of geographic areas having similarities in the combination of four landscape elements: landform, water elements, vegetation, and cultural or manmade modifications. The landscape regions generally correspond to the physiographic provinces identified in section 4.1. Within these characteristic landscapes are areas of high visual quality (distinctive landscapes); areas of lesser, but nonetheless important, visual quality (noteworthy landscapes); and the remaining areas (common landscapes). We did not characterize locations where mainline or lateral loops are proposed; visual affects of these facilities are primarily incremental and are discussed in section 5.1.9.3.

In addition to our assessment of visual resources, Iroquois prepared an assessment of scenic quality in the vicinity of the proposed route using a modified Bureau of Land Management scenic quality inventory/evaluation system. For their assessment, areas along the right-of-way were divided into homogeneous subunits based on land form and vegetative/land use cover patterns. Each subunit was then described and rated based on seven key factors: landform, vegetation, water, color, influence of adjacent scenery, scarcity, and cultural modification. Based on the above factors, Visual Resource Management (VRM) areas were identified by class. These range from Class A combining the most outstanding visual characteristics to Class C with common visual characteristics.

The following seven characteristic landscape regions would be crossed by the proposed facilities. Each has unique visual attributes that would distinguish it from others. We identified visually sensitive areas within each region, including Class A areas identified by Iroquois.

St. Lawrence Lowlands

The first region, which is entirely in St. Lawrence County, New York, begins at the St. Lawrence River crossing (MP 0) and continues to MP 20. The terrain is generally flat (elevations range from 250 to 400 feet), and the area is characterized by farmland interspersed with small forest stands of elm, ash, and cottonwood. Major water bodies include the St. Lawrence River and the Grass River.

Important visual resources in this area include the Seaway Trail/State Route 37 (MP 1.2) and the Grass River (MPs 15.5 and 18.1). Iroquois identified the area adjacent to the St. Lawrence River (MPs 0 to 3) as a Class A VRM area, indicating an area that combines the most outstanding characteristics of each rating factor. The overall landscape quality of this region is considered common.

Adirondack Highlands

This region was delineated in St. Lawrence and Lewis Counties, New York, between MP 20 and MP 90. The terrain is steep with elevations ranging from 800 to 1,000 feet in a few locations, but generally consists of rolling hills. This region is generally undeveloped with several state forests in proximity; dense hardwood forests are the predominant cover type.

Important scenic areas in this region include: the Oswegatchie River (MP 41.4), the West Branch of the Oswegatchie River (MP 48.3), and the Indian River (MP 65.1). Generally, the landscape quality of the region is considered common to noteworthy.

Erie to Mohawk Lowlands

This landscape region is located between MP 90 in Lewis County and MP 160 in Herkimer County, New York. The terrain is rolling with elevations ranging from 340 feet near the Mohawk River (MP 152.5) to 1,500 feet along portions of the route in Herkimer County. Rural residential development can be found throughout the region, primarily in the agricultural areas. Vegetation consists of hardwood forests and sugarbush. Major water features include West Canada Creek, Otsquago Creek, and the Mohawk River.

West Canada Creek (MP 125.6) is considered an important visual resource. The vicinities of the Black River (MP 93-99) and the Mohawk River (MP 150 to MP 156) were identified by Iroquois as Class A VRM areas. Overall landscape quality is common to noteworthy.

Appalachian Uplands

The Appalachian Uplands region begins at MP 160 and continues to MP 228 including Montgomery, Schoharie, Schenectady, Albany, and Greene Counties, New York. The topography consists of rolling hills with steep slopes at creek crossings. The area is generally heavily forested with older developed farm-based communities and active farms.

The Basic Creek Reservoir/Onderdonk Lake area (MP 206 to MP 214) was identified as a Class A VRM area by Iroquois. Most landscapes in this region are common with localized areas of noteworthy to distinctive quality.

Hudson River Valley

The Hudson River Valley would be traversed between MP 228 in Greene County and MP 249 in Columbia County, New York. The terrain is rolling on the west side of the river and steeper on the east side. Elevations range from less than 50 feet to approximately 470 feet on Mt. Merino. Residential development is scattered throughout the region along with areas of farmland and oak-hickory forests.

Iroquois identified the Hudson River area (MPs 228 to 234) as a Class A VRM area; the Hudson River (MP 232) and Mt. Merino (MP 232.5) are considered important scenic resources. Landscape quality ranges from distinctive to common.

Taconic/Hudson Highlands

This landscape region begins in Dutchess County at MP 249 and continues south through Connecticut to the coastal area of Long Island Sound. The terrain ranges from gentle to moderate slopes with very steep slopes in several areas. Elevations range as high as 600 feet with numerous small streams and brooks in the steep valleys. Residential development is found throughout the region with commercial/industrial development more pronounced toward the southern portion of the region in Connecticut.

Important visual resources in this region include the Taconic State Parkway (MP 270.2), Wappinger Creek (MP 265.4 to MP 266.4), West Mountain (MP 280), the Still River Nature Preserve (MP 299.5), and the Paugussett State Forest (MP 315.1), as well as various land trust parcels between MPs 287 and 320. Iroquois also identified the AT area (MPs 284 to 287) and land trust areas between MPs 287 and 320 as Class A VRM areas. Landscape quality ranges from distinctive in rural areas to common as development increases.

Coastal Plain

The Coastal Plain encompasses the area of the proposed route on Long Island between MP 360 and the termination at MP 369.4. The terrain is generally flat with elevations less than 200 feet. Residential and industrial development is predominant along the proposed route.

No important visual resources or Class A VRM areas have been identified in this region. The character of this landscape is predominantly common.

4.1.10 Socioeconomics

The proposed project would traverse 21 counties in 5 states. The counties traversed range from rural and undeveloped (e.g., St. Lawrence County, New York) to densely developed urban/suburban (e.g., New Haven County, Connecticut, and Suffolk County, New York). The statistics in table 4.1.10-1 indicate the diversity of the project study area. Statistics were collected on population, income, and employment to identify existing socioeconomic conditions.

TABLE 4.1.10-1

Existing Socioeconomic Conditions in the Proposed Iroquois/Tennessee Project Area

State/County	1985 Population a/	1985 Population Density (per square mile) b/	1985 Per Capita Income a/	Civilian Labor Force 2/89 (in thousands) c/	Unemployment Rate 2/89 c/
CT/Fairfield	829,350	1323.8	$17,708	525.7 d/	3.1 d/
CT/Litchfield	163,050	175.3	$13,381	47.5 d/	3.7 d/
CT/New Haven	786,500	1301.1	$12,426	269.6 d/	3.2 d/
MA/Berkshire	141,600	150.4	$11,198	71.0	5.3
MA/Essex	648,500	1310.1	$12,952	354.8	4.1
MA/Hampden	444,500	719.3	$10,633	214.7	4.1
MA/Worcester	654,000	431.9	$11,386	348.3	4.1
NH/Merrimack	110,000	117.8	$11,313	65.2	2.8
NY/Albany	284,362	542.6	$15,482	153.2	3.6
NY/Columbia	62,045	97.2	$14,001	29.4	5.0
NY/Dutchess	256,563	319.1	$16,036	131.3	4.1
NY/Greene	40,868	63.0	$11,811	19.4	8.1
NY/Herkimer	67,315	47.5	$10,734	31.3	9.1
NY/Lewis	25,006	19.4	$ 9,560	10.5	13.1
NY/Montgomery	53,112	131.4	$11,564	27.0	10.4
NY/Oneida	253,316	207.8	$12,422	237.5	4.7
NY/St. Lawrence	113,530	41.6	$ 9,569	45.3	12.6
NY/Schenectady	150,149	728.8	$15,018	75.5	4.7
NY/Schoharie	30,800	49.3	$10,333	14.2	8.1
NY/Suffolk	1,321,518	1,449.0	$16,529	683.8	5.1
RI/Providence	578,124	1,393.0	$10,355	346.6 d/	3.5 d/

a/ Department of Commerce, Bureau of Census, Population and Calendar Year 1985 Per Capita Income Estimates for Counties. 1986.
b/ US Department of Commerce, Bureau of Census, Number of Inhabitants, 1983.
c/ State of Connecticut: Department of Employment Security, 1989.
State of Massachusetts: State Data Center, 1989.
State of New Hampshire: Department of Employment Security, 1989.
State of Rhode Island: Department of Employment Security, 1989.
d/ Data is by Labor Market Area, not by county.

Population varies significantly among the states and counties in the study region. New York has the largest population of the states in the study region, with an estimated 1987 population of 17,835,473, an increase of 1.6 percent over the 1980 census. Rhode Island had the lowest population of all of the states in the study area with an 1987 estimated population of 986,000, an increase of 3.8 percent from the 1980 census. As identified in table 4.1.10-1, Suffolk County, New York, had the highest county population in the study area, with a 1985 population of 1,321,518. Lewis County, New York, had the lowest 1985 population which was estimated to be 25,006. Population density per square mile ranges from a low of 19.4 people per square mile in Lewis County, New York, to a high of 1,449 people per square mile in Suffolk County, New York.

The highest unemployment rates are generally associated with rural counties in upstate New York. The 1985 income statistics show that the lowest per capita income in the study area was in Lewis County, New York, and the highest was in Fairfield County, Connecticut. As expected, the highest per capita income levels in the study area are in the counties surrounding the greater New York metropolitan area (i.e., Dutchess County and Suffolk County, New York, and Fairfield County, Connecticut), while the lowest income levels are in rural areas in upstate New York.

In February 1989 the total civilian labor force of the counties that would be crossed by the proposed route was 3,701,800. The national unemployment rate as of February 1989 was 5.6 percent. Unemployment rates for the affected states ranged from a high of 5.5 percent for New York, to a low of 2.8 for New Hampshire. For the counties studied, Lewis County, New York, had the highest unemployment rate (13.1 percent) and Merrimack County, New Hampshire, had the lowest unemployment rate (2.8 percent).

4.1.11 Cultural Resources

Section 106 of the NHPA requires us to take into account the effects of any of our projects (including the issuance of certificates) on cultural resources (prehistoric or historic sites, building, districts, or objects) listed in or eligible for listing in the NRHP, and to afford the ACHP an opportunity to comment on the projects. The applicants, as non-Federal parties, have assisted us in meeting our obligations under the NHPA and under Section 106 implementing regulations (36 CFR 800).

Guidelines were established for collecting and reporting cultural resources information in our July 28, 1988, Order. These guidelines require that Phase 1 reports include information on methods and techniques used to identify known and previously unknown cultural resources, and include the results of field surveys. Phase 2 reports are to include information necessary to evaluate the NRHP eligibility of historic and archeological sites identified in Phase 1 reports.

4.1.11.1 Historic and Archeological Resources

Areas that would be traversed by the proposed Iroquois pipeline include parts of northern, central, and southeastern New York; northern Long Island; and western Connecticut. Native American occupation of this region began with the arrival of the Paleo-Indians ca. 9500 B.C. The West Athens Hill Paleo-Indian site is located near the proposed right-of-way in Greene County, and the Kings Road site lies a few miles north of the proposed pipeline. Sites of the Late Archaic period (4000-1000 B.C.) are the most numerous in this region, perhaps representing a population peak at that time. Sites occur on terraces above rivers and uplands streams, on till deposits, along rocky ridges, along rivers, on swamp edges, and beside tidal marshes and estuaries. Where the proposed right-of-way would cross such topographic settings, there is some likelihood that prehistoric sites would be encountered. European colonization of portions of the proposed project vicinity, particularly coastal areas, began in the early 17th century. However, settlement of some interior areas, such as northern New York, did not occur until the early 19th century, following the construction of roads and canals. Historic sites are most likely to occur in the vicinity of known settlements and transportation corridors.

Most of the areas through which the proposed Iroquois route would pass have never been intensively surveyed for cultural resources. Areas about which information is known include the Hudson Valley in Greene County, the north shore of Long Island, Fort Drum in northern New York, and part of Litchfield County, Connecticut. These areas may, therefore, be relatively over-represented in listings of known sites. Conversely, the low frequency of sites in other areas may be attributed, at least partially, to the lack of intensive investigations. However, the frequency of prehistoric sites in Greene County may also accurately reflect the importance of the chert quarries in this area as a source for stone tool material, from Paleo-Indian through Archaic (8000-1000 B.C.) and Woodland (1000 B.C.-A.D. 1600) times.

Cultural resource investigations of the proposed Iroquois and Tennessee rights-of-way are currently at varying stages of completion. Preliminary documentary research and file searches have been completed for the entire length of the Iroquois route, identifying known resources in the files of the New York and Connecticut SHPOs. However, a field survey has been completed for the submarine segment, where the proposed pipeline would cross Long Island Sound. This survey entailed the use of remote-sensing technology: side scan sonar, sub-bottom profilers, and magnetometers (all anomalies will be avoided). A field study of the terrestrial right-of-way, designed to determine the presence or absence of potentially eligible cultural resources, was initiated in July 1989. Based on topography, particularly proximity to water resources, areas of the proposed route with high and moderate probability of containing archeological sites have been designated. This analysis, the documentary research, and the marine testing, were performed by Ecology and Environment, Inc., or their marine archeological subconsultants, an archeological consultant for Iroquois.

The SHPOs and FERC approved the "Work Plan for Cultural Resources Investigation," prepared by Ecology and Environment. The proposed Iroquois pipeline route was laid out to avoid structures that were identified by preliminary documentary research as NRHP-eligible. Thus, no identified NRHP structures are within the proposed Iroquois right-of-way. If the right-of-way is altered to avoid recently identified wetlands, rare vegetation, etc., the possible presence of NRHP-eligible structures will have to be reassessed.

In all cases, field surveys would be necessary to determine the presence or absence of previously unrecorded cultural resources. If such sites are found, Phase 2 evaluative testing would be necessary to establish NRHP eligibility. The removal of trees and other landscape alterations along the proposed pipeline route may have temporary or permanent effects on the viewsheds of NRHP-eligible structures. A procedure for identifying such impact and remedial measures have been discussed by FERC, SHPOs, and the applicant.

To date, documentary and file searches have been completed for portions of the Wallingford Lateral; preliminary field studies have been conducted for the Concord Lateral and part of the Wallingford Lateral. No Phase 2 (site evaluation) studies have been completed at this time.

Preliminary documentary research has been conducted by the University of Massachusetts Archaeological Service for the Columbia/Berkshire Loop, Worcester Loop, and the Haverhill Lateral in Massachusetts. Map research indicated the existence of nine areas of potential historic cultural resources and eight known prehistoric sites on or near the proposed right-of-way. These have not yet been subject to walkover reconnaissance or shovel-testing. Based on a map analysis, Environmental Archaeology Group (1988) identified six locations on the proposed right-of-way of the Columbia/Berkshire Loop and six locations on the proposed right-of-way of the Haverhill Lateral that are likely to contain prehistoric sites. This prediction has not yet been tested by field investigations.

Phase 1 documentary and field studies have been conducted for the Concord Lateral in New Hampshire. Three prehistoric sites have been discovered near the confluence of the Suncook and Merrimack Rivers. One historic site was located: a 19th century brickyard. No previously recorded historic sites are known from the documentary record of the area.

The Wallingford Lateral was field-tested by Greenhouse Consultants in November 1988. No significant prehistoric or historic cultural resources were identified. However, the Connecticut SHPO noted that the proposed Wallingford Lateral would cross the Farmington Canal, which is listed on the NRHP. The SHPO recommended additional field inspection and "an evaluation of potential project effects upon the historic and archaeological integrity of this important transportation corridor." Apart from these remarks by Connecticut's SHPO, no other SHPOs have commented on Phase 1 studies.

4.1.11.2 Traditional Cultural Values

In accordance with the ACHP regulations (36 CFR 800.1(c)(2)(ii)), every effort should be made to ensure that Indian tribes and other Native American groups are provided full opportunity to participate in the review of Federal projects under Section 106. Specifically, the regulations encourage Federal agencies to "be sensitive to the special concerns of Indian tribes in historic preservation issues, which often extend beyond Indian lands to other properties" (36 CFR 800.1(c)(2)(iii)). Such traditional tribal concerns might include:

- interest in ancestral homelands;
- interest in lands near their present home that may have been transferred to non-Indians;
- interest in tribal history;
- cultural or religious interest, such as a desire to preserve ancestral or ancient burial places or sacred sites from desecration, or the desire to retain access to such religious places for ritual purposes.

The regulations encourage full participation by tribal representatives as interested parties, but no special process is defined.

FERC, in consultation and cooperation with appropriate SHPOs, and in order to document Indian concerns, will send project-specific plans and maps to designated tribal representatives, identified interested Indian groups, and individuals. The accompanying letter will specifically request responses regarding sacred areas, archeological sites and their excavation, burials, and ethnographic-use areas with particular reference to traditional plants, animals, and ritual areas. A copy of the initial letter and the list of those contacted are to be provided in the cultural resources technical report. In addition, existing published documentation on traditional Native American concerns will be incorporated into the analysis.

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5.0 ENVIRONMENTAL CONSEQUENCES

5.1 PROPOSED ACTION

5.1.1 Geology

5.1.1.1 General Construction and Operational Impact

Construction and operation of the Iroquois and Tennessee facilities would not materially alter the geologic conditions in the project region. However, the need to complete rock excavation by blasting during construction could result in environmental impact. Ground motion due to blasting, if not properly controlled, could cause local slope instability or ground subsidence features to develop, or affect the yield of nearby wells. A small reduction in available sand and gravel resources could also occur as a result of pipeline construction.

Rock Excavation and Blasting

The planned excavation depth for most portions of the trench is 5 to 7 feet. Blasting would be necessary along portions of the project alignments where bedrock lies above grade or within approximately 5 feet of ground surface. Rock excavation along portions of the routes could be completed through ripping, thereby avoiding blasting. "Ripping" is the mechanical breakdown of relatively soft, broken, or weathered rock using toothed tools in conjunction with bulldozers, trench excavators, and/or backhoes.

The primary concern during blasting would be the effect of ground vibrations on slopes, existing structures, and wells. If not properly controlled, blasting could damage nearby structures, and cause local changes in groundwater flow patterns. Even if appropriate procedures are followed, adverse effects could occur, and the applicants should be prepared to initiate restorative or compensatory measures. We recommend that the applicants should be required to reimburse property owners for any documented damage caused by blasting during pipeline construction.

Additional temporary effects of blasting could include the hazards posed by uncontrolled fly-rock, and nuisances caused by increased dust and venting of gases following blasts. Proper use of blast matting could minimize potential fly-rock hazards, while dust and gas venting would both be temporary local phenomena that would not have any long-term effects.

Potentially adverse effects associated with blasting could be mitigated through careful adherence to blasting regulations and the use of special procedures. Where blasting would be necessary, Iroquois would employ the following measures to minimize possible impact:

1. Seismographic surveys would be conducted to monitor ground vibrations adjacent to homes and other structures and care would be taken to ensure that vibrations due to blasting are limited.

2. A full-time blasting consultant would be employed to approve types of explosives, loading quantities and procedures, drill patterns, timing of delays, as well as the method, use, and type of matting to minimize vibrations and fly-rock.

3. Blasting would not be permitted within 10 feet of existing operating pipelines or structures. Precautions would be taken where the proposed route parallels or crosses existing electrical transmission corridors, as stray current from electrical fields may be present. In such areas, the use of electrical detonation caps would be restricted.

4. All personnel would be required to remain a safe distance from the blast area during detonation. Loaded drill holes would not be left unattended overnight.

5. All blasting would occur during daylight hours.

6. At the property owners' requests, pre- and post-blast foundation inspections are recommended to be conducted to ensure structures, including wells and septic systems, are not damaged within 100 feet of the blasting zone. The applicants are recommended to consult with the property owners on a one-to-one basis to determine whether pre- and post-blast surveys are requested or declined. Documented damages resulting from blasting are recommended to be reimbursed by the applicant to an extent equivalent or greater than the pre-blasting condition.

Tennessee's Construction Specification for Powder Blasting includes conditions similar to Items 2, 4, and 5 above. We recommend that Items 1 and 3 be added to their blasting procedures. For Tennessee, Item 6 should be modified to say: at homeowners' request, pre- and post-blast foundation inspections are recommended to be conducted within 100 feet of the blast zone to ensure that structures, wells, and septic systems are not damaged.

Blasting Regulations

In areas where blasting would be required for construction of the proposed pipelines, all applicable Federal, state, and local stipulations must be observed and necessary permits and authorizations must be obtained. State laws generally require that a blasting plan be filed with the appropriate agency prior to the commencement of blasting, and that seismic monitoring of blasts be conducted to ensure that vibration limits are not exceeded. Notification to owners of nearby buildings would also be required. Federal and state blasting standards and regulations are described below.

Federal blasting regulations are issued by the U.S. Bureau of Alcohol, Tobacco and Firearms (27 CFR 55), and OSHA (29 CFR 1910.109 and 1926.900-1926.914).

Blasting in New York is regulated by the NYDEC, which is currently in the process of developing a new set of guidelines. Blasting during pipeline construction would likely be regulated by the new guidelines, which are expected to reflect the U.S. Bureau of Mines' (USBM) guidelines on structural response and damage due to ground vibration from blasting (Siskind et al., 1980).

The State Fire Marshal regulates blasting in Connecticut in accordance with Connecticut General Statutes, Title 29, Chapter 530. Permits and blasting licenses can be obtained from the headquarters in Meriden, but individual towns must also be notified prior to blasting.

Permits for blasting in Rhode Island can be obtained from the State Fire Marshal in North Providence, but individual towns must be contacted for final permission prior to blasting. Blasting must be performed in accordance with the General Laws of Rhode Island, Title 23, Chapter 28.

Blasting in New Hampshire is governed by the New Hampshire Code of Administrative Rules, Chapter SAF-C, Section 1600, and is regulated by the State Police, Explosives Division.

Blasting in Massachusetts is regulated by the State Fire Marshal, who must be contacted for permission to blast, and who would then notify individual towns. Contractors must exhibit a blasting bond and a certificate of competency issued by the State Fire Marshal. Specific stipulations are contained in Massachusetts General Administrative Code, Chapter 148, Sections 9, 10A, 19, 20A-C, and Board of Fire Protection Regulations, Chapter 527, Code of Massachusetts, Section 13.00 et seq.

Disposal of Excavated Materials

As discussed in section 5.1.1.2, portions of the alignments would require continuous rock blasting. Therefore, excavation of the trench could result in the need to dispose of considerable quantities of rock and soil materials. Iroquois would dispose of the excess rock in several ways, including: offering the rock to local landowners as fill, windrowing excess rock along the right-of-way, trucking excess rock to disposal sites away from the alignment, or operating a stone crusher and selling the resulting product. The absence of detailed estimates of the quantities of rock that would require disposal prevents accurate assessment of potential impact associated with these alternatives. Tennessee has not provided any information on disposal methods for excess rock.

The applicants are recommended to identify in advance the preferred method of disposal of any excess rock from trench excavation and file this information with the Secretary of the Commission for review and approval by the Director of the OPPR. This would include coordination with local officials to determine the most appropriate disposal options, a survey of local landowners to determine the potential for use as fill, identification of preferred locations for windrows of excavated material, potential locations for offsite disposal, and determination of appropriate locations for rock-crushing activities. We recommend that excavated bedrock not be used as backfill in rotated or permanent cropland, and in no areas should excavated bedrock be mixed with topsoil during backfilling of the trench (see also section 5.1.2.1).

5.1.1.1.1 Mineral Resources

Fifty known surface locations of exploitable mineral resources lie within 1.5 miles of the proposed pipeline alignments (see table 4.1.1-2). Of those 50 sites, 9 could be affected by the construction and operation of the pipeline. Sand and gravel operations adjacent to (eight sites) or crossed by (one site) the proposed Iroquois alignment could also be affected. Adjacent sites are defined as those within 500 feet of the proposed alignment. Impact could include a reduction in the exploitable sand and gravel reserves of the area, together with attendant economic losses to the owner caused by limitations on the possible future expansion of the affected quarries. There are no known underground mining operations near the proposed pipeline segments or compressor sites. In order to mitigate impact on present mining activity and future exploitable mineral resources, the applicants would have to negotiate with mining lease holders during right-of-way procurement.

5.1.1.1.2 Geologic Hazards

Potential hazards to the pipeline would include slope instability, karst features, earthquakes, and liquefaction potential. Construction-related erosion, also discussed in section 5.1.2.1, could undermine slopes, possibly resulting in secondary slope failures and potentially endangering areas near the project. Slope-stability problems are not widespread along the proposed pipeline route and would not be expected to pose a major hazard to construction or operation.

Karst conditions are not widespread in the proposed project area and there is a low potential for significant impact on construction or operation. Site-specific investigation would be required by the applicants in the areas where karst conditions could occur, including the area from MPs 190 to 196 of the proposed Iroquois route and Tennessee's Schoharie/Albany Loop. Iroquois indicated that geophysical exploration methods such as conductivity studies, the use of ground-penetrating radar, or mechanical probing via boreholes, test pits, and soundings could be used to help identify potentially hazardous karst features. Tennessee indicated that site reconnaissance, review of available data, and geophysical investigations would be utilized as needed to evaluate suspected karst areas. Potential mitigative measures to prevent impact on the pipeline as a result of these features include a local shifting of the alignment or design of pipeline support across potentially unstable areas. As karst conditions are not common in the project area, the likelihood that reroutes would be required is low. We recommend that the applicants file the results of final design investigations in areas where the pipeline would cross known karst with the respective state and local agencies for comment.

Considerable attention has recently been focused on the potential for damaging earthquakes to occur in the eastern United States. Iroquois indicates that the pipeline would be designed to sustain the predicted seismic loading from a Modified Mercalli intensity IX event based on a 200-year recurrence interval. No seismic events with Modified Mercalli intensity IX or greater have been experienced near any proposed pipeline segment. Earthquake hazard can also be estimated on a probabilistic basis. Algermissen et al. (1982) have estimated horizontal accelerations in rock (expressed as a percent of gravity) with a 90 percent probability of not being exceeded in 50 years. Using relationships developed by Trifunac and Brady (1975) the peak horizontal ground acceleration in the project area of 0.17g indicated by Algermissen can be correlated with a Modified Mercalli intensity between VII and VIII.

Recent case history studies by O'Rourke et al. (1989) have found that permanent ground movements are the primary cause of damage to buried steel pipelines. These include ground movements associated with surface fault rupture and damage due to secondary effects including landslides, liquefaction, and soil settlement. No occurrences of surface ground rupture have been found in the project area, and occurrences of potentially liquefiable soils or soil subject to settlement are not widespread along the alignment. Therefore, seismic activity would not be expected to pose a hazard to the pipeline.

No areas of potential liquefaction have been identified by the applicants. Should localized areas of potentially liquefiable soils be identified during construction, impact on the pipeline in susceptible areas of loose, saturated, and cohesionless sediments could be minimized by coating or weighting the pipeline to lower its relative buoyancy, as has been suggested by Iroquois.

5.1.1.2 Site-Specific Impact

While depth-to-bedrock would vary along the alignments, preliminary studies performed by the applicants and data available from published reports of the SCS indicate that there would be a high probability of encountering rock during trench excavation along certain portions of the alignments. The areas potentially affected by blasting and areas of potential geologic hazards are described below.

Iroquois

Blasting - Concern has been expressed over the amount of rock excavation that could be required for construction of the proposed pipeline. Iroquois prepared estimates of the amount of blasting required for each construction spread, and general data presented by Iroquois on depth-to-rock in various sections of the alignment have been reviewed by staff using SCS information as well as field inspection of portions of the route.

Iroquois' estimates of the percentage of each construction spread that could require rock excavation vary between 15 and 40 percent. Between MPs 0 and 95.2 (construction spread 1), approximately 30 percent of the route is expected to require rock excavation. A variety of bedrock types exist throughout this region, including gneiss, granite, and carbonates, with lesser amounts of sandstone and marble. Along construction spread 2 (MPs 95.2 to 190.2), less than 15 percent of the alignment would encounter ditch or grade rock. Bedrock along this construction spread consists of carbonates and shale, and typically outcrops or lies within the top 5 feet only along steep slopes, which occur infrequently along the alignment. Rock excavation would probably be necessary along less than 30 percent of construction spread 3 (MPs 190.2 to 270.2), where the route is generally underlain by shale, carbonate, sandstone, and quartzite; most shallow rock is found adjacent to the Hudson River to the west. Construction spread 4 (MPs 270.2 to 334.1) would probably require the most blasting, with ditch or grade rock occurring over about 40 percent of the alignment. Bedrock in this area consists of schist, gneiss, and more resistant metamorphic units such as quartzite.

While these estimates may accurately represent the entire proposed alignment, continuous local areas of 1,000 feet or more could require rock excavation. Particular concerns have been expressed over the amount of rock excavation required in the towns of Dover and Pleasant Valley, New York, and the towns of New Milford, Shelton, and Monroe, Connecticut. If all of the proposed procedures and state and local regulations are adhered to, we believe that blasting impact would be limited to the pipeline rights-of-way.

Mineral Resources - The nine potentially affected sand and gravel operations that could have expansion curtailed by construction of the proposed Iroquois Project are located in a region with abundant similar glacial deposits from Greene County, New York, to Fairfield County, Connecticut. A route variation has been recommended to avoid an active quarry in Columbia County (see section 3.6.17); adequate clearance between the proposed right-of-way and the boundary of future mining activities in other areas would be considered during rights-of-way procurement negotiations in determining compensation.

Geologic Hazards - The only identified geologic hazard that may be encountered along the proposed Iroquois alignment is related to slope stability. Sections of the pipeline crossing deposits of glacial lake clays and the Helderberg Escarpment near the Hudson River display reliefs of 40 feet and potentially unstable slopes in excess of 15 degrees. These units might be susceptible to high rates of erosion during pipeline construction and would require special techniques such as terracing, use of retaining walls, and rapid revegetation to help ensure slope stability. Specific recommendations are discussed in section 5.1.2.1.1.

Tennessee

Blasting - Tennessee provided data on depth-to-rock that was compiled from completion drawings from existing pipeline segments, field notes from previous construction, and from SCS information. The estimated extent of blasting that would be required along each proposed segment is discussed in section 5.1.3.1.2.

Mineral Resources - The closest mining operations to the Tennessee segments lie approximately 0.1 mile (two locations) from the proposed Concord Lateral. Since this proposed segment would involve construction along existing right-of-way, no impact on mineral resources would be expected.

Geologic Hazards - Most of the proposed Tennessee pipeline segments and the proposed Mendon Compressor Station would be located within existing pipeline rights-of-way, which have not experienced adverse effects due to geologic hazards. We recommend, however, that Tennessee complete a survey to insure that the alignments do not fall within any areas potentially affected by subsidence due to subsurface mining activities. Specific recommendations are discussed in section 5.1.2.1.1.

5.1.2 Soils

5.1.2.1 General Construction and Operation Impact

Affects on soils from pipeline construction and operation could result from the potential for increased water and wind erosion during the construction and early postconstruction phases, loss of soil productivity from soil compaction and damage to soil structure by heavy equipment during construction, loss of soil fertility from mixing of topsoil and subsoil, and interference with agricultural drain tile systems.

Soil Erosion

Construction procedures, including vegetation clearing, grading, trenching, topsoil segregation, and backfilling destabilize the soil surface and make it susceptible to water and wind erosion, potentially the most severe impact on soil from pipeline construction. The most critical time for soil erosion is after initial clearing and grading and before reestablishment of vegetation. Water erosion primarily occurs in loose soils on moderate to steep slopes. Wind erosion can occur in dry, sandy soils where vegetation cover is difficult to establish and maintain.

Soil erosion can be reduced with temporary and permanent structures such as terraces, berms, hay- or straw-bale sediment barriers, riprap, and trench breakers to divert, dissipate, or slow runoff and trap silt. The soil surface can be stabilized with temporary and permanent planting and mulching. Construction can also be avoided during periods of maximum runoff.

Soil Compaction and Damage to Soil Structure

Movement of heavy construction vehicles along the right-of-way during construction usually results in compaction of the soil which can have a significant impact on agricultural areas. Within a certain range of moisture content, soil compaction along the construction right-of-way can be significant, but can be alleviated by tillage. Of greater concern is puddling and damage to soil structure. The soil is especially prone to structural damage during the wettest part of the spring season and in areas with poor drainage. Structurally damaged soil has reduced pore space, which impedes the movement of air and water to plant roots, resulting in lower growth rates. Clodding at shallow depths complicates planting. Also, compaction and rutting can increase the erosion potential.

Mitigation measures to minimize compaction normally include avoiding heavy construction during excessively wet periods. Subsoil compaction may occur, but may be alleviated by deep tillage utilizing subsoilers or deep chisel plows. This technique loosens the soil without mixing horizons.

A widely recognized method of restoring structurally damaged soil is to plant a legume or grass-legume cover crop and plow it under when grown. The addition of organic matter, or "green manure," reduces bulk density and promotes granulation, thereby reversing the effects of wet weather construction. Another method is to plow the damaged area with a "winged" plow, which lifts and loosens soil without turning it over. Significant improvements in productivity have been reported following the use of such a device. The use of a similar tool, called the "paraplow," can also be used to restore damaged soil.

Loss of Soil Fertility

Trenching and backfilling can result in the mixing of topsoil and subsoil, reducing productivity of the soil. If the subsoil is gravelly, water retention capacity within the root zone may be lowered by mixing. Large stones brought to the surface during construction could interfere with operation of agricultural equipment. In areas where blasting is required, non-contained blasted rock could also interfere with equipment.

Soil mixing can be minimized by separating topsoil from subsoil during trenching. The removal of stones having a 4-inch or greater diameter from the upper 12 inches of soil is normally performed in cultivated lands. Fly-rock from blasting can be contained by matting or controlled blasting techniques.

Drainage Tile System Damage

Movement of heavy construction vehicles along the right-of-way could push drain tiles out of alignment or cause breakage. Trenching could also cause drain tile damage. Crop production would be lowered if tile damage is not corrected. Drain tile damage can be reduced by locating the drain lines during preconstruction consultation with landowners and appropriate Federal and state agencies. Tile damage from vehicle movement or trenching can be repaired by probing the tile to determine if misalignment or breakage has occurred and replacing the damaged sections.

Pipeline Depth of Burial

The New York State Department of Agriculture & Markets (NYDAM) recommended that in agricultural areas pipeline soil-cover depth in existing pipeline right-of-ways should not be less than 40 inches. To avoid obstructing drainage, we recommend that Tennessee construct pipeline loops at the same elevation as any existing line(s) on the same right-of-way. Iroquois stated that the soil-cover depth would be at least 48 inches in rotated and permanent croplands and hayfields and at least for 36 inches in unimproved pasture. They also sated that the pipeline would be buried below the bedrock level in agricultural areas where there is less than 48 inches of soil over bedrock. In areas requiring blasting where bedrock is exposed at the ground surface, Iroquois would place at least 24 inches of cover over the pipeline. The New York State Task Force (NYSTF) suggested that where the pipeline crosses drain tile outlet ditches, the pipe may need to be buried at 6-7 feet to accommodate periodic ditch cleaning. The applicants would need to coordinate this with the appropriate landowners. Iroquois stated, and we recommend for Tennessee as well, that topsoil from adjacent agricultural land would not be used as backfill or additional surface cover material.

5.1.2.2 Erosion Control, Revegetation, and Maintenance Requirements

The applicants prepared erosion and sedimentation control (E&SC) plans. Some states require that these plans be submitted and approved before construction begins. In Massachusetts, the plan must be submitted to the appropriate town conservation commissions. In New York and Connecticut, the E&SC plan must be submitted to the affected soil county conservation districts and appropriate town conservation commissions. The NYDAM has also requested that these plans also be submitted to their office.

We evaluated each applicant's plan, submitted with the original application, to determine if the proposed mitigation measures are adequate. All of the plans have some components that are adequate and some components that are not. Since each plan contains certain aspects that we do not consider sufficient to reduce impact to acceptable levels, we compiled a standard set of procedures which each applicant would be required to implement as part of its erosion control, revegetation, and maintenance procedures (see appendix C, Erosion Control, Revegetation, and Maintenance Plan (Plan).

Our Plan was reviewed by the applicants in the DEIS. The applicants generally agreed with most of the requirements, but took exception to several general measures and proposed alternative measures. We have reviewed the applicants comments on the Plan and made changes to it where we feel the applicants have raised a valid concern. In addition, we have made revisions to incorporate comments made by other agencies and have reformated it to reflect the sequence of construction activities along the right-of-way. The following is a general description of our Plan, presented in appendix C, and major comments and alternative measures made by the applicants and the NYSTF along with our evaluations and recommendations. Other reviewers have commented on our Plan and the soil erosion and compaction mitigation measures discussed in this section. We have reviewed and responded to these comments in Volume III and have incorporated any appropriate recommendations in our Plan. We recommend that unless the applicant's plan or state or locally approved plans provide for more stringent measures, the measures contained in appendix C be implemented.

Supervision and Inspection

The mitigation measures discussed here and in appendix C could be successfully implemented if the construction process is carefully monitored by environmental inspectors. Our Plan requires that each applicant employ an environmental inspector or other qualified professional knowledgeable of the soil conditions and conservation plantings in the project area to implement the procedures outlined in the Plan. Any noncompliance with the Plan would be reported to the chief inspector by the environmental inspector. We do not recommend giving stop-work authority to the environmental inspectors -- only the chief inspector or resident engineer should have such authority. The inspectors shall interact directly with landowners, Soil and Water Conservation Districts, state representatives, and SCS personnel to ensure compliance during preconstruction, construction, postconstruction, and restoration phases, as well as follow-up inspections. Duties of the inspectors are outlined in appendix C.

Each of the applicants has agreed to use environmental inspectors who would be present at all times during construction. Iroquois agreed with the duties of the environmental inspector as outlined in appendix C. However, they also noted that the environmental inspectors would be responsible for monitoring compliance with other environmental permits and approvals as well as the conditions of the FERC certificate. We agree and have revised the Plan to include these activities as part of the environmental inspectors' responsibilities.

Tennessee commented that the duties outlined in section I of appendix C are beyond the scope of the environmental inspector. They stated that they intend to hire an agricultural/soil conservation specialist who would have knowledge of soil conditions and vegetation in the Northeast and would work closely with the environmental inspector. We agree with this approach as long as the environmental inspector has the overall responsibility of ensuring that the conditions of the Plan are followed. We have revised the plan to state it shall "be implemented under the supervision of the environmental inspector or other qualified professional with knowledge of soil conditions and conservation plantings in the project area." However, it is still the responsibility of the environmental inspector to monitor and supervise these activities.

Preconstruction Planning

Timing of Construction - The most common soil-related problem the proposed project would encounter is saturated soils caused by seasonal high water tables. Saturated soils have low weight-bearing capacities and low resistance to disturbance. Extended periods of rain could also result in saturated conditions, typically between April 1 and May 15. The applicants have committed to avoid heavy construction during the wettest part of the spring season. In the event that this cannot be avoided, follow-up mitigation would be needed during cleanup to decrease effects of rutting.

Drain Tile Location - Drainage tiles can be damaged by operation of heavy construction equipment on the right-of-way and by trenching operations. If not repaired, the soil will not drain properly and crop production could be curtailed. Subsurface drain lines would be identified by the applicants during preconstruction surveys. Both applicants agree to locate drain tiles before construction. We require that drain tiles be located by contacting landowners and local SCS officials.

In areas where there is a potential for future installation of drainage tile, the trench and pipeline must be placed at an elevation so as not to interfere with this future system. We require that the applicants increase the depth of cover over the pipeline to 4 feet or more, if needed, so the pipeline is below the anticipated depth of drain tile installations. The applicants should contact landowners and local soil conservation authorities to determine locations where this increase in cover depth is required.

Landscape Planting Plans - In our Plan we require that the applicants determine the vegetation requirements for screening and landscaping new compression and metering facilities and file a report for our review and approval prior to construction. Tennessee does not feel that we should be involved in approval of screening and landscaping plans for these facilities and proposes that it work directly with local zoning boards. Tennessee would need to work with the local agencies to determine the necessary requirements. However, we still require that the final plans be submitted to us for our review and approval.

Clearing and Installation

Topsoil Segregation - Trenching and backfilling could result in the mixing of topsoil and subsoil materials, which could degrade chemical and physical properties of the soil profile and potentially result in a loss of crop productivity. Much of the cultivated soils crossed by the proposed pipeline have topsoil that is relatively free of gravel, while the subsoil is very gravelly. Mixing these horizons would lower the water retention capacity and organic matter content within the root zone of the soil. Large stones brought to the surface during construction could create conditions that would interfere with agricultural operations. In our Plan, this potential impact is mitigated through separation of topsoil and subsoil during trenching and grading, as well as the removal of stones having at least a 4-inch diameter from within the upper 12-inch zone in areas of cultivated land. The Plan requires topsoil be stockpiled onto topsoil and subsoil onto subsoil to prevent mixing of the horizons (see figure 5.1.2-1). In addition to agricultural areas, the applicants would also apply this mitigation technique where landowners request it and in residential areas. For deep soils (such as floodplains and stream terraces), 12 inches of topsoil stripping is required. Where soils are shallow to bedrock or have a stony subsoil, 8 inches of topsoil stripping is required.

The NYSTF commented that in all tillable agricultural land, topsoil segregation should include the working side of the right-of-way as well as the trench area, since the working side of the right-of-way is where the most damaging long-term silting and mixing of the soil would occur (see figure 5.1.2-1). This full-width right-of-way topsoil stripping would require extra space to store the topsoil that could result in a construction right-of-way 100- to 120-feet wide. The NYSTF suggested that full-width right-of-way topsoil stripping be performed in the following areas: where the landowner requests it; in areas of clayey soils that could pose problems during periods of heavy rain in the fall; in agricultural areas where soil structure is vulnerable (based upon soil surveys); in cultivated areas that have steep slopes where areas would have to be cut to create level grade; and in areas where additional work space is required such as boring under roads. The NYSTF also suggested that topsoil segregation be used in areas other than agricultural areas to promote revegetation.

Both Iroquois and Tennessee agreed to topsoil segregation in cultivated agricultural areas. Iroquois also stated they would do it in other areas as requested by the landowner. Tennessee felt topsoil segregation should not be required in residential areas. Both applicants indicated that the depth to which topsoil would be stripped would be based on site-specific conditions. Iroquois also stated that if the ditch and spoilside method of topsoil segregation is applied, the construction right-of-way width can not be less than 100 feet wide.

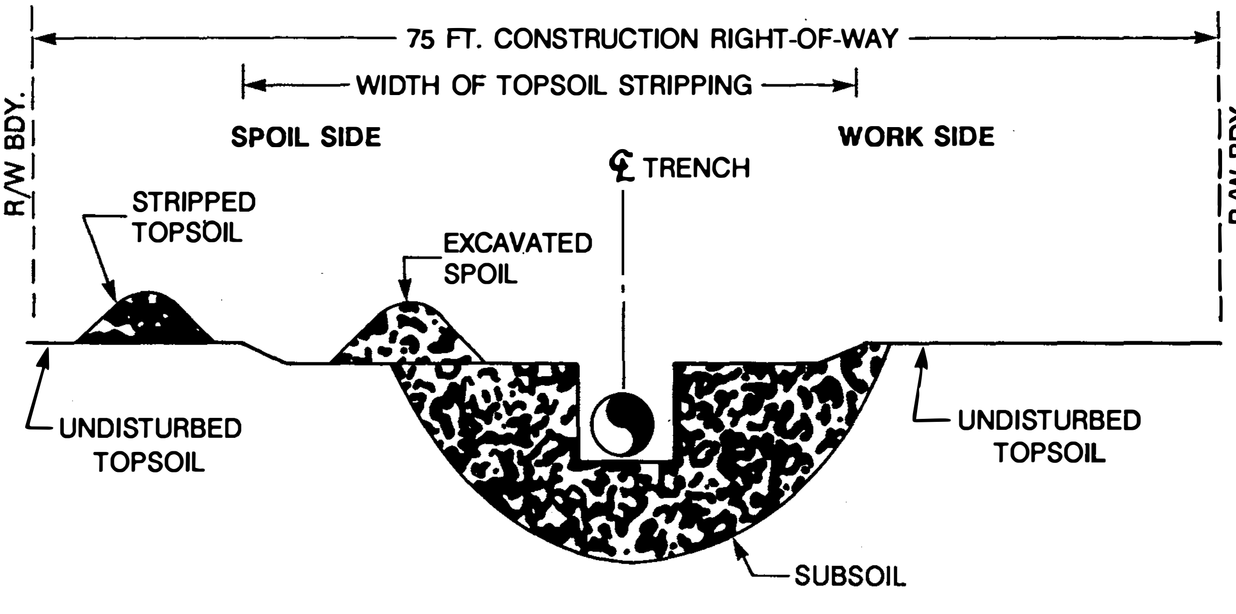
In general, we agree with the NYSTF that full right-of-way topsoil stripping would further reduce the damage to soil structure from compaction and settling on the working side of the right-of-way. We do note that in the diagram that NYSTF submitted depicting full right-of-way topsoil stripping, they showed excavated subsoil being stored on undisturbed topsoil on the spoil side of the trench. To reduce the potential of mixing topsoil and subsoil, we specifically require that topsoil only be stored on top of topsoil and subsoil on top of subsoil. We are also concerned that full right-of-way topsoil stripping requires a substantially wider construction right-of-way than is normally utilized for overland construction. The use of this method of topsoil segregation would need to be strictly limited to actively cultivated agricultural areas, which would include active or rotated cropland and hayfields. We require that for full right-of-way topsoil stripping, the width of the construction right-of-way not exceed 100 feet. In all other improved or residential areas the ditch plus spoilside topsoil segregation method (see figure 5.1.2-1) would be used and the construction right-of-way would be limited to 75 feet. The Plan has been revised to reflect this change. The applicants are required to strip the topsoil to the depths indicated in the Plan. Topsoil, segregation in areas other than those specified in the Plan would be conducted at the landowners' request.

Slope Breakers - Steep slopes have been identified by the applicants and would require special mitigative techniques. The highest water erosion potential along the proposed Iroquois route is in the Taconic Mountains in Dutchess and Litchfield Counties where the pipeline would climb and descend slopes exceeding 40 percent from MPs 247.0 to 249.5. Similar erosion concerns are present near Dover, New York; Monroe, Connecticut; and along the Still River near Brookfield, Connecticut. The proposed Tennessee segments would have a high potential for water erosion from MLV 254 to MP 256+3.0 where the proposed route would ascend and descend areas in excess of 40 percent slope. Additional local areas of steeper slopes would be encountered along most portions of the route.

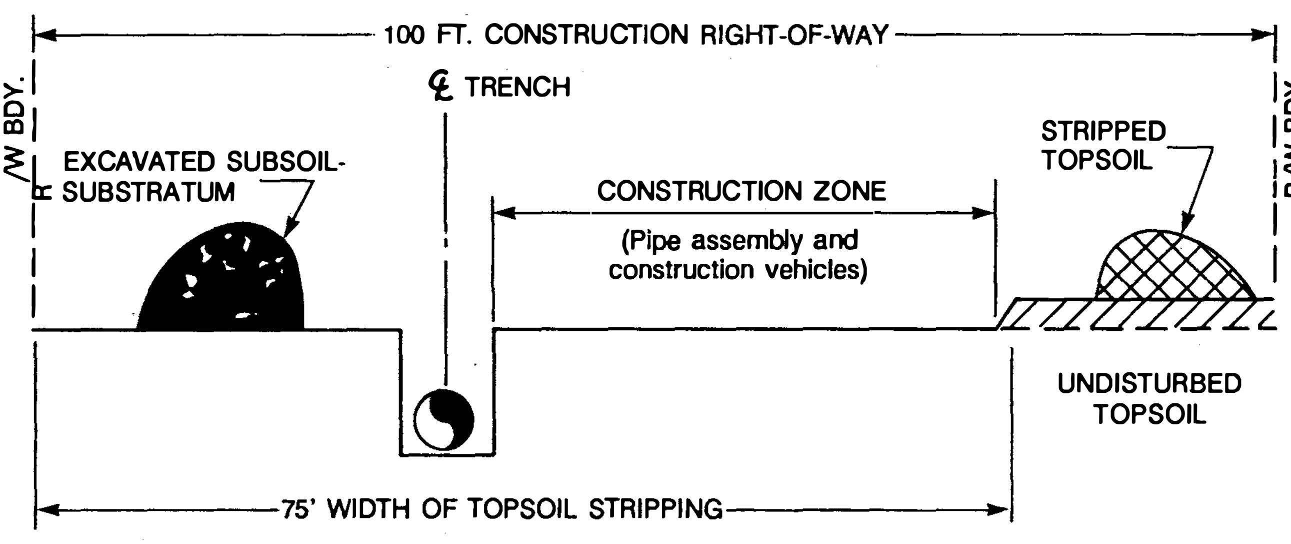
A slope breaker is a berm of soil constructed across the pipeline right-of-way in areas on slopes to reduce erosion caused by water flowing down the cleared right-of-way. Temporary breakers are used after initial grading and permanent breakers are installed during final grading following trench backfilling.

On slopes greater than 5 percent, our Plan requires temporary slope breakers, terraces, or diversion ditches shall be constructed at the end of each working day, according to the following spacing specifications:

Slope	Spacing (ft)
5-15%	300
16-30%	200



DITCH PLUS SPOIL SIDE TOPSOIL SEGREGATION



FULL RIGHT-OF-WAY TOPSOIL STRIPPING

FIGURE 5.1.2-1

TOPSOIL STRIPPING CROSS-SECTION

NOT TO SCALE

The slope breakers would be designed to provide a safe and stable outlet for the runoff, channeling the water to an established vegetated area or rock-lined channels.

Iroquois commented that the installation of slope breakers at the end of each working day should be dependent on the potential for water-induced erosion. To require the installation of slope breakers in areas where there is no potential for water-induced erosion creates unnecessary land disturbance and increases the time to complete construction. Iroquois suggested that the decision to install temporary slope breakers at the end of a working day be made by the construction-spread environmental inspector based on a specific set of guidelines. We feel that the requirement for temporary slope breakers should not significantly increase construction time and that the benefit of controlling runoff due to unanticipated rainfalls outweighs any impact from an increase in land disturbance in constructing the breakers. Therefore, the applicants are required to follow our Plan for utilizing temporary slope breakers during construction.

Sediment Control Measures - At stream and road crossings, a buffer strip of natural vegetation, as wide as practicable, should be left undisturbed to prevent erosion in areas such as stream/river banks and road crossings. Where the vegetative strip is inadequate, silt fences which consist of filter fabric attached to a support fence, or sediment barriers constructed of hay bales, should be used to intercept sediment carried by sheet flow from cut slopes, spoil piles, or other areas of exposed soil. We require that temporary silt fences or sediment barriers be used at the base of all slopes adjacent to streams and at the base of slopes adjacent to road crossings where vegetation has been disturbed within the following distances from the road:

Slope	Vegetation Strip Required
<5%	25 feet
5-15%	50 feet
16-30%	75 feet
>30%	100 feet

Tennessee felt that temporary sediment-control need not be installed at all road and stream crossings but should be installed and maintained based on site-specific conditions. They stressed that installation of siltation fences across the right-of-way could restrict construction traffic movement. We feel our requirement is prudent to control sedimentation problems and will not severely restrict access along the right-of-way, and require Tennessee to follow the Plan specifications.

The NYSTF noted that the above sediment-control measures do not prevent dissolved acids in run-off from highly acidic soils from entering the streams. We feel that acidic runoff into streams is not a significant problem. The potential volume of acidic runoff generated from areas disturbed by construction, in comparison to the overall stream flow, would not be sufficient to alter the pH level of stream. In addition, the applicants would be required to construct slope breakers, which would prevent the flow of surface water directly into a flowing stream. Therefore, we do not recommend liming of areas adjacent to streams prior to or during construction.

Drain Tile System Repair/Testing - Our Plan requires that all drainage systems be probed with a sewer rod or pipe snake to determine if damage has occurred. All tiles damaged during construction shall be repaired to their original or better condition. Detailed records of drainage system repairs should be kept and given to the landowner for future reference.

The applicants stated that they would insure that the affected drainage systems are functioning properly by testing the system on both sides of the trenching operations with sewer rods or pipe snakes prior to repairing damaged segments. Such probes should have no more than a 15-percent size reduction than the minimum undamaged drainage system components, and probing should be completed across the entire width of the right-of-way.

The repaired drainage system should be properly aligned across the trenched zone and seated from 1.5 to 2.0 feet into each trench wall. Iroquois stated that the repaired system would be supported and aligned using perforated, corrugated, galvanized, asphalt-coated pipe with mechanically tamped soil beneath the tiles and sand fill placed to decrease silt infiltration. In lieu of specific agency recommendations, we find this method to be adequate and recommend it also for Tennessee. We recommend that qualified specialists be used to insure proper repairs and adequate probing/testing of the repaired drainage system.

The NYSTF noted that, in most instances, steel pipe is adequate for drainage repair; however, the use of cathodic protection on the gas pipeline may cause premature corrosion of the drain tube. They suggested that extra-heavy-duty solid PVC schedule 80 drain pipe be used instead. We feel that plastic pipe can be required at the discretion of the landowner or in conjunction with appropriate soil conservation agencies.

NYSTF also stated that filter-covered plastic tubing may be used in fine sand soil. Use in any other areas could cause clogging of the drain lines. Iroquois indicated that they would only use filter-covered corrugated plastic tubing in fine sandy soil. We have revised our Plan accordingly to state that filter-covered drain tubes only be used after consultation with the local SCS.

Trench Breakers - Trench breakers are used to prevent water surface erosion or preferential migration of shallow groundwater along the pipe or the pipeline trench. They are usually constructed of sacks of soil or sand placed from the bottom of the trench to the natural ground surface and completely surround the pipe. Trench breaker spacing is based on slope. Our Plan requires construction of trench breakers such that the bottom of one breaker is at the same elevation as the top of the next breaker downslope, which agrees with NYDAM's recommendation. Both applicants agree with our requirements.

Cleanup

Timing - In the DEIS, our Plan required that final cleanup and permanent erosion control measures, as appropriate, would be completed within 10 days after backfilling the trench. Both Iroquois and Tennessee indicated that the Plan did not take into account weather conditions. We agree and have revised the Plan to indicate that cleanup would be done within 10 days of backfilling the trench, weather and soil conditions permitting.

Tennessee also stated that if stove pipe construction is being used, the majority of construction equipment would be utilized for construction and would not be available for cleanup. We do not feel this is a valid reason in that arrangements can be made to provide additional equipment or schedule the use of equipment, to have it available for cleanup.

Restoration of Agricultural Areas - Ruts created by construction equipment can extend into the subsoil, damaging its structure. Mixing of the topsoil with subsoil and shearing soil structure could result in clodding of the dry, surface soil, which would interfere with tillage and reduce soil productivity. This structural damage would have undesirable effects on soil bulk density, water infiltration, and gas exchange. We received many letters from private citizens concerned about the effects of construction on drainage and soil fertility. Studies in Ontario, Canada, have shown that pipeline construction during wet periods can significantly reduce cropland productivity, persisting for as long as 5 years in the absence of restorative measures.

Within a certain range of moisture content, soil compaction along the construction right-of-way could be significant, but could be alleviated by tillage. Deep compaction is not common in connection with normal pipeline construction procedures. Inspection of soil compaction across the project right-of-way should be investigated after construction for the same soil type under the same moisture conditions and should include the following areas: soil from undisturbed areas, soil stockpile areas, the trenched zone, the work area, and any traffic areas related to the project. Devices such as COE-style cone penetrometers or other appropriate devices can be utilized to test for compaction.

Care should be taken to insure that the impact from soil structure damage and compaction are minimized. Tracked vehicles, which cause less disturbance than vehicles with tires, should be used wherever possible under saturated soil conditions. Crushed stone pads for at least a 50-foot length or other appropriate measures should be used at all access points to the right-of-way adjacent to public roadways in active agricultural areas to control rutting along the shoulders of roads and debris transference. The NYSTF suggested and we agree, that the crushed stone be placed on a synthetic fabric material to prevent mixing the stone with the soil and for ease of removal after construction. We have revised our Plan accordingly.

Structurally damaged soils may be restored by planting a legume or a grass-legume cover crop and plowing it into the soil when sufficient plant material has grown. This addition of organic matter ("green manure") helps to reverse the effects of wet weather construction by reducing the soil bulk density and promoting granulation. Significant improvements in productivity have also been observed where a "winged" plow, also called a paraplow, was applied. This type of plow lifts and loosens the soil without turning it over. We require that severely rutted soil be plowed with a paraplow (or similar winged plow) or that the applicant arrange with the landowner to plant a "green manure."

Both applicants stated their commitment to use deep tillage to alleviate the impact of compaction on soil horizons by utilizing devices such as a paraplow. Iroquois commented that the requirement to restore structurally damaged soils via paraplowing or planting "green manure" should be limited to croplands. We agree that green manure or paraplowing should only be used in all active or rotated cropland and hayfields.

In the DEIS we required that landowner compensation for a 4-year period should also be provided in conjunction with soil structure restriction program. Iroquois commented that using a standard 4-year compensation package in conjunction with a soil structure restriction program may be inappropriate. They stated that they would monitor crop productivity along the right-of-way in agricultural land and provide landowner compensation until soil productivity is restored to preconstruction conditions. This would be accomplished by a review in the first and second years immediately following construction. Tennessee stated that they would have agricultural specialists for 2 years to monitor crop productivity. We agree with these procedures as long as the applicants monitor productivity beyond a 2-year period if productivity is shown to be less along the right-of-way.

The NYSTF noted that the use of green manure is a long-term process of at least 3 to 5 years and its application depends on the timing of a field's plant rotation schedule. They strongly recommended that mechanical means be the first choice to alleviate soil compaction. We understand NYSTF concern, but feel our Plan provides the option of "green manure" based on the site conditions and landowner preference.

The NYSTF suggested that when tilling the soil to alleviate compaction the subsoil layer should be plowed first, followed by replacement of the segregated topsoil, and where necessary, be tilled again. If subsequent construction or cleanup activities result in additional compaction, further tilling would be required. They also require that any stones 4 inches or larger in size that are raised to the surface of the subsoil during the deep tilling operation be removed before replacing the segregated topsoil. We agree and have revised our Plan accordingly.

Controlled Blasting - Blasting in agricultural areas shall be conducted in a fashion such that fly-rock is contained by use of either matting or controlled blasting techniques so that there will be little additional rock introduced to the plow zone of cultivated lands. Blasted rock shall not be used as backfill in rotated or permanent cropland, though it may be used as such in pastures and hayfields. The NYSTF indicated that, in hayfield and pasture, blast rock can be used to backfill the trench to the top of the existing bedrock profile or to a depth not shallower than 24 inches. We agree that in hayfields and pasture the blast rock should only be used to landfill the trench to the top of the existing bedrock. However, we do not feel it is necessary to limit its use to a depth not shallower than 24 inches. Our Plan requires that all excess loose blast-rock be removed from the top 12 inches of topsoil in all cultivated and improved lands as well as residential areas, pastures, and other areas at the landowners' request. Preferred alternatives for disposal of excess blasted rock would be developed in consultation with local officials and landowners, as discussed in section 5.1.1.1.

Tennessee noted that our Plan implies that all loose blast rock be removed and suggested that, since some blast rock may be used as backfill, the plan should read "excess rock." We agree and have revised the Plan accordingly.

Slope Breakers - According to our Plan, after construction, permanent runoff diversions on all slopes greater than 5 percent would be constructed according to the following specifications:

Slope %	Spacing ++
5-10	150
11-15	100
16-30	75
> 30	50

Revegetation

Temporary Erosion Control - Any area that is disturbed between October 15 and May 1 or where bare soil is left unstabilized by vegetation should be treated as a winter construction problem and mulched with 3 tons/acre of hay or straw or the equivalent. If construction is completed more than 30 days before the seeding season for perennial vegetation, all areas adjacent to perennial and intermittent streams shall also be mulched with 3 tons/acre straw or hay for a minimum of 100 feet on either side of the waterway. The mulch should be anchored with a mulch anchoring tool or a liquid mulch binder.

Tennessee generally agreed that seeding should be conducted between May 1 and October 15, but felt that, based on site-specific conditions, seeding could be done as late as November. It is possible, depending on weather and soil conditions, to seed later than October 15. However, there is a greater risk of the seed not germinating and causing severe erosion problems at a later date. Therefore, we require the applicant to follow the seeding dates and to mulch any areas that cannot be seeded within those dates as specified in our Plan.

Permanent Revegetation - The applicants proposed a variety of seed mixes, soil amendments, and mulching specifications based on site-specific characteristics. We believe that it would be difficult to implement what the applicants have proposed, and instead, based on consultations with regional SCS offices, we have recommended two seeding mixtures dependent primarily on site drainage conditions. In areas of farmland where the right-of-way interrupts existing crops or pasture, a "green manure" may be planted as recommended above. The applicants have commented that two seed mixtures would be too restrictive given site-specific conditions and landowner preference. We understand the applicants' concern, but feel that the use of any seed mixture other than those specified in our Plan should only be used based on the recommendation of the landowner or land managing agency. Within 30 days of the in-service date for the facilities, the applicants would file a report detailing the number of landowners specifying other seeding requirements and a description of their seeding requirements.

Iroquois stated that soil amendments including chemical fertilizer, manure, if available, and lime would be determined based on site requirements and agency recommendations. Likewise, Tennessee would consult landowners and agencies for recommended fertilizer and lime requirement. Our Plan requires that 2 tons/acre of lime and 300 pounds/acre of 10-20-20 fertilizer be incorporated into the top 2 - 6 inches of soil prior to seeding and planting. This should be considered the minimum requirement to soil amendments to be applied to prepare a seedbed. More stringent measures can be used based on local SCS and landowner requirements.

Off-Road Vehicle Use

A potential problem along pipeline rights-of-way is the use of these areas by off-road vehicle (ORV) enthusiasts. The use of the right-of-way by ORV users could cause a loss of wildlife, intrude upon the privacy of the landowners, and cause a long-term erosion problem where ORV use is heavy. We require that for each owner and manager of forestlands the applicants offer to install and maintain ORV control measures such as a locking heavy steel gate; a screen of conifers across the right-of-way; slash and timber, boulder, and pipe barriers; and posting of signs saying the area is seeded for wildlife benefit and erosion control.

The applicants questioned the viability of these measures. Tennessee felt that the use of conifers or barriers using large boulders would inhibit access for periodic maintenance. They proposed to install locked steel gates or slash and timber barriers. Iroquois felt that since they primarily cross private land, the objective would be to visually screen the right-of-way or to prevent physical access to the right-of-way.

The NYSTF felt that the use of slash and timber barriers could be a fire hazard, visually displeasing, and in some parts of New York State, prohibited by NYS Environmental Conservation Law.

The method of controlling ORV use along pipeline right-of-way has to be resolved between the landowner or land managing agency and the applicants based on state and local requirements. Our Plan requires that the applicants offer to assist the landowner in controlling the ORV use by using one or more of the methods outlined in appendix C.

Maintenance

Follow-up inspections would be performed after the final and second growing season (approximately 3 - 6 months and 12 - 15 months, respectively) to determine the success of revegetation. Revegetation would be considered successful if perennial vegetation covers 70 percent of each square yard of the right-of-way. Where revegetation has not been successful, a professional agronomist would be used to specify the fertilizer and reseeding mixtures to be used in the next growing season.

Vegetation maintenance of the right-of-way would not be done more frequently than every 3 years and not before August 1 of any year. Efforts to control ORV use in cooperation with the landowner would continue throughout the life of the project.

Iroquois indicated that in agricultural areas they would use an agronomist or soil conservation/agricultural specialist to conduct follow-up inspections until preconstruction productivity levels are achieved. In nonagricultural areas, the environmental inspectors would determine the effectiveness of revegetation. Revegetation would be considered successful if an average perennial revegetation covers 70 percent of the right-of-way.

Tennessee stated that the 70 percent success rate would be determined by random sample plants and visual inspection from the air based on coverage of perennial and naturally reseeding plants. Tennessee also stated that if reseeding and fertilizing is required, it would be conducted by right-of-way maintenance personnel and would only employ the help of the local soil conservation service or an agronomist if the problem persisted.

We do not feel aerial inspection is sufficient to determine the effectiveness of revegetation. Per the requirements of our Plan, Tennessee must do field inspection to determine the extent of revegetation and the establishment of desirable species. In addition, the effectiveness of revegetation should be based on the coverage of perennial vegetation only, and not perennial and naturally reseeding plants which could include weed species.

Tennessee also commented that to properly maintain their right-of-way they need to mow at least every 2 to 3 years, as opposed to 5 years. We agree and have revised the plan to say every 3 years. Tennessee also felt that limiting right-of-way maintenance to after August 1 is too restrictive due to possible weather limitations and availability of the workforce. We feel that the August 1 limitation is necessary to prevent the disturbance to nesting birds.

There is also a possibility that construction of the pipeline could cause seepage or drainage problems where none previously existed. We require that the applicants, as part of their normal maintenance routine, monitor and correct any future drainage problems in active agricultural areas that would result from pipeline construction.

5.1.3 Water Resources

5.1.3.1 Groundwater

5.1.3.1.1 General Construction and Operational Impact

Construction activities associated with the proposed pipeline installation could result in impact on groundwater resources. However, most of the potential impact would be avoided or minimized by the use of both standard and specialized construction techniques.

Shallow aquifers could experience minor impact from changes in overland water flow and recharge caused by clearing and grading of the proposed right-of-way. Enhanced water infiltration provided by a well-vegetated cover could be temporarily lost until successful revegetation has occurred. Near-surface soil compaction caused by heavy construction vehicles could also reduce the soil's ability to absorb water. This minor impact would not be expected to significantly affect groundwater resources.

Grade and trench blasting would be necessary where bedrock is exposed or is less than 6 feet below the ground surface (see section 5.1.1). Use of proper blasting techniques, such as time-delayed detonation of each series of charges or loading of less explosive in each hole, can minimize the resulting ground motion and lessen the possibility that blasting would open new fractures in bedrock units, seal existing fractures, or disrupt confining layers (see section 5.1.1). These issues have been the subject of numerous comments received from the public during the scoping process. We believe that compliance with the mitigation measures described herein would allow construction to be completed with minimal impact on groundwater resources.

Studies conducted by the USBM (Suskind and Fumanti, 1974) found that when shot holes approximately 4 inches in diameter are used, blasting in rock generally produces rock fractures no more than 10 feet from the shot hole. While this distance will vary depending on the type of rock being excavated, it is unlikely that changes in groundwater flow paths due to rock fracturing would extend beyond the right-of-way of the pipeline.

Iroquois stated that it would hire a consultant to inventory all public and private wells within 300 feet of the proposed route where blasting would be required. Tennessee stated that in areas where blasting would be required and "where reasonable concerns as judged by Tennessee exist about the integrity of water supply wells," it would conduct a similar inventory. All blasting activities by both applicants would be supervised by a licensed blaster, who would be responsible for types of explosives, loading quantities and procedures, drill patterns, and timing of delays. We recommend that the applicants use alternative rock excavation methods, such as "ripping" trench excavations, rock saws, and pneumatic hammers, where feasible, in residential areas having domestic water wells.

Water quality, level, and pressure should be noted in each potentially affected well before and after the proposed construction. Iroquois stated that it may be necessary to provide new wells and interim potable water supplies, while Tennessee stated it would provide compensation for damages to any existing wells. Iroquois agreed to employ a blasting consultant who would guide blasting procedures in order to protect wells and groundwater resources. We recommend that Tennessee do the same.

Water table elevations could also be temporarily affected by pipeline construction if previously sealed bedrock fractures were exposed during trench excavation, thereby creating a new path for surface water migration. If the proposed construction would result in a higher groundwater table, local flooding of adjoining properties, structures, or basements could occur, which would require compensation by the applicant. The completed pipeline trench, if not constructed with sufficient trench barriers, could create a new pathway for groundwater migration, a particular concern in areas adjacent to hazardous waste sites.

Refueling of vehicles and storage of fuel, oil, or other hazardous materials during the construction phase of the project could create a potential contamination hazard to aquifers. Localized spills of fuel, oil, or lubricants could be expected to occur during the proposed construction. Spills or leaks of hazardous liquids could contaminate groundwater and affect users of the aquifer. Soil contamination could continue to add pollutants to the groundwater for a period of time after the spill had occurred.

This type of impact could be avoided or minimized by restricting the location of refueling and storage facilities and by requiring immediate cleanup in the event of a spill or leak. We recommend that each applicant submit a Spill Prevention, Containment, and Control Plan (SPCCP) that would describe the preventive and mitigative measures they would employ to minimize the impact associated with such occurrences. These measures should include but not be limited to: requiring all fueling and lubricating to be done in areas designated for such purposes, with such areas to be located at least 100 feet away from all water bodies; requiring each construction crew to have on hand sufficient supplies of absorbent and barrier materials to allow the rapid recovery of any spills; and development of standing procedures regarding excavation and offsite disposal of any soil materials contaminated by spillage. In addition, it is recommended that the applicants ensure that construction contractors are able to demonstrate to environmental, local, or state inspectors their ability to implement the SPCCP. Iroquois indicated to FERC that pipeline contractors would be required to carry absorbent materials on each fuel truck. Iroquois also indicated that it will consider using a spill response trailer equiped with appropriate containment and control materials at each construction spread. We would expect the Iroquois and Tennessee SPCCPs to provide for this level of spill preparedness.

In accordance with the provisions of the Safe Drinking Water Act, most states, including those that would be crossed by the Iroquois/Tennessee Project, have designated protection zones around municipal and community water-supply wells. Development and/or construction activities are generally prohibited within these wellhead protection zones. We recommend that the applicant's well inventory should include wells that meet the well protection requirements of the individual states. Known wells and their proximity to the proposed alignments are listed in table 4.1.3-2. Requirements of particular states are described briefly below.

New York requires that the area within a 200-foot radius of all public supply wells be owned or controlled, and thereby protected, by the owner of the well. Connecticut also designated a 200-foot protection zone around all public supply wells. The Connecticut Aquifer Protection Act would require municipalities and utilities to identify aquifer protection areas in accordance with CTDEP regulations that are currently being developed. Municipalities will be required by the Act to develop and implement land-use restrictions in identified protection areas. The pipeline applicants could be required to comply with local land-use restrictions concerning aquifer protection areas that may be crossed by the proposed pipeline.

New Hampshire designated as protected the area within a 400-foot radius around municipal water-supply wells, and a 200-foot radius around community wells serving 10 or more residences. Rhode Island specifies a 400-foot protected zone around wells in overburden, and a 200-foot zone around wells drilled in bedrock.

Massachusetts requires that the area within a 400-foot radius of public water supply wells be protected, and also identifies a second semi-protected zone consisting of watershed area, and a third zone in which certain activities may jeopardize water quality. However, no municipal wells near the project segments in Massachusetts are known to be set in rock, so blasting along the route during the proposed pipeline construction, if necessary, should not affect water quality or well yields.

FERC recommends that the applicants be prohibited from conducting refueling activities or storing any hazardous materials within identified wellhead protection zones and within 200 feet of private wells. Groundwater supply systems would be adequately protected from potential contamination with this restriction and the required SPCCP.

Dewatering of the pipeline trench would be the only activity that would require groundwater pumping, and this activity could be necessary in areas where there is a high water table. The potential affect of groundwater withdrawal on users of the aquifer would depend on the rate and duration of pumping. Pipeline construction activities are typically completed within several days. We recommend that all water produced from trench dewatering activities be discharged into a well-vegetated upland area, which would allow the water to return to the aquifer, either via ground infiltration or through surface water recharge areas. If this recommendation is followed, dewatering during the proposed pipeline construction generally would have minimal impact on groundwater.

5.1.3.1.2 Site-Specific Groundwater Impact

FERC received numerous letters and statements concerning the potential impact groundwater from the proposed construction and operation of the pipeline, particularly as they relate to effects caused by blasting. We believe that if followed, the recommended preventive and mitigative measures would prevent any serious, irreplaceable, long-term impact. Specific areas of concern are described in the following sections.

In order to protect groundwater resources, which are vital for public and private supply systems, we recommend the applicants be required to submit to FERC for review and approval a groundwater monitoring plan that would identify community and private supply wells and springs located near the proposed routes. The plan would be required to document preconstruction and postconstruction well- and spring-water quality and yields and would be of adequate detail to determine with relative certainty whether the pipeline construction activities had been responsible for any adverse impact on any groundwater user. In the unlikely event that groundwater supply systems are affected by the applicants' activities, the applicants would provide for an emergency potable water source and for the necessary repairs, replacement, and/or relocation of the affected facilities to restore the supply system to its former capacity. The groundwater monitoring plan should provide protocols for determining how compensation would be provided to homeowners in the event damage does occur as a result of pipeline construction, including measures that would be taken if it were not technically possible to repair a well to its original capacity and not possible to install a new well. Though both Iroquois and Tennessee proposed to perform various groundwater monitoring and remediation for damaged wells, we believe it is necessary to develop further details and documentation to make such plans effective.

Iroquois

The proposed Iroquois pipeline would pass within 1.5 miles of 165 wells along its route. The proposed route through Oneida and Herkimer Counties (MPs 107 to 160) would pass by numerous wells and springs. Concerns about potential impact on springs and wells are evident near the towns of Booneville, Pleasant Valley, Remsen, and Little Falls. All areas of Columbia County, New York (MPs 237 to 248), depend on groundwater supply, consequently any modification to existing groundwater migration pathways would be of concern.

The Iroquois pipeline route comes in proximity to seven known waste disposal sites. These sites include: the Rose Valley Landfill site (J&J Trucking), crossed at MP 134.5 for 0.3 miles; the Mackay Dump, within 500 feet of MP 267.5; the Dover/Walter Vincent Landfill (Crickett Hill Landfill), crossed at MP 282.3; the Mica Products Landfill, within 500 feet of MP 282.5; the Kimberly-Clark Corporation Waste Disposal Site, within 500 feet of MP 292.2; the New Milford Landfill, adjacent to MP 295.5; and the Silver Sands Landfill, crossed at MP 334.0 for 0.3 miles. We recommend that the applicants identify alternatives that would avoid crossing or bordering those facilities. Where route variations are not feasible, FERC recommends the use of trench breakers in these areas to prevent the pipeline trench from acting as a conduit for potential transport of contamination via groundwater movement.

The proposed route through the inactive Rose Valley Landfill raised questions regarding the disposal of contaminated materials and the potential for migration of contaminants along the excavated or backfilled trench. We recommended a route variation in this area to avoid potential problems associated with this landfill (see section 3.6.13).

In Connecticut several of the towns through which the proposed pipeline would pass have limited water supplies, most of which are drawn from public and private wells. These towns include Newtown, Shelton, Sherman, Monroe, and New Milford. Wetland areas in Shelton and New Milford are groundwater recharge areas, and care must be taken to avoid modifying existing flow regimes. In New Milford, groundwater supplies between MPs 288.7 and 291.2 are considered marginally adequate, while in Newtown, the Pootatuck Aquifer (MPs 311 to 313) was designated as a SSA in March 1990. The Nassau/Suffolk aquifer on Long Island is also designated as a SSA. An SSA designation is issued by the EPA Administrator, pursuant to Section 1424(e) of the Safe Drinking Water Act (Public Law 93-523) for an area containing an aquifer that is the sole source or principal drinking water source. Such designation requires that the EPA review all Federal financially assisted projects to ensure that they are designed and constructed such that they do not bring about, or in any way contribute to, conditions creating a significant hazard to public health. The proposed pipeline facilities are not a Federal financially assisted project; therefore, the requirements of the SSA regulations do not apply.

Groundwater quality regulations for the State of Connecticut require that extra care should be taken between the following mileposts to ensure that groundwater quality is not affected: MPs 289.5 to 294.0 near New Milford; MPs 331.6 to 332.0 and MPs 333.0 to 334.1 near Milford; MPs 302.0 to 304.0 southeast of Candlewood Lake; and near the Means Brook, Shelton, and Beaver Brook Reservoirs at MPs 318.0 to 322.3, MPs 323.8 to 326.0, and MPs 332.0 to 333.0, respectively. We believe impact on wells and groundwater resources could be minimized by implementing the mitigation measures previously discussed.

Tennessee

For each loop that would be constructed adjacent to an existing pipeline, Tennessee provided a detailed listing by milepost of areas where blasting could be required. This data is largely drawn from the construction records of the existing pipelines.

Schoharie/Albany Loop - Minimal impact on bedrock groundwater usage would be expected, as usage is concentrated in the unconsolidated zone. An estimated 0.9 mile of this proposed segment would require blasting.

Columbia/Berkshire Loop - Approximately 4.4 miles of this proposed segment could require blasting. Groundwater usage is primarily from the unconsolidated zone, though some wells are reported in the underlying metamorphic rock units.

Worcester Loop - Groundwater availability from the unconsolidated units is limited, with the principal exception being in the area of the Blackstone River. The proposed route would cross an area of granitic and metamorphic bedrock that serves as a water source. Approximately 3.1 miles of rock blasting would be required.

Concord Lateral - Both till and the underlying granitic bedrock provide groundwater supply. Approximately 2.1 miles of this proposed segment would require blasting, as estimated from soil descriptions.

Haverhill Lateral - Stratified drift and till are the principal aquifers along this proposed segment. Approximately 0.5 mile of the proposed route could require blasting.

Wallingford Lateral - While 2.8 miles of this proposed segment could require blasting (based upon soil descriptions), groundwater usage is reported to be primarily from unconsolidated units. Consequently, minimal impact is expected.

Lincoln Extension - Unconsolidated units provide the principal groundwater sources along this route. Up to 1.6 miles of rock excavation could be required.

Springfield Lateral - Unconsolidated sands (stratified drift) are the principal groundwater source, and no rock excavations are anticipated.

We recommend that the mitigation measures outlined for Iroquois also be applied to Tennessee. We believe that impact on wells and groundwater along the proposed Tennessee route could be minimized by implementing these recommendations.

5.1.3.2 Surface Water

5.1.3.2.1 General Construction and Operational Impact

Potential impact on surface waters could occur due to pipeline construction and hydrostatic testing. Construction techniques that can cause impact include clearing and grading of stream banks, in-stream trenching, trench dewatering, backfilling, and blasting. Potential impact includes increased turbidity, sedimentation, decreased dissolved oxygen concentrations, stream warming, releases of chemical and nutrient pollutants from sediments, and introduction of chemical contaminants such as fuels and lubricants.

In-stream construction would temporarily increase sedimentation and turbidity in the vicinity of the proposed crossing. The extent of sedimentation and turbidity would depend on stream discharge velocity, turbulence, streambank composition, and sediment particle size. Faster flows or smaller particles (e.g. clay or silt) would result in material traveling farther downstream. In addition to the temporary increase in sediment loading due to instream construction, longer-term sediment loading could result from erosion of cleared stream-banks and rights-of way until they are revegetated. In New York, Iroquois agreed (NYPSC, 1988) to seed rights-of-way subject to erosion within six working days of final grading. We believe this procedure would help to reduce impact on surface waters, and we recommend similar practices for those portions of the project that would be in other states as well.

Clearing vegetation from streambanks at proposed crossings and where streams lie parallel to the proposed pipeline right-of-way could result in a decrease of fish cover (see section 5.1.4.1) and an increase in insolation of the water body. It is unlikely there would be any impact on water temperature or primary production from vegetation clearing at most proposed stream crossings, because the length of a streambank segment cleared for pipeline installation would be relatively narrow, usually only 75 feet.

Use of heavy equipment for clearing and grading of banks, and land construction of the proposed pipeline could cause compaction of the soil, resulting in increased surface runoff of water into streams and other surface water bodies. This increased runoff could cause erosion of streambanks and an increase in turbidity and sedimentation in recipient water bodies. Because the length of streambank segment that would be cleared for pipeline installation would be relatively narrow (only 75 feet) and would be revegetated, we believe there would not be significant impact from increased runoff.

Turbidity and sedimentation could cause slight chemical changes in overall stream water quality. Increased turbidity reduces light penetration and, thus, photosynthetic production of oxygen. Organic and inorganic materials in the sediments can, when resuspended, cause an increase in oxygen demand, resulting in a decrease in dissolved oxygen. This impact would be expected to be minimal in trout streams, which have colder temperatures and have gravelly, rubble stream bottoms and high levels of dissolved oxygen. However, during spawning periods or periods of low flows, reduction of dissolved oxygen could have significant impact on fish populations (see section 5.1.4.1). Again, the more susceptible fish species (trout) inhabit faster-flowing streams, where this would not be a problem.

Refueling of vehicles and storage of fuel, oil, or other fluids near surface waters could create a potential for contamination if a spill were to occur. Construction equipment could potentially leak fluids into water bodies during stream construction. Immediate downstream users of the water would be affected by the degradation in water quality, while acute and chronic toxic effects on aquatic organisms would potentially result from such a spill. FERC's recommended SPCCP (see section 5.1.3.1) would provide a mechanism for immediate response and cleanup of accidental spills from operating equipment. In addition, prohibiting refueling and storage of hazardous materials near water resources would minimize potential impact. Similar adverse water quality impact could result from the resuspension of pollutants from previously contaminated sediments during excavation activities (Macek, 1977). The amount of contamination released from resuspended sediments would depend on the existing concentration and on the sorptive capacity of the sediments.

Pipeline integrity is verified by hydrostatic testing, which is conducted by pumping good quality water into the installed pipe and checking for losses in pressure resulting from leakage. Large quantities of water are needed for testing (approximately 1.2 million gallons per 10-mile segment of 24-inch-diameter pipe). Diversion of such volumes from streams and rivers could adversely affect downstream users and aquatic organisms, primarily fish populations, if the diversion would constitute a large percentage of the source's total flow. Impact could include temporary disruption of surface-water supplies, loss of habitat, warming of water, depletion of dissolved oxygen levels, and interruption of spawning, depending on time of withdrawal and current downstream uses. However, the sources of water for testing generally contain large volumes, and withdrawal would be conducted at a rate that would minimize downstream impact. Additionally, the applicants have indicated that test waters would be reused from one pipe segment to the next, when technically feasible, to avoid excessive water use.

Potential impact that could result from discharge of hydrostatic test waters into streams and upland vegetated areas would be generally limited to erosion of soils and subsequent temporary degradation of water quality from increased turbidity and sedimentation. High-velocity flows could cause erosion of the banks and bottom resulting in a temporary release of sediment. A longer term impact could result from continued erosion of the discharge area after the proposed pipeline was in operation, if the discharge area were not properly stabilized. This impact could be generally minimized by the use of energy dissipator devices, regulation of the discharge velocity, and regulation of the discharge location.

Stream Construction and Mitigation Procedures

In response to concerns raised by Federal, state, and local agencies regarding the potential environmental impact of the construction of pipeline projects, we have developed general stream and wetland construction and mitigation procedures (Procedures) (see appendix D). We recommend that each of the applicants be required to comply with the Procedures in order to provide the minimum level of protection for the surface waters that would be affected by the proposed projects. The COE will require a single Section 404/10 permit and could require additional measures to prevent or reduce impact on surface waters. The Procedures would, at a minimum, require that each applicant comply with nationwide Section 404 permit conditions Nos. 12 and 14 (33 CFR 300). State jurisdictional permits, including Section 401 water quality certification, would be acquired as needed. Stream encroachment permits from state and local agencies could require the applicants to follow more stringent procedures.

Our Procedures were reviewed by the applicants, who agreed that they would comply with most of the requirements. The applicants took exception to some general measures of the Procedures and proposed alternative measures that we have reviewed. The following is a general description of the Procedures presented in appendix D, and the applicants' alternative measures along with our evaluations and recommendations. The Procedures have been revised as appropriate, based on evidence and information on pipeline construction and related topics presented to FERC by various Federal, state, and local authorities and the applicants during the public comment period.

Staging Areas

Our Procedures require that all staging areas be located at least 50 feet from streambanks where topographic conditions permit. Potential contamination of surface water by spills of fuels, oil, or other hazardous materials would be minimized or eliminated by restricting the refueling of construction vehicles and the storage of hazardous materials to areas further than 100 feet from all surface waters. In addition, our Procedures require that these activities be prohibited in all municipal surface water-supply watershed areas. Tennessee has taken exception to guidelines for refueling equipment further than 100 feet from streambanks, indicating that under certain topographic situations, it would be more environmentally harmful to move equipment for refueling. Tennessee and Iroquois both indicated that refueling within 100 feet of the streambank would be necessary where flotation equipment (i.e., barges) is employed. We believe that refueling greater than 100 feet from a surface water can be accomplished at most crossing locations. In situations where this requirement is technically infeasible, our recommendation allows the applicants to request an exemption on a site-specific basis.

Spoil Placement

Our Procedures require that spoils from trench excavation in streams be placed at least 10 feet away from the streambank and that silt fence and/or haybale filters be used to prevent the flow of silt-laden water into streams. Iroquois and Tennessee indicated that the location of spoil piles should be determined on a site-specific basis, and that at crossings where the spoil has a high gravel and rock content, it would be preferable to store the material in-stream, taking care not to restrict flow conditions. We understand that this requirement may not be technically feasible at all stream crossings because of topographic conditions or other constraints. In these cases, our recommendation would allow the applicant to provide site-specific reasons why this is not feasible. Excavation spoils should not be placed in-stream except at major river and lake crossings where storage of spoils on the streambank or on a flotation device is not feasible.

Time Window for Construction

To minimize impact on reproducing fish populations, the proposed in-stream construction would be prohibited during spawning periods and periods of high water flows. Our Procedures require that in-stream construction be allowed only from June 1 to September 30 unless otherwise expressly permitted or further restricted by the appropriate state permitting agencies on a site-specific basis. The states that would be crossed by the Iroquois/Tennessee Pipeline Project may, during review of the project, attach conditions to any state-issued stream-crossing permit in order to protect individual streams and fisheries. Site-specific state review may result in additional information that would form the basis for a reasoned judgment regarding construction windows and procedures. In this regard, changes to the recommended windows would be allowed as appropriate. Iroquois and Tennessee indicate that for several water bodies an alternative time window has already been requested by state agencies. More detailed mitigative procedures and more restricitive construction windows concerning impact on fish popultions on a site-specific basis are discussed in section 5.1.4.1.

We also require that the applicants notify authorities of public surface-water supplies located less than 3 miles downstream of any crossing location prior to FERC certification and 72 hours before in-stream construction commences. Iroquois and Tennessee stated that the 3-mile requirement may be excessive; however, we maintain that it is a reasonable and appropriate protective measure.

Crossing Procedures

Our Procedures for stream crossings require that 1) the applicant provide us with a copy of the COE's determination regarding the project's need for individual Section 404 and/or Section 10 permits, 2) apply for state-issued stream crossing permits, and 3) obtain Section 401 water quality certification or waiver. In addition, the applicants would be require to comply with nationwide Section 404 permit Nos. 12 and 14 conditions (33 CFR § 330) at a minimum.

Iroquois and Tennessee have taken exception to our recommended procedures for minor stream crossings, indicating that it may be appropriate to use other crossing methods based on site-specific information such as stream configuration, water quality, and sensitive aquatic species. FERC modified minor stream crossings procedures based on information provided during the public comment period by various Federal, state, and local agencies and the pipeline applicants, to provide additional guidance on specific stream types pertaining to fisheries.

Pipe installation at minor stream crossings (less than 10 feet wide and 2 feet average depth) containing coldwater fisheries or warmwater fisheries considered significant by the state fish management agency would be accomplished by the "dry crossing" technique. This technique involves routing the stream flow through a flume pipe prior to excavation. Trenching, pipe installation, and backfilling activities would then proceed across a "dry" trench, thereby minimizing suspension of sediments downstream. In addition, certain streams that may support sensitive aquatic species, and that would not normally be flumed due to their large size have been recommended for fluming, as discussed in section 5.1.4.1. For minor crossings and warmwater fisheries not containing significant fisheries, construction equipment would cross the stream on a bridge consisting of equipment pads or clean rock fill over culvert pipes, or flexifloat or portable bridges.

Where existing roads and bridges are not available, major streams (greater than 10 feet wide or 2 feet average depth and less than 100 feet wide) would be crossed by constructing a temporary equipment bridge consisting of a portable bridge, equipment pads, or crushed rock fill over pipe culverts. All construction vehicles would be required to utilize the temporary bridge, with the exception of in-stream equipment needed to construct the crossing. Iroquois and Tennessee indicated that based on site-specific conditions, fording of major streams may cause less disturbance than construction of culvert bridges. We disagree and believe that in-stream equipment should be limited to that necessary for construction of the crossing.

We believe that notification of state authorities 48 hours prior to trenching or blasting across major streams is necessary to ensure the applicant's compliance with the recommended stream crossing procedures; therefore, we require that the applicants comply with these notification requirements. The procedures also require that in-stream work (not including blasting) within major streams should be completed within 48 hours, or if not possible, within a maximum of 72 hours.

Our procedures require that site-specific construction plans for crossing rivers greater than 100 feet wide be submitted to FERC for review and approval prior to construction. The proposed Iroquois route would involve 10 major (i.e., greater than 100 feet wide) water body crossings; the Tennessee route would involve two major water crossings (see table 4.1.3-5). Iroquois indicated that all of these crossings, with the exception of the Oswegatchie, West Branch of the Oswegatchie and Beaver Rivers, would be constructed utilizing floating barges.

Silt fences and other filter devices would be installed at streambanks and around spoil piles and inspected daily. Although Iroquois and Tennessee suggested the placement and frequency of inspection of these devices be based on weather conditions, storm events, and sensitivity of the area, we believe these measures need to be followed as a minimum for sediment and erosion control.

Bank Stabilization/Revegetation

Streambank stabilization would be enhanced by allowing native herbaceous and woody plant species to permanently revegetate a 10-foot-wide riparian strip along the stream embankment. Iroquois and Tennessee have indicated that woody growth would be allowed to return where it existed prior to construction, except where directly over (within 10 feet of) the pipeline. We agree that a buffer strip is required only where it existed previously, but maintain that a 10-foot-wide zone across the entire right-of-way adjacent to the streambank should be allowed to revegetate with native woody plants.

Trench Dewatering/Hydrostatic Testing

Trench dewatering and discharge of hydrostatic test waters could temporarily impact water quality in the project area. Our Procedures require that the discharge of silt-laden water from dewatering of pipeline trenches be allowed only in upland vegetated areas. Under no circumstances should silt-laden waters be permitted to flow into surface waters.

Water sources that Iroquois and Tennessee propose to use for hydrostatic testing are listed in table 5.1.3-1. Our Procedures require the applicants to notify state water-quality and fishery management agencies of the intended source of hydrostatic test water 48 hours prior to withdrawal. The use of state-designated exceptional value waters or streams designated as public water supplies would be prohibited unless appropriate state and/or local permitting agencies grant permission. Adequate flow rates must be maintained to protect aquatic life, provide for all in-stream uses, and provide for downstream withdrawals of water by existing users. The applicants have found these procedures to be acceptable.

Discharge of hydrostatic test waters would be conducted at a controlled rate and energy dissipation devices would be utilized to prevent erosion, streambottom scour, suspension of sediments, and excessive stream flows. The applicants would have to comply with Federal and state regulations regarding discharge activities in surface waters as prescribed by the NPDES. In some cases it could be necessary to analyze water samples for various water quality paramenters upon the completion of hydrostatic testing and prior to discharge to surface waters.

5.1.3.2.2 Site-Specific Surface Water Impact

Iroquois

Following our recommended stream crossing procedures (see appendix D), most streams greater than 10 feet wide and 2 feet deep would be crossed using a "wet crossing" technique in which pipeline installation would be performed in the water and construction equipment would cross the stream on some type of temporary bridge. Minor streams (<10 feet wide) having coldwater fisheries, or warmwater fisheries considered to be significant, or major streams determined by us to be sensitive would be crossed using a "dry crossing" or flume technique. Water bodies may be considered sensitive to pipeline construction for a number of reasons, including but not limited to their proximity to downstream municipal water supply intakes, critical aquatic habitat, presence of threatened or endangered species, migratory passage, or recreation/high quality visual resource value. Some of these stream crossings of concern are discussed below.

Navigable Water Crossings - The proposed Iroquois route would involve four crossings of major navigable water bodies. These major crossings are too deep or wide to be conducted via the use of equipment bridges; therefore, floating barges or other flotation devices would have to be used to support trenching equipment. A drag line technique could also be used to avoid in-stream construction equipment. The excavation spoils would be temporarily sidecast in the stream and later reused as backfill.

Blasting may be necessary to remove boulders and excavate in bedrock. In some cases where blasting is required and excavated spoils may be unsuitable for use as backfill, it would be necessary to bring in additional fill. Blasting mitigation techniques with respect to impact on fish populations are discussed in section 5.1.4.1.1.

TABLE 5.1.3-1

Location/Quantity of Proposed Hydrostatic Test Water Sources for the Proposed Iroquois/Tennessee Project

Applicant Segment/State	Milepost	Water Source	Volume Reqired (millions of gal)
IROQUOIS			
New York	0.5	St. Lawrence	4.70
	41.3	Oswegatchie River	2.10
	76.8	Beaver River	2.10
	94.8	Black River	3.90
	125.5	West Canada Creek	3.60
	154.0	Mohawk River	4.10
	187.5	Schoharie Creek	1.85
	199.4	Fox Creek	1.95
	213.2	Basic Creek	.80
	224.4	Potic Creek	1.30
	232.0	Hudson River	3.20
	265.4	Wappinger Creek	2.85
	279.9	Coopertown Brook	.45
Connecticut	297.5	Still River	3.20
	311.2	Pootatuck River	.72
	331.5	Housatonic River	1.70
	360.5	Long Island Sound	3.00
TENNESSEE			
Schoharie/Albany Loop	-	Pitcher Stream	4.39
Columbia/Berkshire Loop	-	Crystal Lake, Fairfield	3.51
	-	Kinderhook, Queechy Lake, Stockbridge Bowl	3.21
Worcester Loop	-	Thompson Pond,	1.69
		Blackstone River/Pratt Pond	.03
	-	Singletary Pond, Clark Reservoir	
Concord Lateral	270B-105+10.65	Suncook River	.14
Haverhill Lateral	-	Crystal Lake, Frye Pond	.19
Wallingford Lateral	345A-201+0.32	Willow Brook	.900
Lincoln Extension	265E-103+2.48	Woonasquatucket River	.05
Springfield Lateral	-	Westfield River	.001

The applicant may be required by certain Federal, state, and local agencies to submit construction plans which would provide the details of specific water crossings prior to construction. Iroquois submitted detailed procedures for crossing the St. Lawrence, Mohawk, Hudson, and Housatonic Rivers to FERC and the COE as part of its Section 404 and Section 10 permit applications.

Potential impact at these navigable water courses includes temporary water quality degradation and interference with navigation and recreational activities. Because of the long period of time that would be required to construct the crossings of these major navigable rivers, care would be taken to plan the timing of construction activities to minimize navigational obstructions. The applicant shall notify the COE and Coast Guard of the construction schedule for navigable waters so that appropriate noticing can take place.

Sediment testing at the major river crossings indicates above-background levels of certain priority pollutant metals (see table 4.1.3-7). As discussed below, the COE and the appropriate state agencies may impose additional conditions on in-stream construction activities in order to minimize the release of contaminated sediments. FERC recommends that sediments containing high levels of contamination not be used as backfill but be disposed of in accordance with Federal and state regulations.

The St. Lawrence River would be crossed by a 3,100-foot section of the proposed pipeline. The present water quality classification at the proposed crossing is "A" because it serves as an international boundary, indicating that the St. Lawrence would receive a high level of protection from water quality degrading activities. Iroquois indicated that construction equipment will work off of floating barges and will utilize existing roadways. Analysis of a sediment sample collected 6 kilometers downstream indicated elevated levels of arsenic, cyanide, barium, and total phosphorus. FERC recommends that Iroquois conduct testing of subsurface and surficial sediments at the proposed crossing location. Chemical parameters should include metals, PCBs, pesticides and priority pollutant volatile and semivolatile organic compounds. The results of the analyses should be filed with the Secretary of the Commission for review by the Director of OPPR, with the COE, and with the appropriate state water quality agency.

The proposed Mohawk River crossing at MP 154.2 is 390-feet wide and is afforded less protection than the other major river crossings due to its "C" classification. Elevated levels of copper were detected in the sediments at this crossing, but the elutriate testing indicated that violations of water quality standards would not result from the resuspension of sediments at this proposed crossing (Ecology and Environment, 1987).

The proposed Hudson River crossing at MP 231.9 is 2,500-feet wide, and the river at this location is classified as "A." This classification indicates that a higher level of protection is afforded to the maintenance of water quality at this point. Although sediment analysis indicated elevated levels of cadmium, elutriate tests indicated that violations of water quality standards would not result from the resuspension of sediments at this crossing (Ecology and Environment, 1987).

The Housatonic River in Connecticut would be crossed by the proposed Iroquois route at MP 330.9. Although the Housatonic has a history of water quality problems, the State of Connecticut's goal for its future water quality is SB (current classification is SC/SB), and the river is afforded a greater level of protection from water quality degrading activities. Elevated levels of chromium and copper were detected in the sediments at the proposed crossing, but elutriate testing indicated that violations of water quality standards would not result from the resuspension of sediments at this crossing (Ecology and Environment, 1987).

Although previous elutriate testing of sediments in the proposed Mohawk, Hudson, and Housatonic Rivers indicated that resuspension of sediments would not result in a violation of water quality parameters for metals or organics, FERC is recommending retesting of surficial sediments at these locations to ensure that contamination of sediments has not occurred during the 4-year period that has passed since the previous tests were conducted. The results of the chemical analyses would be filed as specified above for the St. Lawrence River.

Long Island Sound - Nearshore construction of the proposed Iroquois pipeline in Long Island Sound would affect bottom habitats and smother benthic communities. Trenching or jetting operations would temporarily increase turbidity and sedimentation in nearshore fish nursery areas, and could, therefore, affect future commercial fish harvests (see section 5.1.4.1). Disturbance of nearshore sediments by dredging operations would not affect recreational use of Long Island Sound (boating, fishing, swimming) as construction is scheduled to occur during the winter months when recreational activities are at a minimum. Additionally, sediments in the areas where trenching would be employed are relatively coarse, and would settle out of the water column more rapidly than finer sediments. Since the sediments are of good quality, no chemical degradation of the water quality should occur. In offshore areas, the pipeline would be laid on the bottom, rather than buried, with minimal disturbance of the sediments. The exposed pipeline could, however, interfere with certain types of bottom fishing gear or anchors. Field investigations in the North Sea and evaluations of fishing gear used by Long Island Sound commercial fisherman indicate that a 20-inch, concrete-coated pipeline would not affect the bottom fishing gear used in Long Island Sound. Four acres of benthic habitat would be covered by the pipeline, which would result in a minor long-term impact.

A potential impact on water quality could occur in the event of a fuel or oil spill in Long Island Sound. Diesel fuel is highly toxic to aquatic biota (fish and invertebrates) and could potentially affect the aquatic community in the vicinity of pipeline construction in the event of a spill. Iroquois indicated that potential spills during construction of the marine pipeline could occur as a result of equipment failure or human error during fuel transfer operations, improper storage and disposal of spent lube oil, or pumping untreated bilge water overboard. FERC recommends that Iroquois address these hazards in the SPCCP. Specifically, Iroquois should provide procedures for handling storage and disposal of spent oils and bilge waters that are in accordance with identified Federal and state requirements.

During construction and laying of the proposed pipeline in offshore areas, there would be a moving exclusion zone with a radius of 2 miles around the pipe laying vessel. This 12.6-square-mile zone would be off limits to all vessels and would potentially affect some commercial fishermen where it would cover a good fishing or shellfishing ground. At a pipe-laying rate of 0.6 miles per day, a given fishing ground could be made off limits for a 3 - 4 day period.

Filtered seawater would be used to test the marine pipeline. Iroquois indicated that test water would be reused between test sections and that no chemicals would be discharged at the proposed Northport landfall into the LILCO cooling water return channel.

Candlewood Lake - The Candlewood Lake watershed would be crossed by the proposed pipeline. Candlewood Lake is classified B and is used for pumped-storage hydroelectric power generation. The B class is due to the fact that water from the Housatonic River is pumped up into Lake Candlewood during nonpeaking nighttime hours. No potable water supply intakes are located on Lake Candlewood. No water quality or turbidity impact would result from crossing of the aqueduct.

Independence River - The Independence River would be crossed at MP 91.05. This river is less than 100-feet wide and therefore, is considered a major stream crossing (see appendix D). The water quality classification at the proposed crossing point is C(T), indicating that it is capable of supporting trout. Impact on this river would be minimized by following the specific erosion and sedimentation control procedures as outlined in appendix D, and installing the pipeline during the allowed construction time window to avoid spawning season (see section 5.1.4.1).

Still River - A portion of the proposed pipeline would be located in the Conrail right-of-way along the Still River Gorge (MPs 300 to 301). The Still River is classified C/B indicating that Connecticut is striving to upgrade this river to a swimmable, fishable river.

Public Surface Water Supplies - Five municipal surface water supplies are located downstream of proposed Iroquois stream crossings. These water supplies are listed in table 4.1.3-9. Three tributaries of Basic Creek would be crossed greater than 4 miles upstream of Basic Creek Reservoir. Shelton and Beaver Brook Reservoirs, are currently inactive as water supplies. Potable water intakes on Beaver Creek and Means Brook are located greater than 1 mile downstream of proposed Iroquois crossings. Portions of the Means Brook and Shelton Reservoir watersheds are reported to be class I property in Connecticut. Land use restrictions on class I properties would require the applicants to apply for a permit from the Connecticut Department of Health. Only land-use changes that are determined to not adversely affect the drinking water supply and are consistent with the water companies' water supply plan would be permitted.

Although no deposition is typically evident 0.5 mile downstream of trenching activities (Michigan Public Service Commission, 1978), suspended sediments, turbidity, and resuspension of nutrients or contaminants could temporarily affect these municipal water supplies. In order to minimize sedimentation-related impact, we recommend that Iroquois utilize dry-ditch crossing techniques when constructing across these streams, and that Iroquois notify the operators of the water supply intake 3 days in advance of crossing.

Class AA Crossings - FERC recognizes the exceptional quality of Class AA streams and recommends that the applicant construct these crossings using dry-ditch construction methods.

Hydrostatic Test Water Sources - Table 5.1.3-1 lists the hydrostatic test water sources proposed for Iroquois. We believe that compliance with appendix D conditions and with Federal and state regulations regarding withdrawal, and NPDES requirements for discharge, would ensure that there would be no significant impact to these water sources.

Tennessee

As discussed above for Iroquois, all streams would be crossed using the procedures outlined in appendix D.

The Larrywaug Brook (Stockbridge Bowl) (Columbia/ Berkshire Loop, MP 256+4.84) crossing would require large staging areas. Additionally, the citizens of Stockbridge have expressed concern that the proposed pipeline would affect the amount of drawdown that would be possible for Stockbridge Bowl. We recommend that Tennessee prepare site-specific construction plans for this crossing, to be filed with the Secretary of the Commission for review and approval prior to construction. In addition, we recommend that Tennessee coordinate with the Stockbridge Bowl Association to prevent the new construction from impacting the drawdown capability of Stockbridge Bowl.

Another concern specific to the Tennessee project is the potential for resuspension of contaminated sediments at the proposed cross of the Blackstone Canal (Worcester Loop, MP 264+7.03). As part of the COE Section 404/10 permitting process, the applicant would be required to conduct testing of river sediments to determine the presence of toxic contaminants. We recommend that the test results be filed with the Secretary of the Commission for review by the Director of the OPPR, with the COE and with the appropriate state water quality agency.

Public Surface Water Supplies - Municipal water supplies are located downstream of two proposed crossings. These crossings are listed in table 4.1.3-7. In addition to following the stream crossing procedures outlined in appendix D, we recommend that Tennessee notify the operators of the water supply intake 72 hours in advance of crossing.

Hydrostatic Test Water Sources - Table 5.1.3-1 lists the hydrostatic test water sources proposed for Tennessee. We believe that compliance with our recommended intake and discharge procedures, and with state and Federal permitting conditions as appropriate, regarding withdrawal and NPDES requirements for discharge, would ensure that there would be no significant impact to these water sources.

Class AA Crossings - FERC recognizes the exceptional quality of Class AA streams and recommends that the applicant construct these crossings using dry-ditch construction methods.

5.1.4 Fish and Wildlife

5.1.4.1 Fishery Resources

5.1.4.1.1 General Construction and Operational Impact

Impact on fishery resources, such as sedimentation and turbidity, acoustic shock, loss of stream cover, introduction of water pollutants, or entrainment of fish, could result from construction activities. The applicants would be required to comply with stream and wetland construction procedures we developed (see section 5.1.3.1) in order to provide the minimum acceptable level of protection for these areas (see appendix D). In addition to these minimum requirements, state and local agencies may require the applicants to follow more stringent procedures and to prepare site-specific stream- and river-crossing plans. No activities that violate existing state or Federal water quality standards would be allowed.

Sediment and Turbidity

Increased sedimentation and turbidity from construction would have the greatest potential to adversely affect fishery resources. However, impact from construction-related sedimentation and turbidity would be reduced to short-term, temporary disturbances if our Procedures, summarized below, were followed.

Construction of stream crossings should be limited to the low-flow period between June 1 and September 30 (unless otherwise expressly permitted or restricted by state agencies) in order to minimize sedimentation and turbidity induced by high water flow. In addition, limiting construction to this period would reduce impact on salmonid spawning areas that may be present at or downstream of the proposed crossings. Trench spoils should be stored above the streambank and protected with silt fences, hay bales, or other facilities that would reduce sediment runoff into the stream. Additionally, all staging areas would be located at least 50 feet back from the stream to reduce loss of riparian vegetation and limit the probability that these additional cleared areas would contribute to sediment runoff.

Permits would be required from state agencies (see section 2.6) for the proposed stream crossings to ensure proper construction methods are used relative to the fishery resource quality. Following the procedures outlined in appendix D, minor streams (less than 10 feet wide) containing coldwater or warmwater fisheries considered to be significant by the state fish management agency would be flumed prior to in-stream construction activities. Construction equipment would cross major streams (10 to 100 feet wide) and minor streams containing average quality coldwater and warmwater fisheries, on equipment bridges to minimize stream disturbance. Most in-stream work would occur in less than 48 hours or within a maximum of 72 hours. Large rivers would have site-specific criteria for in-stream work submitted to FERC for review and approval prior to construction. Where possible, in-stream and shoreline vegetation would be left in place. After construction, all stream shoreline areas would be mulched and reseeded with appropriate vegetation. Revegetation with native herbaceous and woody plant species is recommended for long-term soil stabilization.

During construction of the proposed stream crossings where open trenching is required, the suspended solids concentration would be high for a relatively short period of time (24 - 48 hours following completion of construction), and for a limited distance downstream of the crossing. The highest suspended sediment levels would occur only during actual construction activity in the channel.

Mitigation methods outlined in our Procedures would be employed at all stream crossings to minimize suspended sediment levels. All crossings, except those of major rivers (greater than 100 feet wide), would be constructed in less than 3 days unless otherwise permitted by state agencies. Increased suspended sediment levels could increase invertebrate drift and reduce fish feeding for brief periods. Following our recommended stream crossing procedures, this impact would be temporary and suspended solid levels would return to background levels soon after construction in the river would be completed.

If the stream crossing area contains spawning habitat, the substrate would be directly disturbed for a maximum in-stream construction-area width of 75 feet. Spawning areas directly downstream of these proposed crossing sites could receive increased fines in the substrate. Much of these fines would be washed away during subsequent fall and spring high flows, reducing impact on the following season's spawning success.

Acoustic Shock

Some stream crossings would require blasting of bedrock, which, due to acoustic shock, could be harmful to fish that are in the immediate vicinity of the explosion. The degree of blasting impact on fish would depend on the type of explosive, blasting technique, fish species, and timing. Teleki and Chamberlain (1978) conducted experiments on the survival of various species following detonation of charges placed in bedrock or mud of a lake bottom. These experiments revealed that laterally compressed fish species (e.g., pumpkinseed, crappies) were most sensitive to blast-related acoustic shock, while those with more rounded body forms (e.g., rainbow trout, white sucker) were least affected.

Based on several assumptions, we can estimate the distance to which fish would suffer mortalities in the stream from underwater detonation. Robbins (1988) described techniques and quantity of blasting material used for a major gas pipeline crossing on the Susquehanna River. Assuming similar techniques would be utilized for a major stream crossing of the Iroquois and Tennessee pipeline allows us to estimate distances to which fish mortality would occur. Based on Robbins' described methods, a double row of drill holes, with the holes spaced 5 feet apart, and 60 pounds of explosive placed in each hole could be used. This method would use 2,400 pounds of explosive per 100 feet of excavation. Most streams that would be crossed are much less than 100 feet wide, so we will assume a 50-foot-wide crossing area would be detonated at one time, which equals 1,200 pounds of explosive detonated. Based on the data presented by Teleki and Chamberlain (1978), the most sensitive laterally compressed fish (e.g., crappie) would suffer 95 percent mortality within 213 feet of the detonation, and 10 percent mortality within 472 feet of detonation. The least sensitive rounded fish (e.g., rainbow trout) would suffer 95 percent mortality within 174 feet of the blast, dropping rapidly to 10 percent mortality at 194 feet.

Effects of these explosions would be mitigated by several factors. Teleki and Chamberlain (1978) suggest that active construction in the stream area would scare most fish out of the area prior to detonation. We recommend detonation be done in such a manner (e.g., utilizing delayed detonation, air bubble curtains) as to reduce the total acoustic shockwave intensity to the greatest extent possible, based on site-specific conditions. Additionally, we recommend that prior to each detonation in rivers (greater than 100 feet wide), a disturbance such as a scare charge be used to scare fish out of the area.

In the worst case scenario described above, laterally compressed fish could be affected as far away as 490 feet from the detonation, and rounded fish as far away as 197 feet. These effects would be short term and could result in some fish mortality, but we do not believe the impact would be significant because most fish would be scared away from the immediate area during initial drilling, there would be a reduction in shockwave intensity by blasting delays, and only a small portion of each river would be impacted.

Cover Loss

Some in-stream and shoreline cover would be altered or lost at the proposed stream crossings. Streambank vegetation, in-stream logs, rocks, and undercut banks provide important cover for fish. Fish that normally reside in these areas could be displaced. Our Procedures recommend that mitigation include long-term revegetation of shoreline areas with native herbaceous and woody plant species, and where stream flow rates preempt vegetative stabilization of streambanks, that large riprap should be used for stabilization and to add cover to the area. Effects on fish from cover loss would be minor because of the small area affected on each stream (a maximum of 100 feet wide).

Other Impact

Other potential impact includes interruption of fish spawning migration, fish entrainment, and fish mortality from toxic substance (fuel) spills. Some fish, such as trout and anadromous fish, migrate during spawning runs and could be briefly interrupted during installation of pipelines across water bodies. Most fish migrate over several days or weeks in small streams. Consequently, migration would only be briefly interrupted, since installation across streams less than 100 feet wide would take less than 3 days, and is scheduled to occur during nonmigrating periods (i.e., summer).

Entrainment of fish would not likely occur from water withdrawal for hydrostatic testing, since intakes would be screened. Because water would only be taken from large streams for the hydrostatic testing (see table 5.1.3-1), the quantity of water would not significantly reduce instream flow.

Direct spills into streams could be toxic to fish, depending on the quantity of spill and concentration. To reduce the potential for surface-water contamination, our Procedures recommend that fuel and other potentially toxic materials be stored away from streams (at least 100 feet), minimizing the chance of direct stream spills. FERC's recommended Spill Prevention, Containment, and Control Plan (see section 5.1.3.1.1.) would act to prevent these spills and would provide a mechanism for immediate response and cleanup of accidental leaks/spills from operating equipment.

Because of the narrow width of shoreline vegetation that would be removed during the proposed construction (100 feet maximum), temperature increases from increased solar isolation would be insignificant.

5.1.4.1.2 Site-Specific Impact

As previously discussed, effects from construction would be generally short term at the proposed stream crossings. The primary concerns would be increased turbidity, sedimentation of spawning areas, and acoustic shock from blasting.

Streams of major concern are those with spawning areas of salmonids at or immediately below the proposed crossings, those considered exceptional fishery resources, those with important recreational fish species of limited distribution, and those containing endangered species or species of special concern.

Iroquois

Since trout are most sensitive to sedimentation and disturbance of spawning gravel, and since trout are a major recreational species in the region, they are a species of high concern. Impact on trout spawning could be long-lasting, and even minor impact on spawning areas could have significant effects on trout populations if spawning habitat is already limited. Therefore, some of the streams of concern include those that have trout or salmon spawning at or immediately below the proposed crossing site.

Increased sedimentation and turbidity could decrease the feeding efficiency of sight feeders (e.g., walleye), and could interfere with respiration, resulting in mortality. Construction of most major stream crossings (>10 feet wide) would be completed within 48 hours, with a maximum allowance of 72 hours. Thus, the short duration of in-stream activities would minimize impact on these fisheries.

The stream crossing procedures we have recommended would reduce the expected impact on most streams. These procedures address staging areas; spoil pile placement and control; construction scheduling; and crossing procedures for minor streams (less than 10 feet wide), major streams, (10 to 100 feet wide), and rivers (greater than 100 feet wide). Streams for which additional protection measures would be required are discussed below.

In New York, Iroquois, the NYDEC and the New York Department of Public Service (NYDPS) have agreed on a construction schedule for proposed stream crossings that would involve dredge and fill activities (table 5.1.4-1). We agree that this schedule would help to minimize most impact. However, for several crossings we believe additional protective measures and schedule restrictions would be necessary and have made specific recommendations as described below.

Big Bill Brook - The proposed Iroquois route would parallel Big Bill Brook from MP 139.0 to MP 139.1, crossing three times in that stretch. Effects on Big Bill Brook, a trout stream with natural spawning, could result from increased sedimentation, from in-stream construction and runoff, and from reduction of cover. Although the proposed crossings would not occur during spawning season, we feel that the impact on this stream could be significant and we have recommended a route variation that would avoid multiple crossings of Big Bill Brook (see section 6.2.35). Impact on other trout streams in this region would be minimized by the relatively short duration of in-stream construction and by implementing our Procedures, outlined in appendix D.

Anadromous Fisheries - Several rivers, including the Mohawk, Hudson, Farmill, and Housatonic, have established anadromous fisheries. Pipeline crossings of these rivers could interfere with the passage of anadromous fish such as the striped bass, American shad, blueback herring, alewife, shortnose sturgeon, and rainbow smelt. This interference would be a special concern at the larger Mohawk, Hudson, and Housatonic Rivers, which are major crossings that would require longer time for construction.

Scheduling the crossings of these anadromous fisheries to avoid seasons of spawning migration would minimize effects on these fisheries. A schedule has been recommended by NYPSC for some of these proposed major river crossings. The Hudson River would be crossed between August 1 and November 30; the Housatonic River would be crossed between October 1 and May 31.

TABLE 5.1.4-1

New York Recommended Schedule of Proposed Iroquois Pipeline Construction That Would Involve Dredge and Fill Activities a/

Aquatic Ecosystem	Construction Period
STREAMS AND RIVERS	
Coldwater streams	
Northern New York	July 1 - September 15
Eastern New York	July 15 - September 30
Warmwater streams	July 15 - end of low flow b/ or April 1, whichever is earlier
St. Lawrence River	July 1 - August 31
Hudson River c/	August 1 - November 30
MARINE	October 1 - May 31
WETLANDS	No general restrictions

a/ Schedule agreed upon by Iroquois, the New York Department of Environmental Conservation and the New York Department of Public Service, as stipulated during the New York Article VII proceedings.
b/ End of winter low flow, before spring runoff.
c/ Restriction based on the presence of shortnose sturgeon and other anadromous fish.

The proposed crossing of the Housatonic River is located in the vicinity of a spawning area that is utilized by winter flounder between January and May. Iroquois proposed to construct this crossing between October 1 through May 31. We recommend that Iroquois construct this crossing during nonspawning months (October - December) in order to avoid potential adverse impact on this species. The NMFS indicated that this schedule would be environmentally sound, and should avoid potential adverse impact both to the winter flounder fishery and to the other species found in the Housatonic River (Ludwig, 1989). In addition, no-dredge restrictions in Long Island Sound would not be violated, because in Connecticut these restrictions are in effect between June 1 and September 30.

A comment was raised that juvenile striped bass have been sighted in the lower Housatonic River. The Connecticut Bureau of Fisheries (Moulton, 1989) has stated that no striped bass reproduction occurs in the state. These striped bass probably came from the Hudson River through Long Island Sound. Since striped bass reproduction does not occur in the Housatonic, we believe that with implementation of our recommended stream crossing procedures, no significant impact would occur to the striped bass fishery in the Housatonic River.

Other Important Streams - Some of the streams that would be crossed by the southernmost portion of the proposed pipeline were brought up as concerns during scoping. These streams include Coopertown Brook (MP 279.9), Swamp River (MP 281.7), Tenmile River (MP 284.2 and MP 285.2), and Deuel Hollow Brook (MP 286.2). All of these streams support trout. We believe that with implementation of our recommended stream crossing procedures (appendix D), impact on these streams would not be significant.

Long Island Sound - Trenching and jetting operations, and the resultant turbidity and sedimentation, could affect fish nursery areas in Long Island Sound. However, the limited area and duration of the proposed pipeline construction operations would minimize any impact on fish communities. Nearshore construction of the proposed marine pipeline in Long Island Sound could smother local benthic communities, which would reduce fish food supply. Large areas of benthic habitat would be temporarily destroyed, but recolonization would occur in all areas except that covered by the offshore pipeline. The offshore pipeline would make approximately four acres of benthic habitat unavailable for recolonization by benthic macroinvertebrates.

Some lobster habitat in the area north of Stratford Shoals could experience localized disturbance resulting in loss of habitat. We believe this effect would be negligible, given the total available habitat in Long Island Sound. Clam and oyster habitat would be disturbed in the nearshore area off Milford. The proposed pipeline would cross about 10,000 feet of shellfish grow-out beds in this area, and would disturb approximately 46 acres of shellfish area due to sedimentation from trenching. These are nonharvest beds; however, if harvest beds would be crossed, Iroquois agreed to compensate lease-holders for the lost resources. Following installation, Iroquois would replace the bottom and place clutch along the area to re-establish shellfish beds. If only grow-out beds would be crossed, Iroquois would allow leaseholders to move the shellfish to depuration areas prior to disturbance.

In the event of a fuel spill, fish and invertebrates in the affected area could die. While it would be difficult to quantify the impact, the potential for occurrence could be minimized by proper fueling procedures. Additionally, adequate supplies of fuel-absorbent material and equipment (surfactant booms) would be available to contain and clean up spills. Our recommended Spill Prevention, Containment, and Control Plan would be in place prior to marine pipeline construction. Additionally, Iroquois would notify the appropriate authorities in the event of a fuel spill.

Offshore pipeline construction and installation could affect commercial fishing by interfering with certain types of bottomfishing gear. A series of field investigations in the North Sea (Carstens, 1980), however, showed that hooking is not a problem with pipelines greater than 16-inches in diameter. Additionally, Allardice and Associates, Ltd. (1986) and Ecology and Environment (1987) have shown that no damage would occur to fishing gear of the types used in Long Island Sound.

Some interference to commercial fishing could occur by denying access to important fishing grounds during pipeline installation. During the proposed installation in offshore areas, there would be a moving exclusion zone with a radius of 2 miles around the laying vessel. This 12.6-square-mile zone would be off-limits to all vessels, and could potentially cover a good fishing ground for 3 to 4 days at a pipe-laying rate of 0.6-mile per day. As most commercial fishing occurs outside Long Island Sound, however, we believe this exclusion zone would not cause significant impact.

The NMFS concurred with a Long Island Sound crossing schedule of October 1 through May 31. This schedule will comply with restricted dredging times imposed by New York and Connecticut.

Tennessee

The main concern regarding potential impact on significant fishery resources from construction of the proposed Tennessee pipeline loops is the crossing of trout streams, both stocked and naturally reproducing. We believe that by following the schedule outlined in our recommended Procedures, impact on these resources would be minimal.

5.1.4.2 Wildlife

5.1.4.2.1 General Construction and Operational Impact

Impact on wildlife species, due to construction and operation of the proposed Iroquois/Tennessee facilities, would largely result from temporary and permanent alteration of habitats. The impact on individuals would include disturbance, displacement, and direct mortality. During construction, the more mobile species would be temporarily displaced from the right-of-way and surrounding areas into nearby similar habitats. Wildlife displaced from the construction right-of-way should return to adjacent, undisturbed habitats soon after construction would be completed. Less mobile species, primarily small mammals, reptiles, and amphibians, and bird nests located in the proposed right-of-way would be more directly affected by pipeline construction and could be destroyed. Regardless of mobility, some individuals would suffer loss of cover, nesting, and foraging habitat. Similar impact, although less extensive, would result from routine vegetation maintenance.

We have reviewed the Migratory Bird Treaty (MBT) (16 USCA § 701-718) to determine its applicability to the proposed project. We believe the MBT seeks to prohibit activities that intentionally harm or destroy migratory bird species, particularly those resulting from hunting migratory birds or trading in bird eggs, nests, or body parts. The MBT was not intended to apply to activities that result in incidental impact on migratory birds, such as those related to highway construction, commercial and residential development, and agricultural and forestry management practices. The provisions of the MBT do not, therefore, apply to the proposed pipeline project, as any impact on individuals of a migratory bird species that would result from the project would be incidental and unintentional.

In a letter dated January 17, 1990, the FWS commented that the proposed project would be an unlawful activity under the MBT because it would result in the periodic clearing of nesting habitat. If this were true, then all of the activities mentioned above would also be illegal. The FWS states:

> *The Service believes that if the Commission does not incorporate the Service's Migratory Bird Treaty [Act] provisions then the Commission would be purporting to authorize an unlawful activity.*

We note that the FWS states in the same letter that application of its "recommended provisions" would minimize, not eliminate, "Conflicts and/or violations" caused by the taking of individuals. Since the FWS interprets the MBT as prohibiting <u>any</u> takings, the FWS would be condoning an illegal activity even if we were to apply the "provisions."

In light of the other conditions we have recommended, we believe the FWS "provisions" are excessive.

However, in order to minimize impact on bird species that would utilize the permanent right-of-way for breeding purposes, we recommend that the applicants not conduct vegetation maintenance of the right-of-way prior to August 1 of any year, and that vegetation maintenance be performed no more frequently than once every 3 years.

The most significant impact on wildlife would result from the long-term or permanent alteration of vegetative cover types. The cover types most altered by the proposed construction and maintenance would include forested lands and wetlands vegetated with woody cover. For the proposed project, approximately 2,087 acres of forestland and 227 acres of wooded wetlands would be cleared for right-of-way construction. Clearing would not only permanently decrease the available forest habitat, but could also contribute to the fragmentation of forest tracts. Forest habitat on the permanently maintained right-of-way would be converted to open shrub and herbaceous cover. Forest cleared for the temporary construction right-of-way would be allowed to naturally revegetate following construction, and return to a young-aged forest stand within 15 to 25 years.

The wildlife species that would be most directly affected by the clearing of forested areas would be those forest interior species that require large tracts of unfragmented habitat to ensure breeding and nesting success, (e.g. barred owl, marten). Large contiguous forest tracts are more likely to support breeding individuals of less common species than smaller forest tracts. However, smaller tracts in proximity to other forested areas may attract or retain area-sensitive species (Robbins et al., 1989). According to the most recent and extensive scientific research on the subject, a permanently maintained 50-foot-wide right-of-way would not result in significant fragmentation impact on large forest tracts.

Fragmentation of forest habitat is a general concern in areas where new right-of-way would be constructed (Colburn and Schalch, 1989). In areas of increasing development, forest habitat occurs in patches or "islands" surrounded by residential or industrial developments, which could limit even common woodland species. In addition, populations of some forest interior species, primarily songbirds (e.g., various warblers, woodthrush, veery), have been shown to be limited by the size of available unbroken forest tracts. For these species, construction of the proposed right-of-way through forest tracts of marginal size could fragment available habitat into patches of unsuitable size. In addition, the creation of additional edge habitat may result in increased competition and nest depredation by opportunistic edge species. Forest clearing for pipeline construction could therefore have a greater impact than that suggested by measuring the amount of forest habitat lost.

The potential for impact on forest interior species from forest fragmentation could be greatest where the proposed pipeline passes through relatively smaller, isolated woodlots (Galli et al., 1976). In larger forested areas, the creation of early successional and edge habitats would decrease the quality of habitat for forest interior species in the right-of-way, and possibly up to 100 feet on either side (Anderson et al., 1977). Construction of the pipeline could therefore reduce the density of forest interior species in a forested corridor much wider than the actual cleared right-of-way. While the width of permanent right-of-way would possibly not be a barrier to movement of forest interior species, it could affect the amount of breeding and foraging habitat available to these species, particularly in those areas or regions where large forested areas are currently limited.

While forest interior species could be negatively affected by the clearing of forest habitats, species that utilize early- and mid-successional stage habitats would benefit from right-of-way clearing in large forested areas. Density and diversity of both small mammal and bird species often increase after the initial clearing of forest tracts (Monthey and Soutiere, 1985; Anderson et al., 1977) and remain high for about 3 years. Other species that would utilize the right-of-way during various seasons include numerous songbirds, ruffed grouse, wild turkey, white-tailed deer, and black bear. White-tailed deer could benefit from the proposed right-of-way construction, particularly in those areas where it would clear forest cover and provide increased foraging habitat. This benefit could be significant, especially where deer populations are high and insufficient browse is available to support healthy herds, particularly through severe winters.

During severe winters with deep snow cover, white-tailed deer may rely on DWAs for shelter. These areas are generally located on southwest facing slopes and consist of dense stands of softwoods (white pine, red spruce, hemlock) or a mixture of hardwoods and softwoods. These stands serve as screens from high winds. They also reduce depth of snow cover, and help maintain higher nighttime temperatures and higher humidity relative to more open forest stands (Wiley, 1987). Of the states that would be crossed by the proposed facilities, only New York and New Hampshire have winters severe enough that deer utilize DWAs. The wildlife management agencies of these two states consider DWAs significant habitats.

Clearing a 100-foot-wide right-of-way through a DWA would reduce the amount of suitable winter cover available to deer using the wintering area. This could also limit travel by deer between areas on either side of the right-of-way when deep snow cover is present, particularly if the proposed right-of-way is parallel and adjacent to an existing cleared right-of-way. The cleared right-of-way would not, however, create an absolute barrier. Studies have shown that during winter, deer will cross an open right-of-way as wide as 450 feet (Doucet et al., 1981).

Predatory species including red-tailed hawk, great-horned owl, coyote, and gray fox would utilize the right-of-way for hunting. Little benefit to these species would result where forest habitat would be cleared in areas that already have abundant early successional habitat (e.g., agricultural land, residential areas, existing rights-of-way). Blasting within rock outcrop in forested areas may destroy some denning and nesting habitat for some species, including porcupine, turkey vulture, and some snakes.

The clearing of right-of-way could also provide ready access to previously inaccessible areas for not only mammalian predators (fox, coyote, skunk, and raccoon) but also for humans. These corridors are often used as unauthorized ORV routes, which can disturb wildlife, prolong erosion, and prevent revegetation along the right-of-way. In order to reduce the uncontrolled use of rights-of-way, the NYDEC recommends that dense vegetation at least 7 feet high should be planted where the right-of-way crosses any road in the vicinity of sensitive areas (Ollivett, 1989). Our experience indicated that a variety of methods would be suitable for limiting ORVs; specific recommendations are discussed in section 5.1.9.2.

Nonforested habitats that would be affected by construction and operation of the proposed Iroquois/Tennessee pipeline include nonforested wetlands (see section 5.1.7 for detailed discussion), agricultural lands, and industrial and residential developments. Impact on these habitat types, and associated wildlife species, would be relatively minor and short term. We have recommended techniques for construction through nonforested wetlands that would allow emergent wetlands vegetation to recover within one or two growing seasons following construction. Agricultural habitats (pasture, hay fields, abandoned fields) on the right-of-way would also recover within one or two growing seasons following pipeline construction. The temporary alterations to these habitats would generally not be expected to have significant impact on wildlife species.

Tennessee has not indicated whether it would utilize herbicides. In the event that either applicant decided to utilize herbicides in the future, they would be required to comply with all Federal, state, and local regulations concerning the use of herbicides.

5.1.4.2.2 Site-Specific Impact

Iroquois

Construction of the Iroquois portion of the proposed pipeline would result in the clearing of approximately 1,454 acres of forested habitat, of which 727 acres would be allowed to revegetate. This proposed route would pass through extensive forested areas in St. Lawrence, Lewis, and Dutchess Counties, New York, and Fairfield County, Connecticut. Several of these forested areas are already transected by roads or existing rights-of-way, mostly transmission lines. In these areas, the effects of additional forest clearing on interior species would be incremental since fragmentation of the forest has already occurred. The potential impact associated with fragmentation would be greatest where the proposed route would clear new right-of-way through previously uninterrupted forested areas of moderate size (5 - 10 square miles). Such areas occur along the proposed route at MPs 37 - 41, MPs 47 - 51 and MPs 68 - 72. Construction of the pipeline through these areas could result in permanent impact on forest interior species, including increased human disturbance and ultimately decreased wildlife population densities or at a minimum, changed wildlife communities consisting of different species. Implementation of the recommended mitigation would help to reduce impact resulting from uncontrolled use of the right-of-way.

In order to properly assess the impact on wildlife associated with constructing a natural gas pipeline through upland forests, wetlands, DWAs, and across streams, Iroquois has proposed (at the request of the parties to the New York Article VII proceeding) to conduct several long-term ecological studies. These 5-year studies would utilize habitat evaluation procedures, vegetative sampling, and wildlife surveys to determine the long-term impact of construction and operation of the Iroquois facilities.

Funding for these studies would be provided from Iroquois' proposed Land Preservation and Enhancement Program (LPEP; see section 5.1.9.1). In order to ensure that the proposed studies are adequately designed to help answer long-standing questions pertaining to the construction and operation of pipeline facilities in the Northeastern United States, we recommend that Iroquois submit a detailed study design and implementation plan for each phase of its proposed study to the Director of OPPR for review and final approval prior to implementation.

To mitigate impact on breeding bird species, Iroquois agreed to survey for nesting raptors prior to leaf-out, and to survey during the breeding season for avian species listed as uncommon or rare in the New York State Atlas of Breeding Birds (Andrle & Carroll 1988). This information would be used for construction route refinement and for determining the location, type, and extent of mitigative plantings, screens and brush piles. Uncommon or rare species to be surveyed include: green-winged teal, gadwall, and black tern (St. Lawrence County); olive-sided flycatcher (Lewis, Herkimer, and Oneida Counties); bay breasted warbler and Philadelphia vireo (Herkimer County); bank swallow (Albany County); prairie warbler, acadian flycatcher, and orchard oriole (Greene, Columbia, and Dutchess Counties); and yellow-crowned night heron (Suffolk County).

Upper and Lower Lakes State Wildlife Management Area - Upper and Lower Lakes Wildlife Management Area (MPs 18 - 19) is one of the largest (8,657 acres) state-managed wetland complexes in the northeastern United States, and provides high quality habitat for nesting and migratory waterfowl. It is managed primarily for surface feeding ducks (black duck, mallard, teal, pintail, and wood duck) and also includes a large black tern colony and a DWA. Even though the proposed route would pass through only mapped upland areas, Iroquois agreed to construct a water intake structure to aid in the enhancement of wetland vegetation through regulation of the water level (Ollivett, 1989). The NYDEC believes this would be appropriate mitigation for the wildlife management area.

Deer Wintering Areas - The only DWAs along the proposed Iroquois route are located in New York (table 5.1.4-2). Iroquois agreed to conduct specific winter surveys of these areas to determine the potential extent of shelter lost due to right-of-way construction. Iroquois agreed to revegetate the right-of-way and to consult with the NYDEC to determine recommended plantings that would provide screening and increased palatable browse. We believe that the planting of screening and browse species would help to reduce impact on these DWAs. Additionally, Iroquois proposed to conduct a long-term study of the effects of right-of-way construction on DWAs.

TABLE 5.1.4-2

Deer Wintering Areas Crossed by the Proposed Iroquois/Tennessee Project

Applicant Segment/State	Beginning MP	Crossing Length (ft)	Area to be Cleared (ac)	New or Existing ROW Width a/
IROQUOIS				
Mainline/NY	18.12	1,200	2.8	N/100
	50.73	2,500	5.7	N/100
	56.93	5,200	11.9	N/100
	204.00	2,000	4.6	N/100
	226.40	2,900	6.7	N/100
	276.56	4,000	9.2	N/100

a/ Indicates whether proposed pipeline at DWA crossing is new right-of-way (N) or parallel and adjacent to existing right-of-way (E).

Source: New York Department of Environmental Conservation, Natural Heritage Program

Schoharie Bat Cave - The Schoharie Caverns (MP 191) are located approximately 0.1 mile from the proposed pipeline in Schoharie County, New York. The entrance to the cave consists of a 45-foot-vertical drop. This cave does not contain any threatened or endangered species and it is sufficiently distant from the proposed route to be subject to little, if any, impact. Depths to bedrock are from 0.5 to 5 feet (see table 4.1.1-1) and blasting would probably be required in the vicinity of the cave. Should blasting be required, Iroquois agreed to minimize potential adverse impact by reducing load factors and detonating fewer simultaneous charges. As an alternative, backhoe-mounted pneumatic hammers could be employed.

Bank Swallow - A bank swallow colony, located along the Switz Kill (MP 202) in Albany County, New York, would be unaffected by the proposed pipeline construction and maintenance. This colony of three holes is located approximately 0.1 mile from the proposed route.

Great Blue Heron - The proposed route through Albany County, New York (MP 210), would pass within approximately 0.1 mile of a great blue heron rookery containing nine active nests. Great blue herons are sensitive to disturbance during the nesting period (April - July). Because of the proximity of the proposed pipeline to the heronry (about 0.1 mile), we re-examined the route in this area to determine if more distant routes were possible. We found that the proposed route would be the best one through this area, since it would successfully avoid several wetlands, including the one associated with the rookery. Since great blue herons generally require very large trees, preferably mature white pines, for nest construction, we recommend that Iroquois conduct a survey of the right-of-way within 0.5 mile of the rookery to determine the location of suitable nesting trees. Final centerline adjustments should be made to avoid clearing suitable nesting trees. This would prevent destruction of possible future nesting sites if the present rookery expands. We also recommended that all construction and activity within 0.5 mile of the rookery, be prohibited between April 1 and July 31. We believe these measures would be sufficient to avoid any impact on this rookery.

Boys Halfway River Caves - The Boys Halfway River caves in the vicinity of MP 318 have been identified in scoping as an environmentally sensitive area. The area consists of one to several collapsed limestone caves and associated calcareous soils which provide the potential to support unique and possibly rare plant species. The area could also support a population of bats although this has not been determined. Currently no significant habitats or unique ecosystems have been specifically identified or designated in this area. Our experience indicates that appropriate surveys, scheduling of construction and centerline realignment, if required, would mitigate impact on these resources.

Tennessee

Construction of the Tennessee facilities would result in clearing of approximately 633 acres of forested habitat, of which 414 acres would be allowed to revegetate. Ninety-nine percent of the permanently cleared forest habitat (216 acres) would be adjacent to existing utility rights-of-way, where impact on wildlife would be minor since open herbaceuos and forest edge habitat already exists.

5.1.5 Endangered and Threatened Species

Section 7 of the Endangered Species Act requires that any project authorized, funded, or conducted by any Federal agency (e.g., FERC) should not "...jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of habitat of such species which is determined to be critical..." (16 USC 1536 (a) (2) (1988)). FERC is required to consult with the FWS or the NMFS to determine if any federally listed or proposed endangered or threatened species, or their designated critical habitat, occur in the vicinity of the proposed project. If, upon review of existing data, FERC determines that these federally listed species or designated critical habitats may be affected by the proposed project, FERC is required to initiate formal consultation to identify the nature and extent of the adverse impact, as well as identify mitigation measures that would reduce potential impact to acceptable levels. If, however, FERC determines that no federally listed or proposed species or their designated critical habitat would be affected by the proposed project, then no further action would be necessary.

To comply with Section 7 requirements, FERC and the project applicants have consulted informally with the appropriate FWS and the NMFS threatened and endangered species experts regarding the presence of federally listed or proposed species in the project area. Four federally listed wildlife species are known to occur within the project area: the shortnose sturgeon, Kemp's Ridley sea turtle, bald eagle, and piping plover. Through informal consultation with FWS, NMFS, appropriate state agencies, and recognized experts, we determined that with our recommended mitigation measures the Iroquois/Tennessee Project would not affect these four species.

5.1.5.1 General Construction and Operational Impact

The general construction and operational impact of the proposed Iroquois/Tennessee Project discussed in section 5.1.4.2.1, would also apply to endangered and threatened species. However, since the distribution and occurrence of threatened and endangered species are limited or in decline, there may be greater impact on the size or viability of the populations. Habitat availability is often the limiting factor for endangered and threatened species, and loss of suitable habitat could mean the demise of certain individuals or populations, since displacement into surrounding areas could result in conditions unsuitable for survival.

5.1.5.2 Site-Specific Impact

Iroquois

Iroquois is currently conducting field surveys to identify the occurrence of state-listed species in New York and Connecticut. These field surveys will determine the occurrence of endangered, threatened, and rare plant species, as well as species of concern and significant habitats that might occur within the 100-foot construction right-of-way. Iroquois also agreed that it would survey for the following state-listed endangered and threatened bird species: common loon and least bittern (St. Lawrence County, New York), osprey (St. Lawrence and Lewis Counties, New York), and sedge wren (St. Lawrence and Oneida Counties, New York). Information obtained from these surveys would be used for route refinement and in coordination with the appropriate state agencies, the development of appropriate mitigation plans, including revegetation techniques. We recommend that the survey results and mitigation plans be submitted to FERC for review and approval prior to initiation of construction.

The following discussion is a compilation and summary of currently available data from recent and ongoing state agency surveys and databases, and those data presented by Iroquois in their application. Species discussed in this section, their general locations, and

Federal or state status are listed in table 4.1.5-1. At the request of the agencies that have provided this information, exact locations of each occurrence are omitted to prevent further disturbances and degradation of these sites.

The following discussions describe potential impact and mitigation for the individual species listed in section 4.1.5.

Bald Eagle (Federal-Endangered)

The NYDEC has reported that a pair of bald eagles have been frequenting an area approximately 0.1 mile from the proposed pipeline in Albany County, New York (Nye, 1989). This pair is expected to establish a nest site in the fall of 1989 or the spring of 1990. Since this pair of eagles has not selected an actual nest site, we recommend that Iroquois contact the FWS and NYDEC prior to pipeline construction to determine if the pair has established a nest site. If a nest site has been established, Iroquois shall develop in consultation with the FWS, a final route alignment and construction schedule that would avoid any impact on this pair. The final route alignment and construction schedule must be filed with the Secretary of the Commission for the Director of OPPR's review and approval prior to commencing any construction in Albany County, New York.

Established bald eagle winter roost sites on the St. Lawrence, Hudson, and Housatonic Rivers in St. Lawrence County, New York, Columbia County, New York, and Fairfield County, Connecticut, respectively, would not be affected by pipeline construction and maintenance. No roost sites are located within or adjacent to the proposed right-of-way. Roosts on these rivers are used from late November/early December until mid-March. Pipeline construction in the vicinity of these roosts is proposed to take place between April and November (see section 5.1.4.1.2). Construction of the proposed Housatonic crossing is recommended to be scheduled for October through December in order to avoid impact on winter flounder (see section 5.1.4.1.2). The nearest established roost would be approximately 15 miles from this proposed crossing. At this distance, there would be no impact on roosting bald eagles. However, to ensure that wintering bald eagles are not affected by construction, we recommend that construction be prohibited within 1 mile of any active bald eagle winter roost site from November 1 through March 31.

Piping Plover (Federal-Threatened)

The piping plover is known to nest on both the Connecticut and New York shorelines of Long Island Sound. Known active breeding sites are located over 2.5 miles from the proposed Connecticut and New York landfalls. At this distance, there would be no impact on nesting piping plovers. Additionally, if construction of the marine portions of the proposed pipeline were scheduled to occur on or after March 15, Iroquois agreed it would conduct surveys of the landfall areas for piping plover nesting activity. We concur, and recommend that a qualified ornithologist conduct these surveys prior to any construction activity, and that no construction occur at the landfall areas between March 15 and October 1 if nesting piping plovers are located within 0.5 mile of construction activities.

Shortnose Sturgeon (Federal-Endangered)

The shortnose sturgeon is a Federal- and state-listed endangered species found in the vicinity of the proposed Hudson River crossing. The area near Kingston, New York (located

28 miles south of the crossing), has been identified as the overwintering grounds for the species. As the water temperature rises at the beginning of May, the shortnose sturgeon migrate north to the Albany area. Spawning takes place in mid-May, depending on water temperature, between Coxsackie and Troy, New York (located between 8 and 33 miles north of the crossing) (Dovel, 1979; 1989). A smaller population of shortnose sturgeon is also found in the tidally influenced portion of the Housatonic River.

We recommend that Iroquois construct the crossing of the Hudson River between August 1 and November 30 and the crossing of the Housatonic River between October 1 and December 30 to avoid the spawning and migration season of the shortnose sturgeon. We believe that by implementing the stream crossing procedures and following the proposed crossing schedule for these two rivers, this species will not be affected. The NMFS concurred with these schedules.

Kemp's Ridley Sea Turtle (Federal-Endangered)

Kemp's Ridley sea turtle uses the Long Island Sound as a summer foraging area after which the majority of the turtles migrate south. A few cold-shocked juveniles remain through December. Pipeline construction across the Long Island Sound is scheduled for October 1 through May 31. Since the proposed landing site would impinge upon only a small portion of the habitat, the NMFS believes that the proposed construction would result in virtually no impact on the Kemp's Ridley sea turtle (Ludwig, 1989). We agree that the construction schedule would ensure that this species would not be affected, and therefore, recommend that Iroquois construct this crossing between October 1 and May 31.

Bog Turtle (Federal-C2, NY-Endangered)

The proposed pipeline route would traverse several wetlands where confirmed occurrences of the bog turtle have been documented, as well as several wetlands where suitable habitat exists but sitings have not been recorded. Eleven confirmed sitings have been recorded in wetlands associated with the Roeliff Janson Kill drainage in Columbia County, New York (Vance, 1989), and four sitings have been confirmed in various wetlands throughout Dutchess County, New York. Even though impact on these wetlands would be temporary, the potential combined effect of changes in surface hydrology, increased siltation, and loss of vegetative cover could result in conditions inadequate for the bog turtle during and after the construction period. The NYDEC recommends that wetlands where confirmed sitings of the bog turtle have been documented be avoided. We have considered route variations designed to avoid these habitats. Our review of the potential route variations determined that there would be little opportunity for alteration of the route without introducing additional impact on adjacent wetlands with additional suitable bog turtle habitat in the area. We recommend that in areas where suitable habitat occur within the proposed right-of-way, daily surveys should be conducted by a qualified herpetologist for a 2-week period between May 1 and June 30. These surveys should be completed prior to construction. If any bog turtles are encountered, they should be captured and held, in consultation with NYDEC, for later release into suitable habitat adjacent to the right-of-way after construction has been completed.

Lake Sturgeon (NY-Threatened)

The lake sturgeon is reported to occur in water bodies along the proposed Iroquois pipeline route (Schiavone, 1987). This species spawns in the vicinity of the proposed crossings of the St. Lawrence River (MP 0.0) and the Grass River (MP 15.55 and MP 18.10). Lake sturgeon are confined to larger lakes and rivers where they prefer clean sand, gravel, or rock bottoms. Spawning occurs at ice breakup (Smith, 1985). By following the stream crossing schedule in appendix D, impact on this species would be insignificant.

Blanding's Turtle (NY-Threatened)

Confirmed occurrences of Blanding's turtle have been documented in Dutchess County, New York. Clearing of right-of-way through wetlands where suitable habitat exists would result in impact similar to those for bog turtles. The NYDEC recommends avoidance of wetlands where confirmed sitings have been documented. We considered route variations in these areas, but our review determined that most reroutes would result in further impact on wetlands with suitable habitat, and are consequently not feasible. To mitigate possible impact on this species, we recommend that surveys by a qualified herpetologist be conducted in those wetlands associated with confirmed occurrences of Blanding's turtles. Surveys should be conducted on a daily basis for two weeks prior to construction, no earlier than May 1 and not later than June 30. If Blanding's turtles are encountered, they should be captured and held, in consultation with the NYDEC, for later release into suitable habitat adjacent to the right-of-way after construction has been completed.

Timber Rattlesnake (NY-Threatened)

Occurrences of timber rattlesnakes have been confirmed in Dutchess County, New York. These sitings involve individual snakes as well as the location of winter dens. Pipeline construction would take place when the snakes are out of their dens and foraging in the surrounding areas. The snakes are most distant from their wintering dens in July and August, after which they start their return to their winter dens where they hibernate from September to April. These known dens are sufficiently distant from the proposed route (0.3 and 0.4 miles) to avoid any adverse impact from construction (i.e., blasting, should it be necessary). NYDEC recommended that surveys be conducted by a qualified herpetologist prior to construction and that such a person be available during construction to relocate any snakes that might be encountered (Briesch, 1989). We concur, and recommend that specific survey plans be developed in consultation with the NYDEC and submitted to FERC for review and approval prior to construction. Plans should include areas to be surveyed, expected construction schedules, name and qualifications of the herpetologist, and relocation procedures, should this species be encountered.

Endangered, Threatened, and Rare Plants

Fifteen plant species currently listed as endangered, threatened, or rare were recorded in the general vicinity of the proposed Iroquois pipeline route (see table 4.1.5-1). Since no specimens have been located in the actual proposed right-of-way, we do not anticipate impact on these species from proposed pipeline construction or operation. However, where suitable habitat for each of these species occurs on the proposed right-of-way in the vicinity of their documented locations, we recommend that Iroquois conduct thorough field surveys of suitable habitat to identify actual occurrences prior to construction. Studies should be conducted between May 1 and September 30 to coincide with the species' flowering period, if appropriate. Results of the survey shall be submitted to FERC with clearly identified mitigative actions, such as reduced right-of-way width in designated areas, centerline realignments, and habitat restoration or enhancement.

Tennessee

Tennessee currently does not plan to conduct an endangered and threatened plant and animal field survey in the five states that would be affected by the proposed pipeline. The following discussion is a compilation and summary of currently available data from recent and ongoing state agency surveys and databases, and those data presented by Tennessee in their application. Due to the number of protected species potentially affected by the proposed action, we recommend that Tennessee conduct field surveys, and then submit an endangered and threatened species mitigation plan for approval by FERC prior to initiation of construction.

The fourspine stickleback has been reported to occur in the vicinity of the Mill River and Willow Brook in Connecticut. This fish is not a Federal- or state-listed species, but is considered to be rare in Connecticut. However, we feel that any impact would be avoided by following the "Stream Construction and Mitigation Procedures" (see appendix D).

Bald Eagle (Federal-Endangered)

Bald eagle winter roost sites on the Merrimack River would not be affected by pipeline construction and maintenance since these sites are not located in or near the proposed right-of-way. Roosts on this river are used from late November/early December until mid-March. Pipeline construction is scheduled to occur between April and October. In the event that construction would be rescheduled in this area, the New Hampshire Fish and Game Department recommends that no construction take place during the winter roosting season (Nevers, 1989). We believe that this would help to avoid any impact, and recommend that construction be prohibited within 1 mile of active bald eagle winter roost sites from November 1 through March 31.

Wood Turtle (MA-Rare)

Occurrence of the wood turtle has been confirmed along the proposed loop in Worcester County, Massachusetts. Impact on the wood turtle would be minimal since their preferred habitat (forested shrubland habitat in the vicinity of streams) is abundant in this area.

Eastern Hognose Snake (NH-Special Concern)

The eastern hognose snake has been documented in the immediate vicinity of the proposed pipeline in Merrimack County, New Hampshire. We recommend that daily surveys be conducted by a qualified herpetologist for approximately 2 weeks prior to construction. If individual snakes are encountered, they should be captured and relocated to suitable habitat.

Drooping Bulrush (MA-Rare), Fringed Gentian (MA-Rare)

Drooping bulrush and fringed gentian have been recorded in the proposed right-of-way in Berkshire County, Massachusetts. These plants are associated with a wetland that has been designated as a significant ecological community by the Massachusetts Natural Heritage Program, which strongly recommends that this wetland be avoided (Copeland, 1989). Construction impact could result in loss of individuals and degradation of this relatively undisturbed habitat. The proposed route would parallel an existing right-of-way, and the Massachusetts Office of Environmental Affairs recommends that the new right-of-way be constructed on the north side of the existing right-of-way to avoid this wetland (Sorrie, 1989). We agree, and recommend that construction be limited to the north side of the existing right-of-way.

Other Endangered, Threatened, and Rare Plants

Two state-listed threatened species (ram's head lady's slipper and Hill's pond weed) were determined to occur in the vicinity of Tennessee's proposed loops (table 4.1.5-1). Since no specimens have been recorded from any location in the proposed right-of-way, we do not anticipate impact on these species from proposed pipeline construction or operation. However, since suitable habitat for these species does occur in the proposed right-of-way in the vicinity of their documented locations, we recommend that Tennessee conduct thorough field surveys to identify potential occurrences prior to construction. The surveys should be conducted in conjunction with the NYDEC and the CTNDDB. Studies should be conducted between May 1 and September 30 to coincide with the species' flowering period, if appropriate. Results of the survey and the proposed mitigation plan shall be submitted to FERC for review and approval prior to construction.

5.1.6 Vegetation

5.1.6.1 General Construction and Operational Impact

The primary impact on vegetation during construction and routine maintenance of the proposed Iroquois/Tennessee Project would be the temporary and permanent alteration of vegetative cover. The cover type most affected by construction would be forestland. Approximately 2,333 acres of right-of-way (including forested wetlands) would be cleared for the project, of which 963 acres would be maintained in a herbaceous state as permanent right-of-way. Forest cover on the permanent right-of-way would be converted to herbaceous and open shrub cover. Allowed to revegetate naturally, the temporary right-of-way would grow into a young-aged forest stand in 15 to 25 years.

In addition to direct impact from vegetation clearing, there could be secondary effects on uncleared vegetation. Construction of a right-of-way through forested areas would create sharp vegetation edges where none existed previously. This may expose the new edge trees to elevated levels of sunlight and wind, which could increase moisture evaporation and the probability of wind throws. Root damage or soil erosion near the root zone could also occur as a result of construction activity that would be near the right-of-way edge. Clearing through large tracts of mature forestland could result in the fragmentation of those tracts, possibly causing a change of forest community in the areas adjacent to the right-of-way. Shade- intolerant species may become established and persist in the understory along the right-of-way edge (Carvell and Johnston, 1978). Creating and maintaining an open right-of-way may also allow early successional vegetation to invade the construction and maintained rights-of-way, as well as the edges of the uncleared forest. The applicants have agreed to identify, clearly mark, and protect during construction any trees immediately adjacent to the cleared right-of-way that are of significant value to the landowner. In general, secondary effects on adjacent, uncleared vegetation are expected to be minor.

Impact on nonforest vegetation should be relatively short-term. Non-forested wetlands should return to preconstruction condition in one or two growing seasons. Construction through agricultural land, in most cases, would result in the loss of only one growing season. Abandoned agricultural land in early successional stages could also revert back to preconstruction conditions in a relatively short time (one to three growing seasons). Effects on vegetation in residential areas should be short-term, except in those instances where trees would be removed for construction.

In certain locations where the proposed pipeline would parallel an existing electric transmission line right-of-way, we believe there would be sufficient room for the pipeline to be placed in the existing right-of-way. If this were done, forested areas already disrupted by existing right-of-way would not be further affected. Use of existing rights-of-way is discussed in greater detail in section 5.1.9.1.2.

Another potential effect of vegetation clearing during construction could result from inadequate stump disposal. Burial of large volumes of tree stumps at specific locations could result in ground-level sinking. In addition, when large volumes of stumps decompose under anaerobic conditions, methane and leachates may be generated. To reduce this potential, we recommend that where stump burial has been approved by the landowner, stumps be buried individually Where approved by the landowner, stumps may also be left on the right-of-way ground surface, exposed to the weather to deteriorate. This would minimize the bulk waste disposal problem in the project area. Many comments were raised about the disposal of bulky construction wastes. Disposal of those materials on the right-of-way would ease the landfill space problem. However, if onsite stump disposal was not agreed to by the landowner, the applicants would be responsible for removing all stumps offsite, to an acceptable disposal site.

Onsite disposal of brush and slash would also be done at the discretion of the landowner. This material would be piled at the edge of the right-of-way, or chipped and spread on the right-of-way if done so in accordance with appropriate provisions of appendix C. At the landowner's request, the applicants would be responsible for removing this material to an acceptible disposal site.

To avoid potential impact on wildlife species that utilize the right-of-way for breeding, nesting, and brood-rearing purposes, we recommend that no vegetation maintenance be conducted prior to August 1 of any year. In addition, we recommend that vegetation maintenance be conducted no more frequently than once every three years.

5.1.6.2 Site-Specific Impact

Iroquois

Construction of the proposed pipeline project would result in the clearing of all existing vegetation within a 100-foot-wide construction area. Following construction, the entire area would be restored to its preconstruction contours and reseeded. In most areas, a 60-foot-wide right-of-way would be maintained in grass or other nonwoody vegetation; the remaining 40 feet would be allowed to naturally revegetate. For rights-of-way through forested areas, Iroquois agreed it would allow an additional 10 feet to revert to natural vegetation, which would result in a 50-foot-wide maintained right-of-way in these areas. For cleared wetlands, Iroquois has agreed it would allow the entire construction right-of-way to revert to natural vegetation, including revegetation by trees (see section 5.1.7 for a detailed discussion concerning wetlands). However, we believe that these widths are excessive, and recommend that they be reduced (see section 5.1.9.1.2).

The majority of the forested land that would be affected is in St. Lawrence and Lewis Counties, New York, along the northern third of the proposed route, and in Dutchess County, New York, and Fairfield County, Connecticut, along the southern third of the proposed route. The potential for impact attributed to forest fragmentation would be greatest where the proposed construction would clear a right-of-way through unbroken forested areas of moderate size (2 to 10 square miles). Such areas occur at MPs 37-41, MPs 47-51, and MPs 68-72. Areas of extensive forested tracts that would be cleared, but which are already transected by roads, existing rights-of-way or patch development, occur at MPs 83-93, MPs 126-129, MPs 219-225, MPs 278-281, MPs 307-311, and MPs 315-320.

In developing plans to revegetate the cleared right-of-way, Iroquois agreed it would consult with landowners and appropriate state and county agencies to determine seed mixtures and, as required in specific areas, types of trees and/or other woody vegetation to be replanted. Iroquois also agreed that, upon completion of the project, it would conduct an assessment of the need for vegetation plantings to screen and landscape the pipeline and metering facilities, and that it would develop specific mitigation plans for the clearing and revegetation of forested areas identified as visually sensitive (see section 5.1.9.3). Specific revegetation plans for selected stream crossings and visually significant areas are provided in section 5.1.9.3. We recommend that an assessment of vegetation requirements for screening and landscaping of aboveground facilities be submitted to FERC for review and approval prior to completion of construction. Furthermore, Iroquois agreed to identify specimen trees and to protect them from damage. It would use the Big Tree Point System for New York State and a similar methodology in Connecticut (DR Q3P).

Iroquois also agreed that it would identify black cherry trees that would be cleared in the vicinity of active livestock areas. Black cherry vegetation cut for construction of the right-of-way would not be stockpiled in areas accessible to livestock.

Iroquois agreed that right-of-way maintenance would occur at 5- to 7- (or more) year cycles and would be conducted from midsummer through late fall. Iroquois agreed not to use herbicides for right-of-way maintenance. Maintenance would be accomplished with power-driven equipment except for environmentally sensitive areas, such as areas subject to visual impact, where more selective methods would be employed.

Tennessee

All but one of Tennessee's proposed segments would parallel existing gas pipeline rights-of-way. The width of construction and permanent rights-of-way would vary for the eight segments proposed by Tennessee (see table 5.1.6-1 and section 5.1.9.1). Following construction, Tennessee would restore the entire right-of-way to its preconstruction contours and reseed it. The portion of the construction right-of-way not permanently maintained would be allowed to naturally revegetate. Permanent right-of-way would be maintained in grass or other nonwoody vegetation. Large areas of forest would be cleared adjacent to existing right-of-way along the Columbia/Berkshire Loop (110 acres), and the Worcester Loop (50.9 acres), fragmentation of forest tracts due to clearing would be minimal, since disruption of the forest has already occurred.

TABLE 5.1.6-1

Right-of-Way Widths for the Proposed Tennessee Segments

Segment, State	Width of Construction ROW (ft)	Width of Permanent ROW (ft) a/
TENNESSEE		
Schoharie/Albany Loop, NY	50	25
Columbia, NY	50	25
Berkshire, MA	60	35
Worcester Loop, MA	60	35
Concord Lateral, NH	25	10
Haverhill Lateral, MA	25	10
Wallingford Lateral, CT	25	-
Lincoln Extension, RI	55	30
Springfield Lateral, MA	25	10

a/ The Wallingford Lateral would be a replacement line and would not require any additional permanent right-of-way; the Lincoln Extension would be a new right-of-way. All other segments would require a new right-of-way in addition to existing right-of-way.

As noted previously, we recommend that where sections of the proposed pipeline parallel existing electric transmission line rights-of-way, they should be placed within the existing rights-of-way, and that only clearing of temporary construction right-of-way (maximum 25 feet) would be allowed.

Nonforest vegetation along the proposed Tennessee segments is primarily agriculture, accounting for 38 percent of the total area that would be affected. Implementation of our recommended soil mitigation measures would ensure that impact on agriculture would be minimal (see section 5.1.2).

Tennessee is currently evaluating herbicides and regrowth inhibitors to maintain existing rights-of-way, and could extend that use to additional rights-of-way associated with the proposed loops, laterals, and extensions. However, no herbicides would be used in Massachusetts. The selection and application of herbicides would be in accordance with applicable EPA regulations.

5.1.7 Wetlands

5.1.7.1 General Construction and Operational Impact

The primary impact on wetlands as a result of the construction and operation of the proposed Iroquois/Tennessee Project would be the temporary and long-term alteration of wetland vegetation. Additional impact could include temporary changes to wetland hydrology, water quality, aesthetic values, and the quality of wildlife habitat. Pipeline construction would not significantly alter any wetlands since wetlands would not be filled or drained. Therefore, no wetland "loss" would occur. As discussed in section 5.1.7.2, the applicants would be required to follow specific wetland construction procedures that would eliminate or minimize the majority of potential impact on wetlands.

Several additional effects could result from the clearing of right-of-way through wetlands. Soil compaction and rutting may result from the temporary stockpiling of soil and the movement of heavy machinery. Surface drainage patterns and hydrology may be temporarily altered, and there would be increased potential for the trench to act as a drainage channel. Increased siltation and turbidity may result from trenching activities. Trenching could remove an impervious soil layer and consequently drain a perched water table. This would result in dryer soil conditions which could inhibit the reestablishment of wetland vegetation. Erosion and flood control capabilities of affected wetlands could be altered.

The clearing of wetland vegetation could result in the temporary loss and alteration of wildlife habitat. A temporary displacement of wildlife or loss of some individuals could also result from construction activities. Mitigation measures that we have recommended to reduce or eliminate impact on wildlife and endangered and threatened species are discussed in sections 5.1.4 and 5.1.5.

Impact on the aesthetic or recreational value of wetlands would be relatively short-term where the proposed pipeline would pass through wetlands dominated by herbaceous vegetation, and long-term for those wetlands vegetated by woody cover. Aesthetic effects would be long-term where the pipeline would cross forested wetlands, since regrowth of the vegetation within right-of-way would take from 10 to 20 years. Aesthetic effects would also occur during the period of construction to initial revegetation.

5.1.7.2 Construction and Mitigation Procedures

The COE has determined that a single individual Section 404 permit would be required for the project. A Section 404(b)(1) guidelines analysis would be conducted by the COE to ensure that discharge of dredged and fill materials would be minimized and that all practical construction alternatives have been identified and utilized to reduce impact on wetland resources. These guidelines require that dredged or fill materials would not result in violations of state water quality or toxic effluent standards; nor jeopardize the existence of species listed as endangered or threatened under the Endangered Species Act of 1973; nor cause significant degradation to waters of the United States (as demonstrated by chemical testing); nor result in significantly adverse individual or cumulative effects on human health or welfare, aquatic life or wildlife dependent on aquatic ecosystems, or on recreation, aesthetic, and economic values. As a result of the COE analysis, additional conditions could be imposed on the applicants in the proposed crossings of wetlands.

In order to establish a minimum level of protection during pipeline construction through wetlands, we have developed a common set of Stream and Wetland Construction and Mitigation Procedures (Procedures) that we recommend be employed by both Iroquois and Tennessee for all unavoidable wetland crossings. These Procedures are described below and are outlined in detail in appendix D. Implementation of these Procedures would eliminate or significantly reduce the majority of adverse effects associated with pipeline construction. The Procedures were developed in cooperation with the FWS, EPA, and several state agencies. In addition, certain state or local agencies could require Iroquois and Tennessee to follow more stringent construction and mitigation procedures and could also require the applicants to prepare site-specific wetland crossings plans.

The applicants have reviewed and commented on the Procedures, and, in general, have agreed to comply with the majority of its measures. The applicants have not agreed to all of the Procedures, however, and in some cases have proposed alternatives that we have reviewed. Based on the applicants' comments and our continued review, some of the Procedures have been modified. Our recommended Procedures, the alternatives proposed by the applicants, and our evaluation and recommendations are described below. If the applicants determine that they cannot comply with one or more of the Procedures at a specific location, they may submit site-specific alternative measures for our review and approval prior to construction. Where we determine that these alternative measures differ significantly from our Procedures, they would need to be submitted to the Director of OPPR for review and approval prior to construction.

Staging Areas

The Procedures require that all staging areas be located at least 50 feet from wetland edges where topographic conditions permit, and that these areas be limited in size to the minimum area needed for prefabrication of pipe segments. Potential contamination of surface water by spillage of fuels, oil, other hazardous materials, or concrete would be minimized or eliminated by restricting the refueling of construction equipment, the storage of hazardous materials, or concrete coating activities to areas further than 100 feet from all wetland boundaries. Iroquois has agreed in general to the 50-foot setback for staging areas but states that it is not always feasible. Tennessee indicates that the 50-foot setback is not practical because of the wide range of soil and hydrologic conditions encountered. Iroquois has expressed concern that variable definitions of a wetlands' boundary would make the required setback distance difficult to determine. We have since determined that the unified Federal method to delineate wetlands will be used. Wetland boundaries must be delineated using this method prior to construction. Tennessee has taken exception to guidelines for refueling equipment further than 100 feet from wetland boundaries, indicating that under certain topographic situations, it could be more environmentally harmful to move construction equipment in order to refuel. We maintain that moveable construction vehicles should not be refueled within 100 feet of wetland boundaries.

We have added the recommendation that no aboveground facilities be constructed within the limits of federally delineated wetlands.

Spoil Placement

The Procedures require that sediment filter devices be used to prevent the flow of trench excavation spoils off of the right-of-way. Iroquois and Tennessee indicated that use of these measures would be determined on a site-specific basis, and that this restriction would generally not be met in long wetland crossings where spoil is sidecast, or in wetlands with deep standing water, except to isolate specific sensitive areas. Because of the potential for large amounts of sediment to enter surrounding undisturbed wetland areas, we feel that sediment filter devices should be used around all spoil piles and at the edges of the right-of-way within all wetland areas, regardless of length of crossing or depth of standing water.

Crossing Procedures

Our Procedures for wetland crossings require that the applicant notify the COE concerning the proposed construction activities and submit to us a copy of the COE's determination regarding the project's need for individual Section 404 and/or Section 10 permits.

Our Procedures require that construction through wetlands comply with nationwide Section 404 permit conditions (33 CFR 330) at a minimum, and that applicants apply for state-issued wetland-crossing permits, where appropriate, and obtain Section 401 water quality certification or waiver. The Procedures include a requirement that if a wetland cannot be avoided, the route be located to minimize disturbance to the wetland. One method of minimizing disturbance to wetlands is to locate the route adjacent to existing rights-of-way. Where pipeline looping is to occur, the new loop line would be located no more than 25 feet away from the existing pipeline.

In order to minimize the area of wetland vegetation affected, our Procedures require that the construction right-of-way width be limited to 75 feet or less in wetlands. This has been modified from previous requirements of 50 feet or less. Evidence submitted by the applicants, as well as numerous pipeline companies and independent contractors, indicates that pipeline construction within a 50-foot right-of-way could not be safely or adequately accomplished in the majority of wetlands. Concentrating activity to within 50 feet may also result in greater impact on wetland soils and vegetation. Iroquois and Tennessee indicate that maintaining a right-of-way width of 75 feet may even be too restrictive in some wetlands, especially for long wetland crossings. We feel that by using appropriate methods to temporarily stabilize the right-of-way, the majority of wetlands could be crossed while limiting right-of-way clearing to 75 feet or less.

During right-of-way clearing, woody wetland vegetation would be cut off at ground level, leaving root systems intact. Only stumps and roots directly over the trench would be removed where required for pipe installation. This would allow for a more rapid revegetation of woody plants than if root systems were pulled or the entire right-of-way were graded. Both applicants have stated that where wetlands occur on slopes, additional stump pulling and grading may be required to create a safe working area. We believe that this issue is best handled through the use of site-specific exemptions.

In order to maximize revegetation of the area over the trench, the Procedures specify that the top 1 foot of topsoil from the area to be disturbed by trenching be segregated and replaced as the top layer after installation is complete, except in areas with standing water or saturated soils. Iroquois indicated that some wetlands may have a topsoil horizon less than 1-foot deep. Because of the value of returning the seeds, roots, and rhizomes that are within the topsoil to the surface where they can rapidly revegetate, we stand by this recommendation.

To minimize the disturbance and compaction of wetland soils, the Procedures require that the applicants limit construction equipment operating in wetlands to that needed to dig the trench, install pipe, backfill the trench, and restore the right-of-way. Iroquois and Tennessee agree to the general principle of this, but indicate that it would not be possible in all cases (e.g., pipeline bends and very long wetlands). The intent of this recommendation is to minimize construction traffic in wetland areas and to prohibit construction equipment travel through wetlands as a means of accessing non-wetland right-of-way areas. We recognize that there may be no available off right-of-way access around long wetlands in some instances. In these cases, our recommendation allows the applicants to provide site-specific information for our review and approval prior to construction.

The use of fill to stabilize working areas within wetlands may permanently alter wetland characteristics. Our Procedures require that no dirt, rock, stumps, or brush be used as temporary or permanent fill within wetlands. Iroquois and Tennessee indicate that they would not use dirt, rocks, stumps, or brush, but would use crushed stone over filter cloth to stabilize the right-of-way. Both applicants indicated they would remove this temporary fill. We have determined that the use of crushed stone over geotextile fabric is an acceptable method to temporarily stabilize the right-of-way. This material must be removed following construction. In addition, any timber used as a base for the geotextile fabric must also be removed following construction.

To minimize impact on wetlands with standing water or saturated soils, the Procedures require that the applicants use wide-track or balloon-tire construction equipment, or operate normal equipment off of timber riprap or pre-fabricated equipment pads where these conditions exist. In addition, only trees within the right-of-way are to be cut for use as riprap or equipment pads, and no more than two layers of these materials are to be used to stabilize the right-of-way. Also, these materials must be removed upon completion of construction.

Tennessee indicates that for some wetland crossings, there may not be enough timber on the right-of-way, and timber outside of the right-of-way may need to be cut with the landowner's permission. The Procedures require that in such cases, prefabricated pads be used. Iroquois and Tennessee take exception to removing timber riprap, except where it would impede drainage, suggesting that removing material would cause more damage than leaving it. We believe that leaving timber riprap in any wetland would be a significant impact, and that by laying riprap over a series of cables, it may be removed without a great deal of additional disturbance to the wetland.

The "push-pull" or "float" technique would be used to place the pipe in the trench wherever standing water and other site conditions allow. This would reduce impact on wetlands by minimizing equipment traffic through the wetland.

Temporary Erosion and Sediment Control

Silt fences and other filter devices would be installed around the edge of all wetlands, and inspected and repaired daily until right-of-way revegetation is complete. Although Iroquois and Tennessee have suggested the placement and frequency of inspection of these devices be based on weather conditions, storm events, and sensitivity of the area, we believe these measures need to be followed as a minimum for sediment and erosion control. We have added the requirement that permanent slope breakers be installed at the base of all slopes adjacent to wetlands.

Revegetation Techniques

Following construction through wetlands, no lime or fertilizer would be added to disturbed areas, unless required by the appropriate state permitting agency In addition, where there is no standing water, the topsoil would be returned to its original horizon and then seeded with annual ryegrass.

To minimize permanent alteration of wetland vegetation, the Procedures specify that the entire disturbed right-of-way be allowed to revegetate with herbaceous and woody vegetation. Tennessee stated that it would not allow woody vegetation to become permanently established on the right-of-way within 25 feet of the pipeline. Because maintaining the right-of-way free of woody vegetation would be a permanent alteration of wooded wetlands, all herbaceous and woody vegetation should be allowed to reestablish itself on the rights-of-way. Maintenance of woody vegetation shall be limited to those procedures described below under Right-of-Way Maintenance Practices.

The invasion and spread of undesirable plant species (i.e., purple loosestrife) in disturbed wetland areas may significantly alter the plant composition in the wetlands. The primary method of preventing the establishment of undesirable plants is through quick reestablishment of native plant species. This would be accomplished as described above. In addition, the Procedures require that each applicant develop specific measures to prevent or control the introduction of undesirable vegetation, in coordination with appropriate state agencies. Tennessee commented that the currently available means of control for purple loosestrife (artificial water-level regulation, chemical control, and hand pulling) are neither environmentally acceptable nor cost-effective. We recognize that there are no easy solutions to this problem, yet it remains a concern for most states. The applicants should consult with the appropriate state agency to determine the most appropriate or best available technique to be used within each state.

Right-of-Way Maintenance Practices

To minimize permanent alteration of forested or scrub-shrub wetlands, our Procedures recommend that no mowing or other vegetation maintenance practices occur on the right-of-way within wetlands. The only exception to this would be the selective cutting of trees greater than 15 feet in height that are located within 15 feet of the pipeline. Tennessee, takes exception to this, indicating that it would maintain a 50-foot-wide permanent right-of-way through wetlands. Tennessee stresses that woody vegetation maintenance is required to maintain access and to prevent physical damage to the pipeline caused by root systems. We have revised this recommendation from previous versions where only trees greater than 6-inches dbh, rather than 15 feet in height, were to be cut. We feel that there is little chance that root systems of 15-foot-tall trees would damage the pipeline. Considering the type of vehicles that would be used in wetlands during pipeline reconnaissance or maintenance, we believe that allowing 15-foot-high woody vegetation to regenerate may limit, but would not prohibit, access through wetlands. In addition, aerial surveillance would still be possible. Because regular vegetation maintenance would be a permanent impact on forested or scrub-shrub wetlands, we stand by our mitigation measure.

Trench Dewatering

Water that collects in the pipeline trench would be pumped out (where required) in such a manner that no silt-laden water would flow into wetland areas off of the construction right-of-way. This would reduce impact on the water quality in the surrounding, undisturbed wetlands.

We have studied and recommended that the applicants utilize numerous variations to eliminate or minimize impact on wetlands (see section 3.6.35). In addition, our Procedures require that the applicants field-delineate all wetland areas, using Federal methodology, prior to construction, and that they further realign the proposed pipeline route to eliminate or minimize impact on wetland areas to the maximum extent practicable.

Implementation of our recommended wetlands construction procedures would ensure that impact on wetland areas would be of a short-term nature, and that long-term impact would be restricted to the alteration of vegetation on the maintained right-of-way.

Therefore, we conclude that impact on wetland areas has been minimized to the maximum extent practicable, and believe that the proposed project, as modified by our recommended measures, complies with the Section 404(b)(1) Guidelines. While the staff recognizes that a final determination of compliance with the Guidelines is the responsibility of the COE, we note that the COE has preliminarily determined that Iroquois' portion of the proposed project complies with the Section 404(b)(1) Guidelines (see section 2.6).

5.1.7.3 Site-Specific Impact

Iroquois

The proposed Iroquois Project would result in the temporary clearing and alteration of approximately 267 acres of wetlands. Forested and shrub swamps are the most common types of wetland vegetation that would be crossed by the proposed Iroquois route. Table 4.1.7-2 lists the areas of each wetland cover type. Of the 267 acres of wetlands that would be cleared, 211 acres consist of woody vegetation cover. Implementation of our recommended right-of-way maintenance procedures (see appendix D) which permit vegetation maintenance only of trees taller than 15 feet, would allow much of these woody wetlands to revert to their original forested or scrub states. The remaining 56 acres of wetlands that would be cleared include emergent marshes, wet meadows, intertidal flats along the Hudson and Housatonic, and coastal tidal marshes and mud flats adjacent to Long Island Sound. Impact on these wetlands would be temporary and relatively short-term, as they would return to preconstruction conditions in one or two growing seasons.

During preconstruction surveys, Iroquois proposed to continue to make minor routing modifications to avoid wetlands, provided that no other environmentally sensitive areas would be affected by such changes. Final route alignment could be altered slightly, where possible, to avoid a wetland or significantly decrease a crossing length, assuming there would be no additional land use-constraints. In the field, realignment would also avoid small wetlands that do not appear on National Wetland Inventory maps or that were not detected from aerial photography or previous field review.

Iroquois is currently conducting onsite and offsite studies to further refine wetlands delineation along the proposed right-of-way. Onsite field delineations are being conducted using the three-parameter unified Federal wetland where access has been granted by affected landowners. Where access has been denied, Iroquois is utilizing the offsite method as defined in the Federal Manual for Identifying and Delineating Jurisdictional Wetlands. Results of onsite and offsite delineations will be used to modify the pipeline route to avoid wetlands and/or select the most appropriate construction technique to minimize impact on wetlands. Preliminary results of Iroquois' field and offsite delineation effort are presented in appendix J. At COE's request, our staff field-checked Iroquois' field delineations of wetlands at several key locations. These locations included the Hudson River staging area (MP 231.5), Still River area (MP 297.8 to MP 301), Means Brook (MP 319.5 to MP 320.8), Cranberry Bog (MP 327.8), and the Housatonic River staging area (MP 331). The EPA and FWS were invited to attend the field checks, but could not attend, except on April 25, 1990, when a FWS representative was present. Our field reconnaisance indicated that Iroquois' implementation of the on- and off-site procedures for field-delineating wetlands using the unified Federal method was accurate and acceptable.

Large (greater than 0.25 mile) forested or shrub wetland complexes would be crossed in the vicinity of MP 1, MP 13, MP 110, MP 117, MP 121, MP 231, MP 236, and MP 320. Clearing of these wetlands would result in long-term impact, since forested wetlands could take up to several decades to return to preconstruction conditions. Our recommended wetland crossing construction procedures (see appendix D) would help to reduce this impact, particularly by protecting root stocks. Several individual wetlands of particular significance would be crossed by the proposed route. A large wetland complex is associated with the Hudson River (MP 231) where long-term impact would result from the clearing of forested wetlands. Iroquois agreed to prepare a wetlands mitigation plan for restoring the wetland disturbed at the Hudson River staging area. We recommend this plan be submitted to the Director of OPPR for review and approval prior to construction.

We have evaluated potential impact on a number of specific wetland areas, which were identified during scoping as significant due to size, cover type, or uniqueness.

St. Lawrence River-Crossing Staging Area - Iroquois originally proposed to locate a portion of its St. Lawrence River-crossing staging area in a wetland. This wetland is designated by the FWS as L20WHh and is aligned along the St. Lawrence. Iroquois' original proposed route would cross 300 feet of this wetland. In addition, the southern part of the Iroquois staging area would impinge on a palustrine forested wetland (PFO1E); the original proposed staging area currently would traverse about 1,600 feet of this wetland. A portion of the same wetland (which overlaps with the FWS designated area) has been designated by the NYDEC as class III.

Based on review of existing map resources, the St. Lawrence River Variation was recommended in the DEIS to reduce the area of affected wetland. However, subsequent field studies conducted by Iroquois revealed that the recommended variation would affect a large forested wetland (including an area of northern white cedar) that was not shown on NWI or NYDEC wetland maps. Based on the field-delineation of these wetland areas, the route as originally proposed by Iroquois would result in less impact on wetlands and would be preferable to the variation. In addition, Iroquois indicated that a slight modification of the original proposed point of landfall on the St. Lawrence River, a move approximately 250 feet to the west, would allow the entire staging area to be located within upland area. Therefore, we recommend that Iroquois utilize its original proposed route, modified as indicated to move the entire staging area out of the wetland.

Bonaparte Swamp - Bonaparte Swamp in Lewis County, New York (MP 56.5), has been identified by the New York Natural Heritage Program (NYNHP) as a significant habitat. This wetland, approximately 0.2 mile from the proposed route, contains rare and state-listed plant species. However, since this wetland is separated from the proposed route by a paved road, we conclude that no impact would result from pipeline construction.

Black Ash Swamp - Black Ash Swamp, an extensive forested/ shrub wetlands complex also located in Lewis County, New York, would be crossed by the proposed route at MPs 66.5 to 66.9. The pipeline would cross this wetland at its narrowest point, and the NYDEC concurs with our conclusion that impact would be minimal (Farquhar, 1989).

Cady Brook Wetland Bog - A wetland associated with Cady Brook in Oneida County, New York, has been identified by the NYNHP as a significant habitat. The proposed route would pass through the southern tip of a wetland associated with this bog. We have reviewed the route in this area and recommend the route be shifted to the southwest between MPs 123.2 and 123.5 to minimize impact on this wetland (see section 3.6.26).

Silver Lake/Mud Pond - Several concerns have been raised by local residents and the NYDEC regarding impact on the Silver Lake/Mud Pond wetland complex in Dutchess County, New York. In this general area, the proposed route would follow an existing transmission line right-of-way and avoid Silver Lake and Mud Pond, but would cross associated wetlands to the north. We considered alternative routes between MPs 255.8 and 256.2 to avoid these wetlands, but we rejected the modification as it would result in greater impact on other resources (see section 3.6.19).

Wimisink Valley Sanctuary - The proposed crossing of wetlands associated with Wimisink Valley Sanctuary in Litchfield County, Connecticut, has caused concern among local residents. The wetlands within the sanctuary include forested, shrub, and emergent swamp. We developed and recommended a route variation between MPs 287.3 and 288.1 that would reduce the amount of wetlands crossed (see section 3.6.26), and shift the majority of the route within the Sanctuary to herbaceous wetlands.

Still Rivers Meanders - Wetlands associated with the Still Rivers Meanders Natural Area (MP 297.5) have been identified as a significant habitat by the Connecticut Natural Diversity Inventory, and the crossing proposed by Iroquois has been a concern to local area residents. This wetland complex, which is primarily a floodplain community, includes forested, shrub, and emergent wetland vegetation types. The proposed route would follow an existing electric transmission line right-of-way through this area. A route variation that would reduce the amount of wetlands affected has been identified and is recommended (see section 3.6.27).

Newton Wetlands - Concern has been expressed about two wetlands that would be crossed by the proposed route in Newton, Connecticut (MPs 306.3 and 308.6). These wetlands are significant because of their size, flood control capacity and wildlife value. We considered several route variations to reduce the amount of wetland affected. We recommend a route variation between MPs 305.6 and 306.4, but we rejected a route variation between MPs 308.3 and 310.1 until further justification can be provided (see sections 3.6.29 and 3.6.35).

Shelton Wetlands - A 2,220-foot section of wetlands associated with Means Brook that would be crossed in Shelton, Connecticut (between MPs 319.6 and 320.8), was cited as a concern during scoping. This wetland is significant due to its large size and contribution to Bridgeport Hydraulics Company's water reservoir system (Cook, 1989). A route variation was identified and evaluated in order to minimize impact on this wetland complex (see section 3.6.31).

Mondo Ponds - Concern was expressed in scoping about the Mondo Ponds wetlands complex in Milford County, Connecticut. These wetlands include forested, shrub, and emergent cover types. We have recommended a route variation between MPs 331.1 and 332.8 that would avoid this wetland (see section 3.6.34).

Other Wetlands - Several wetlands that have been identified by state natural heritage or natural inventory programs as known or potential habitats for threatened or endangered species, or as significant habitats or areas of concern, could be affected by Iroquois' facilities. The potential effects of pipeline construction on these wetlands would be similar to the general impact described in section 5.1.7.1. However, since populations of threatened and endangered plants and animals may be small or in decline or very localized, construction could have long-term adverse impact on these populations. Refer to section 5.1.5.2.1 for discussion of possible impact on specific wetland species.

Tennessee

The proposed Tennessee segments would result in the temporary clearing and alteration of approximately 14 acres of wetland vegetation even though the right-of-way would be located adjacent to an existing gas pipeline right-of-way for 99 percent of its length. As noted previously (section 5.1.6.1), we believe the pipeline could be placed within the existing electric transmission line rights-of-way where they are paralleled. By implementing this recommendation, no additional clearing would be required, and the wetland areas already disrupted by the existing right-of-way would not be further affected.

Forested and shrub swamps are the most common wetland types that would be crossed. Of the 14 acres of wetlands proposed to be cleared by Tennessee, 11 acres consist of woody cover. The remaining wetlands include emergent and wet meadow wetlands and open water. Implementation of our recommendation to utilize existing electric transmission line rights-of-way when they are paralleled would eliminate the need for new right-of-way clearing and would substantially reduce the impact.

A total of 55 wetlands would be crossed by the 8 segments proposed by Tennessee. The majority are small wetlands (less than one-quarter acre crossed), but a large crossing would occur along the Haverhill Lateral at MP 270B-302+ 2.10.

The Massachusetts Natural Heritage Program identified two significant wetlands that are known or potential habitat for threatened or endangered species. The potential effects of pipeline construction on these wetlands would be similar to the general impact described above. If these and the other wetlands crossing procedures outlined in appendix D are followed, we believe impact would be minimal.

Columbia/Berkshire Loop Wetlands - Two wetland complexes are located in the vicinity of the proposed Columbia/Berkshire Loop in Massachusetts. Both of these wetlands have been designated as significant habitats by the Massachusetts Natural Heritage Program and both contain rare and state-listed species. One, an unnamed shrub swamp, is crossed by the existing pipeline right-of-way and would be crossed by the proposed loop. Avoidance of this wetland has been recommended by the Massachusetts Division of Fish and Wildlife (MADFW) (Copeland, 1989); however, we did not consider a reroute of this loop to be practical. We have recommended surveys for rare and state-listed plant species (section 5.1.5) and believe that the recommended wetland crossing procedures would minimize potential impact.

The Kampoosa Bog, a calcareous fen, is considered to have extraordinarily high value due to the rarity of this type of wetland within the state and the high concentration of rare species. The proposed route would not cross this wetland, but would cross the watershed that supports it. The MADFW recommends that no construction or expansion should take place within this wetland or its watershed and strongly recommends avoidance. However, since this wetland occurs on the southern edge of the existing right-of-way, the Massachusetts Office of Environmental Affairs recommends that the new pipeline be constructed on the north side of the existing right-of-way (Sorrie, 1989). We agree, and recommend that construction be limited to the north side of the existing right-of-way and the site-specific construction and mitigation plan be submitted to the Director of OPPR for review and approval prior to construction.

Lincoln Extension - The wetland located at the eastern end of the Lincoln Extension is forested and would require both clearing and filling of approximately 0.5 acres of this wetland for construction and operation of the Lincoln Meter Station. The location of an aboveground facility within a wetland area is completely unacceptable to FERC. Consequently, we recommend that Tennessee relocate this meter station to an upland area and submit the revised location, including a plot plan detailing the area required for construction and operation of this station, to the Director of OPPR for review and approval prior to construction.

5.1.8 Air Quality and Noise

5.1.8.1 Air Quality

5.1.8.1.1 General Construction and Operational Impact

Construction of the proposed pipeline would cause a temporary reduction in local ambient air quality as a result of fugitive dust and emissions generated by construction equipment. The extent of dust generation would depend on the level of construction activity and on soil composition and dryness. If proper dust suppression techniques were not employed, dry and windy weather would create a nuisance for nearby residents. The emissions from construction vehicles and equipment should have an insignificant impact on the air quality of the region. However, under certain meteorological conditions, high concentrations of pollutants might occur in the vicinity of the proposed construction.

During pipeline operation, the compressor stations would emit varying amounts of NO_x, CO, SO_2, and HC. Of these, the pollutant of concern would be NO_x. Emission of CO and HC would be below significant Federal impact levels established by the EPA. Emissions of SO_2 would be proportional to the amount of sulfur in the fuel; since the fuel would be natural gas containing very little sulfur, the amount of SO_2 would be low.

Regulatory Requirements

The Federal New Source Performance Standards (NSPS) (40 CFR Part 60, Subpart GG,(c)) limit NO_x emissions in the exhaust gases from stationary gas turbines with a heat input greater than 10 million Btu per hour (approximately 1,000 hp) to 150 parts per million by volume (ppmv) at 15 percent oxygen on a dry basis and at a turbine heat-rate of 14.4 kJ/W-hr. Proportional increases in the 150 ppmv are permitted with higher efficiencies.

The Federal PSD regulations (40 CFR 52.21) require that any proposed facility that would emit more than 250 tons per year of any pollutant be classified as a major stationary source and subject to PSD review. If an existing facility is already classified as a major stationary source, then an increase in emissions of more than 40 tons per year would cause it to be classified as a major modification and require PSD review. PSD regulations for major stationary sources and major modifications include a review of the existing air quality, the use of a modeling analysis to demonstrate compliance with NAAQS, an analysis of the incremental increase in air pollution levels, application of BACT, and an assessment of the impact of new emissions on the environment.

BACT requires the applicant to use a top-down approach to demonstrate the use of the best available technology in controlling emissions from major stationary sources and major modifications. This approach requires that the applicant first consider the most stringent controls available and either use this technology or demonstrate why it is not feasible to do so. The process is then repeated for the second most stringent controls, then the third, etc., until a feasible solution is reached. This process is required even though a less-stringent method of control may meet other air quality regulations.

Dispersion modeling analysis is required to demonstrate that the new emissions would not result in a significant incremental increase over existing ambient air quality and that the emissions comply with the NAAQS. Assessment of the impact of the new emissions is required to ensure the health and welfare of the general public.

Tennessee's Compressor Stations 245 and 254 would be required to comply with the air pollution control regulations of the State of New York. These regulations are similar to Federal regulations with the same limits for classification of major stationary sources.

Tennessee's Compressor Station 261 and the proposed Mendon Compressor Station would be required to comply with the Massachusetts Air Quality Control Regulations (310 CMR 7.00) and the Massachusetts Air Quality Control Act (301 CMR 11.00). The Massachusetts Air Quality Control Regulations are similar to the Federal NAAQS except that Massachusetts has a 1-hour ambient air quality NO_x limit of 320 $\mu g/m^3$. In addition, any stationary source with an energy input greater than 3 million Btu/hr would require application of BACT. The Massachusetts Environmental Policy Act (MEPA) Regulations are similar to the Federal PSD Regulations except that a major stationary source is one whose emission rate of NO_x is greater than 100 tons per year. A compressor station classified as a major emission source would be subject to MEPA review.

5.1.8.1.2 Site-Specific Impact

Compressor Station 245

Compressor Station 245 is located approximately 1-mile southeast of West Winfield, New York. The existing 11,316-hp compressor station currently emits 1,219 tons of NO_x per year and the site is considered a major stationary source of air pollutant. Tennessee proposes to install a Cooper-Bessemer Model GMVH-10C turbocharged reciprocating engine-driven compressor rated at 2,100 hp. The proposed compressor unit would have an emission rate of 13.9 pounds of NO_x per hour, which corresponds to an increase of 61 tons of NO_x per year for continuous operation. By exceeding an increase of 40 tons per year, the addition of the proposed unit would be considered a major modification and would be subject to PSD review.

Tennessee has not applied for a PSD or state permit to construct this station. They have, however, conducted a modeling analysis using Industrial Source Complex Long Term (ISCLT) to assess the impact of the NO_x emissions. The modeling analysis shows an estimated maximum incremental increase of 1.1 $\mu g/m^3$ to the annual average concentration in the vicinity of the station. This increment would increase the annual average ambient level of NO_x from 59.0 $\mu g/m^3$ to 60.1 $\mu g/m^3$. This estimated impact is within the limits of both the Federal NAAQS and PSD increment. Tennessee did not perform a modeling analysis for CO but estimated that CO levels would be low. The results of Tennessee's modeling analysis for NO_x are summarized in table 5.1.8-1.

TABLE 5.1.8-1

Estimated NO_x Air Quality Impact from Tennessee Gas Compressor Stations

Location	Existing NO_x Level ($\mu g/m^3$)	New Unit Only NO_x Impact ($\mu g/m^3$)	Total NO_x Level ($\mu g/m^3$)
Station 245	59.0	1.1	60.1
Station 254	75.5	4.7 *	80.2
Station 261	76.2	1.1 **	20.3
Mendon	20.0	3.6 **	23.6

* Value shown is scaled by an assumed emission rate for a gas turbine engine and the previously proposed reciprocating engine.
** Values shown are scaled to reflect an increase in hp from that modeled.

Compressor Station 254

Tennessee's Compressor Station 254 is located approximately 1-mile northeast of Malden Bridge, New York. The existing 9,216-hp compressor station currently emits 948 tons of NO_x per year and the site is considered a major stationary source of air pollutant. Tennessee proposes to install a gas-turbine compressor engine rated at 3,500-hp. A previously proposed 3,500-hp reciprocating engine had an emission rate of 15.4 pounds of NO_x per hour; however, a gas-turbine compressor engine with an emission factor of 2.9 lb NO_x/hr would have an emission rate of 10.2 lbs NO_x/hr, or 44.7 tons of NO_x per year for continuous operation. By exceeding an increase of 40 tons per year, the addition of the proposed unit would be considered a major modification and would be subject to PSD review. Tennessee has not applied for a PSD or state permit to construct this station. They have, however, conducted a modeling analysis using ISCLT to assess the impact of the NO_x emissions from the initially proposed reciprocating engine unit. The modeling analysis showed an estimated maximum incremental increase of 7.1 $\mu g/m^3$ to the annual average concentration in the vicinity of the station. When the modeling results are scaled by the emission rates of the reciprocating engine and the gas turbine, the maximum predicted incremental increase is 4.7 $\mu g/m^3$. Tennessee did not perform a modeling analysis for CO but estimates that CO levels would be low. The results of Tennessee's modeling analysis for NO_x are summarized in table 5.1.8-1.

Compressor Station 261

Tennessee's Compressor Station 261 is located approximately 2-miles south of West Springfield, Massachusetts. The 5,500-hp compressor station currently emits 470 tons of NO_x per year and the site is considered a major stationary source of air pollutant. Tennessee is proposing to retire three existing reciprocating engine units that emit 366 tons NO_x per year, and replace these units with one 3,500-hp turbine-driven compressor unit that would emit 65 tons NO_x per year based on an emission rate of 14.8 pounds of NO_x per hour, which would reduce the overall station NO_x emission rate from 470 to 169 tons per year.

Tennessee proposes to install a gas turbine rated at 3,500-hp at this station. As a result, the change would not be considered a major modification since the addition of this new unit would be combined with the retirement of three existing units and the net result would be a reduction in station NO_x emissions. The selected turbine package must be designed so that its NO_x emission rate is below 150 ppmv in order to comply with the NSPS. This limit would be the absolute minimum requirement for NO_x emission controls. In addition, since the engine fuel consumption would be greater than three million Btu per hour, the new unit would require BACT and a modeling analysis as specified in the Massachusetts Regulations.

Tennessee has not applied for a state permit to construct this station. They have, however, conducted a modeling analysis to assess the impact of the NO_x emissions with the slightly smaller 3,300-hp engine initially proposed. The modeling analysis shows an estimated maximum incremental increase of 1.1 $\mu g/m^3$ due to the addition of the new unit and a decrease of 57 $\mu g/m^3$ from the retirement of the three reciprocating units. The combined result is a decrease in the maximum annual average concentration of NO_x in the vicinity of the station from an existing level of 76.2 $\mu g/m^3$ to a new level of 20.3 $\mu g/m^3$. Tennessee did not perform a modeling analysis for CO but these emissions should also be lower because of the retirement of the three existing units. The results of Tennessee's modeling analysis for NO_x are summarized in table 5.1.8-1.

Mendon Compressor Station

Tennessee's proposed Mendon Compressor Station would be located approximately 3-miles southeast of Mendon, Massachusetts. Tennessee proposes to install a reciprocating engine-driven compressor rated at 1,200 hp. The proposed compressor unit would have an emission rate of 5.3 pounds of NO_x per hour, which corresponds to approximately 23 tons of NO_x per year. The compressor site would, therefore, not be considered a major stationary source of air pollution. Since the engine fuel consumption would be greater than three million Btu per hour, the station would require BACT and a modeling analysis as specified in the Massachusetts Regulations.

Tennessee has not applied for a state permit to construct this station. They have, however, conducted a modeling analysis to assess the impact of the NO_x emissions. The modeling analysis shows an estimated maximum incremental increase of 3.6 $\mu g/m^3$ to the annual average concentration in the vicinity of the station. This increment would increase the annual average ambient level of NO_x from an existing level of 20.0 $\mu g/m^3$ to a new level of 23.6 $\mu g/m^3$. This estimated impact is within the limits of the Federal NAAQS. Tennessee did not perform a modeling analysis for CO but estimates that CO levels would be low. The results of Tennessee's modeling analysis for NO_x are summarized in table 5.1.8-1.

5.1.8.2 Noise

5.1.8.2.1 General Construction and Operational Impact

Noise would affect the local environment during both construction and operation of the proposed facilities. Pipeline construction would proceed at rates ranging from several hundred feet to 0.5 mile per day. As construction activities progress along the right-of-way, the open-trench phase of construction in rural areas would last approximately 3 to 5 weeks. Construction equipment would be operated on an as-needed basis during this period. Although individuals in the immediate vicinity of the work could experience temporary annoyance, the impact on the environmental noise level at any specific location along the route would be short-term. Nighttime noise levels normally would be unaffected, since most construction would be limited to daylight hours.

During the operational phase of the project, the impact on the noise environment would be limited to the vicinity of the compressor stations. Principle noise sources at the compressor stations would include the air inlet, exhaust, and casing of the engine or turbine. Secondary noise sources would include the compressor casing, cooling fans, and yard piping valves. Noise from the gas piping vent stacks and emergency electrical generation equipment would be infrequent. The amount of silencing required for the equipment and piping would depend on the station location and size and its proximity to noise-sensitive receptors.

The basis for evaluating the operational impact of compressor station noise is an Ldn of 55 dBA, the sound level which protects the public from activity interference and annoyance in residential areas. Although no state or local noise regulations would affect the proposed compressor stations, the NYPSC has issued a proposed guideline policy (October

28, 1986) that gas compressors be designed to an Leq 40 dBA at the nearest residences in areas where the existing L90 levels in rural areas are 35 dBA or less. If the existing L90 has been permanently elevated, the compressors should be designed to increase the L90 at the nearest residence by no more that 10 dBA. The MADEP has noise guidelines, which restrict a noise increase from a new facility to no more than 10 dBA over the existing L90 at the nearest residence.

5.1.8.2.2 Site-Specific Impact

Compressor Station 245

The existing facilities at Compressor Station 245, the proposed new compressor, and locations of the nearest homes are shown in figure 4.1.8-1. Tennessee proposes to install a Cooper-Bessemer Model GMVH-10C turbocharged reciprocating engine-driven compressor rated at 2,100 hp. The addition of this unit would require the additional cooling capacity of four new fans. The engine air intake would be equipped with a Vanec Model 316-18 inlet silencer and a Vanec Model 267-22 filter/silencer. The engine exhaust would be equipped with a Vanec Special Model 141-28 silencer. The engine-compressor unit would be installed inside a new extension to the existing building that would attenuate some of the engine block noise. Cooling fan noise would be controlled by installing a quiet fan or by locating coolers in a location suitable for lessening the impact.

The nearest home to the proposed new compressor building is located 1,200-feet southeast, as listed in table 5.1.8-2. Projected compressor noise levels at each of the nearest residences are listed in table 5.1.8-2 along with the existing ambient noise levels and the estimated increase. These estimates are based on equations relating engine horsepower to sound power levels for the air intake, exhaust, and casing instead of far-field sound-level data for the actual unit. Building and silencing insertion losses were obtained from Tennessee's application and related documents. Since Tennessee has not yet selected a specific fan design, a nominal 3 dBA was added to the noise estimates to account for the potential increase in noise from the fans.

At the nearest residence, located 1,200-feet southeast of the proposed compressor building, a 10-decibel terrain reduction was included because of a hill located between the noise source and the receptor. Tennessee's noise model predicted an Ldn of 51 dBA at the residence located 1,300-feet west due to operation of the additional compressor unit. The estimated total Ldn of the existing and proposed units would be approximately 54 dBA and remain below an Ldn of 55 dBA. However, this analysis is based on a theoretical horsepower/sound-level relationship rather than actual noise data for the proposed engine. Therefore, we recommend that Tennessee provide a noise analysis based on far-field sound-level data (from either the manufacturer or a similar unit in place elsewhere) to the Director of OPPR for the actual engine/compressor unit for review and approval prior to construction.

Compressor Station 254

The existing facilities at Compressor Station 254, the proposed new compressor, and locations of the nearest homes are shown in figure 4.1.8-2. Tennessee originally proposed to install a gas-turbine Cooper-Bessemer Model 10V-275 turbocharged reciprocating engine-driven compressor rated at 3,500 hp.

TABLE 5.1.8-2

Noise Impact At Noise-Sensitive Receptors from Tennessee Gas Compressor Station

Receptor	Dist from Proposed Compr. Bldg (feet)	Existing Ldn Levels (dBA)	Add'l Ldn Levels (dBA)	Total Ldn Levels (dBA)	Noise Increase (dBA)
TENNESSEE					
Station 245					
Residence (SE)	1,200	37	42	43.2	6.2
Residence (W)	1,300	51	51	54.0	3.0
Station 254					
Residence (SW)	800	60	50	60.3	0.3
Subdivision (S)	1,100	52	48	53.5	1.5
Station 261					
Condominiums (N)	800	65	52	65.2	0.2
Residence (W)	900	64	48	64.1	0.1
Mendon					
Residence (NW)	1,500	46	42	44.5	3.5
Residence (NE)	1,800	46	40	43.5	2.5

The nearest home to the proposed new compressor building is located 800-feet southwest, as listed in table 5.1.8-2. Projected compressor noise levels at each of the nearest residences are listed in table 5.1.8-2, along with the existing ambient noise levels and the estimated increase. These estimates are based on the same equations relating engine horsepower to sound-power levels for the air intake, exhaust, and casing that were applied at Compressor Station 245. We, therefore, recommend that Tennessee provide actual far field data for this unit. Building and silencing insertion losses were obtained from Tennessee's application and related documents. Since Tennessee has not yet selected a specific fan design, a nominal 3 dBA was added to the noise estimates to account for the potential increase in noise from the fan.

Tennessee's noise model predicted that the noise from the proposed compressor alone would be an Ldn of 50 dBA at the residence located 800-feet southwest. Although the new unit would not exceed an Ldn of 55 dBA, the estimated total Ldn of the existing and proposed units exceeds 60 dBA which is greater than the EPA guideline.

Tennessee recently amended its application to substitute a 3,500-hp turbine engine-driven compressor for the above-described reciprocating unit. Acoustic information for the turbine installation has not been received. We recommend that Tennessee file the acoustic design and analysis for the newly proposed unit at Station 254 with the Director of OPPR for review and approval prior to construction.

The existing noise levels from Station 254 have aroused considerable protests and complaints from neighboring residents. They have requested that Tennessee be required to first reduce the noise produced by the existing station to levels that are compatible with the residential neighborhood. These residents have recommended that the new compressor unit be installed 1,000-feet northeast of the present compressor building. The neighboring residents believe that new additions should not be allowed to contribute further to the already noisy environment.

Although the existing station was installed over 40 years ago, before FERC environmental reviews were instituted and before the existing zoning laws were passed, Tennessee has voluntarily undertaken measures to reduce the noise emanating from this station. As discussed in section 4.1.8.2, Tennessee has installed new mufflers on the air intake and exhaust of the existing compressor units and has planted a large number of pine trees along the east side of the station. Tennessee also plans to replace the fan blades on the gas coolers with blades that would be quieter, to evaluate noise from the compressor building, and to plant more trees on the south side of the station. It was understood that Tennessee was preparing a report documenting the results of its investigations, and its current plans and schedules for further reduction of the noise from the existing-station cooler fans and compressor building, and that the report was to have been available during the summer of 1989. We recommend that Tennessee file the report with the Director of OPPR prior to the initiation of construction.

We understand the concerns of the nearby residents and their request to have the new compressor located 1,000-feet further towards the northeast in order to lessen impact on their residences. Since noise radiated through the existing compressor building is the major source of existing compressor noise, we recommend that Tennessee locate the proposed compressor in a separate acoustically treated building, rather than an extension of the existing building. Further, we recommend that Tennessee prepare an analysis of compressor building locations including those locations identified in figure 5.1.8-1. The analysis shall also examine the feasibility of excavating the hillside at alternative site B to form a berm that blocks the line of site to nearby residences and file the analyses with the Secretary of the Commission for review and approval by the Director of OPPR prior to construction.

Compressor Station 261

The existing facilities at Compressor Station 261, the proposed new compressor, and locations of the nearest homes are shown in figure 4.1.8-3. Tennessee proposes to install a Solar Centaur T-4500/80 turbine rated at 3,300 hp. The turbine air intake would be equipped with a Model AX-3263 intake silencer and a Model AX-4005 filter/silencer, and the turbine exhaust would be equipped with a Model AX-3526 exhaust silencer. The turbine compressor unit would be installed inside a new, separate building that would attenuate some of the turbine-casing noise.

The nearest homes to the proposed new compressor building are located 800 feet to the north, as listed in table 5.1.8-2. Projected compressor noise levels at each of the closest residences are listed in table 5.1.8-2, along with the existing ambient noise levels and the estimated increase. These estimates are based on equations relating turbine horsepower to sound-power levels for the turbine air intake, exhaust, oil cooler and casing. Again, we recommend that Tennessee provide an analysis based on far-field sound-level data for the actual turbine. Building and silencing insertion losses were obtained from Tennessee's application and related documents.

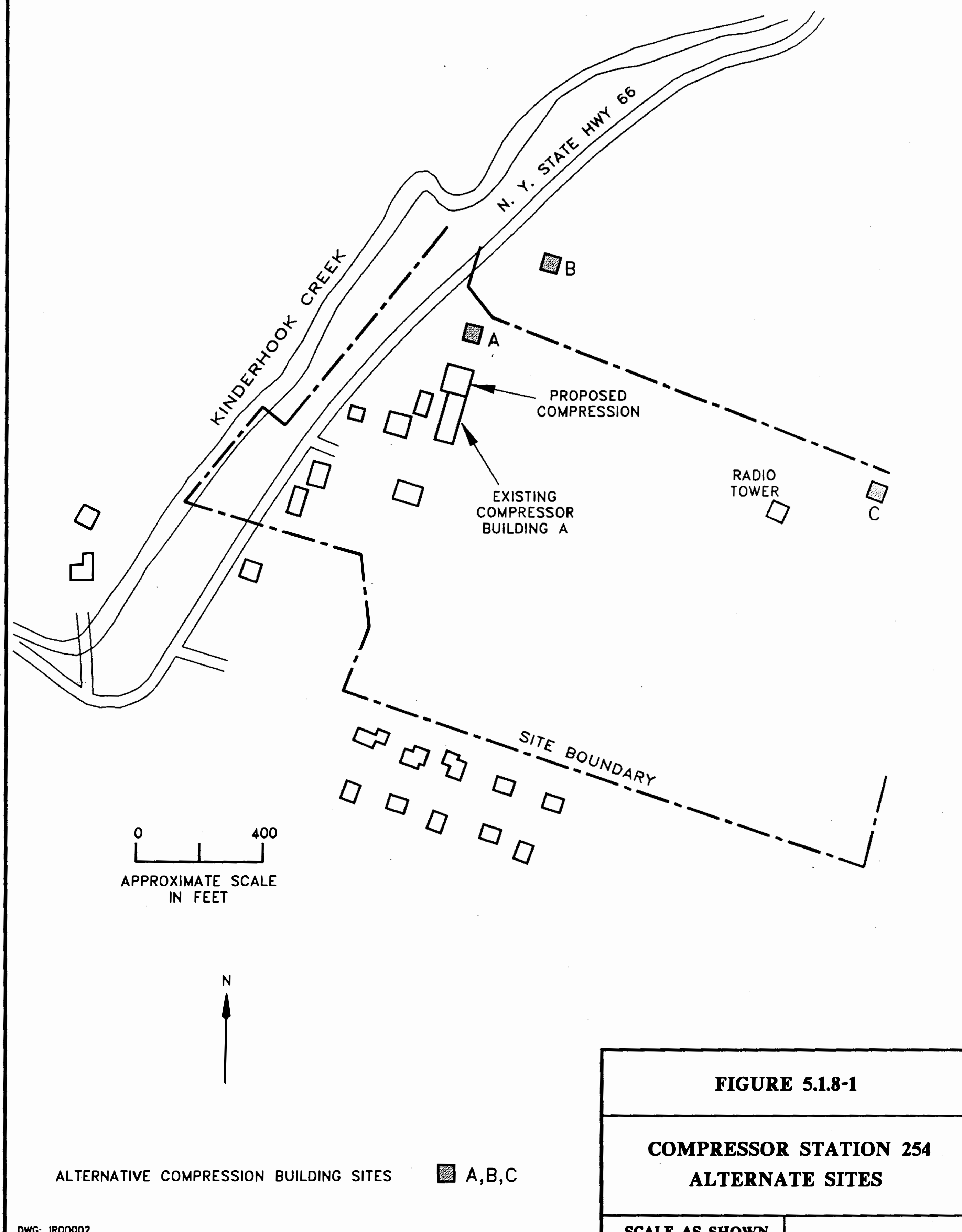


FIGURE 5.1.8-1

COMPRESSOR STATION 254 ALTERNATE SITES

SCALE AS SHOWN

Tennessee's noise model predicted an Ldn of 52 dBA at the closest residence due to the additional compressor unit. This is less than the EPA guideline value of 55 dBA. The estimated total Ldn of the existing and proposed units is 65.2 dBA, which exceeds an Ldn of 55 dBA by 10 dBA. However, actual total station noise should be less, due to the retirement of three 550-hp reciprocating compressors and the upgrading of the existing turbine exhaust silencer. The MADEP noise guidelines (DDS-8) require that the station noise should not exceed the residual L90 background sound by more than 10 dBA, and that the station should not produce a puretone condition.

Tennessee recently amended its application to change the previously proposed horsepower rating from 3,300 hp to 3,500 (1,850-hp additional and 1,650-hp replacement). Acoustic information for the newly proposed installation has not been received. We recommend that Tennessee file the acoustic design and analysis for the newly proposed unit at Station 261 with the Director of OPPR for review and approval prior to construction.

Mendon Compressor Station

The proposed new compression facilities and locations of the nearest homes are shown in figure 4.1.8-4. Tennessee proposes to install a Caterpillar Model 399TAA/LE naturally aspirated reciprocating engine-driven compressor rated at 1,000 hp. The engine air intake would be equipped with a Vanec Model 311-8 inlet silencer and a Vanec Model 267-8B12 filter/silencer. The engine exhaust would be equipped with a Vanec Special Model 144-8A exhaust silencer. The engine-compressor unit would be installed inside a new building that would attenuate some of the engine block noise.

The nearest home to the proposed new compressor building is located 1,500-feet northwest, as listed in table 5.1.8-2. Projected compressor noise levels at each of the nearest residences are listed in table 5.1.8-2, along with the existing ambient noise levels and the estimated increases. These estimates are based on the same equations relating engine horsepower to sound-power levels for the air intake, exhaust, and casing that were used at Compressor Station 254. We, therefore, recommend that Tennessee provide actual far-field sound-level data for this unit. Building and silencing insertion losses were obtained from Tennessee's application and related documents. Since Tennessee has not yet selected a specific fan design, a nominal 3 dBA was added to the noise estimates to allow for the potential increase in noise from the fans.

An Ldn of 42 dBA is predicted for the residences located 1,500 feet to the north, due to the proposed compressor unit. The estimated Ldn of the ambient noise and compressor noise is 44.5 dBA. These noise levels are well below an Ldn of 55 dBA.

The MADEP noise guidelines (DDS-8) require that the station noise should not exceed the residual L90 background sound by more than 10 dBA and that the station should not produce a puretone condition.

Tennessee has recently amended its applications to change the previously proposed horsepower rating from 1,000 hp to 1,200 hp. Acoustic information for the newly proposed installation has not been received. We recommend that Tennessee file the acoustic design and analysis for the newly proposed unit at the Mendon Station Site 266A with the Director of OPPR for review and approval prior to construction.

5.1.9 Land Use, Recreation, and Visual Resources

5.1.9.1 Land Use

5.1.9.1.1 General Construction and Operational Impact

A general discussion of impact anticipated as a result of construction of the pipeline and related facilities is presented below. Specific recommendations for mitigation are presented in section 5.1.9.1.2 for the Iroquois and Tennessee portions of the Iroquois/Tennessee Project.

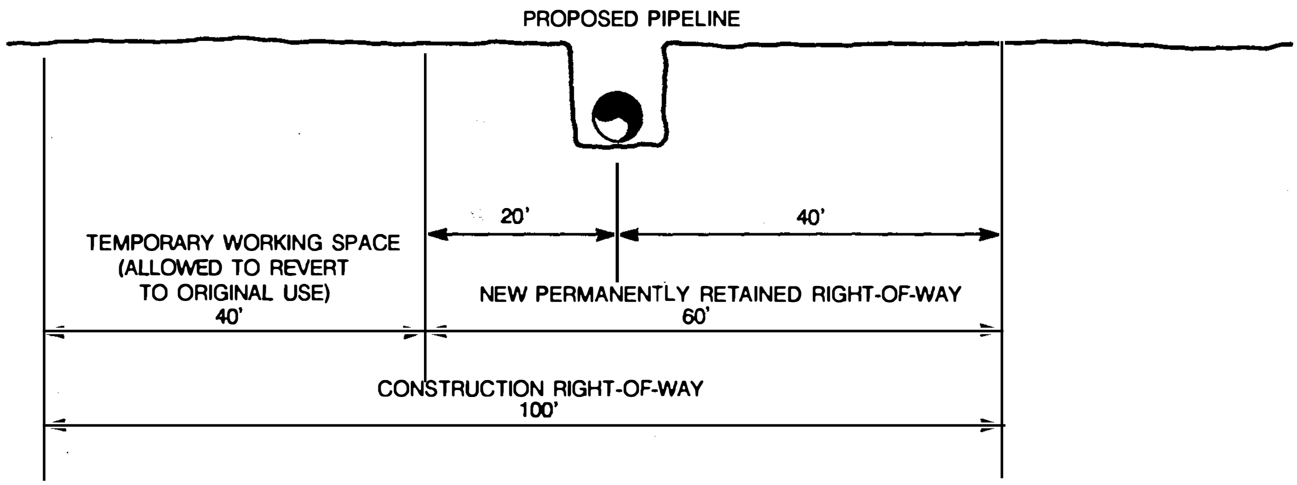
Pipeline

Impact on land use along the proposed pipeline would result from the clearing of a construction right-of-way for the installation of the new pipeline and from the maintenance of a permanent cleared right-of-way. In addition, temporary staging areas would be required for pipeline construction work space in areas of steep side hills, and crossings of rivers, streams, railroads, and roads. Laydown areas for the storage of centralized equipment and materials would be located near existing rail and highway transportation hubs, convenient to the pipeline route. Access to the pipeline during construction would be via existing roads and the pipeline right-of-way. In remote areas, new off-right-of-way construction access roads would sometimes be required.

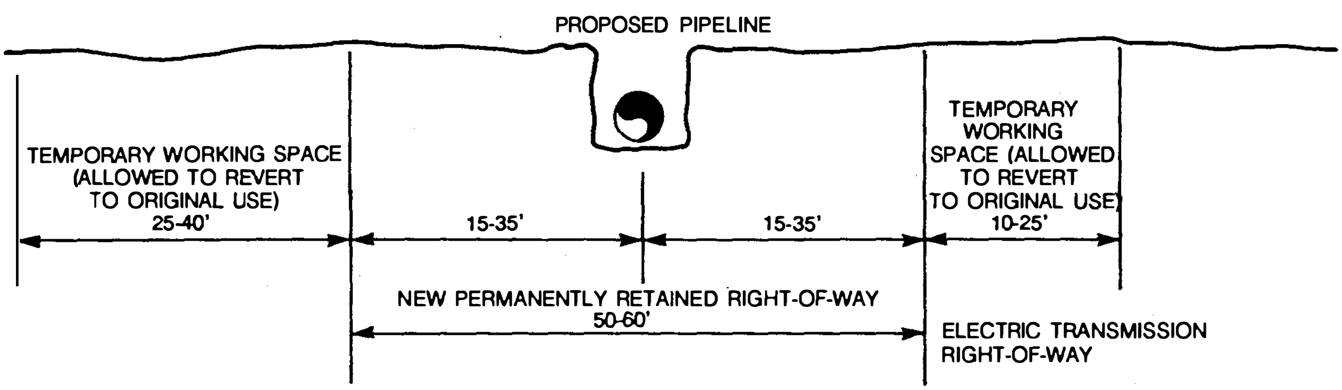
Figures 5.1.9-1, 5.1.9-2, and 5.1.9-3 show typical right-of-way cross-sections for construction of pipeline on new right-of-way and for construction of pipeline adjacent to existing right-of-way for the proposed Iroquois/Tennessee Project. Iroquois is proposing a 100-foot-wide construction right-of-way of which 60 feet would be maintained as permanent right-of-way. Tennessee's mainline loops would require a 75-foot-wide construction right-of-way, of which 25 feet would be maintained as new permanent right-of-way along the segments located in New York, and 35 feet would be maintained for new permanent right-of-way in Massachusetts. The Wallingford Lateral, a replacement line, would also require a 75-foot-wide construction right-of-way but would not require any additional permanent right-of-way. The proposed lateral loops (the Concord, Haverhill, and Springfield Laterals) would require a 40-foot-wide construction area, of which 25 feet would be retained for new permanent right-of-way. The new Lincoln Extension would require a 55-foot-wide construction right-of-way, of which 30 feet would be retained for permanent right-of-way. In most locations, a portion of the existing maintained right-of-way would be used for the construction right-of-way.

The construction right-of-way is temporary work space that would be returned to the landowner following construction and allowed to return to its previous use and condition. All rights and interests to the permanent right-of-way would be retained by the applicants. This area would be kept cleared in a generally grassy condition (although most agricultural practices would be permitted) and no trees, large shrubs, or other nonrelated pipeline structures except roads would be permitted.

The actual space required for temporary staging areas at river, stream, railroad, and street crossings or areas requiring construction on steep slopes or side slopes would be determined during detailed design based on site-specific conditions. Generally, these areas are not expected to exceed the construction right-of-way by large margins. The exception



TYPICAL RIGHT-OF-WAY CROSS-SECTION FOR NEW PIPELINE

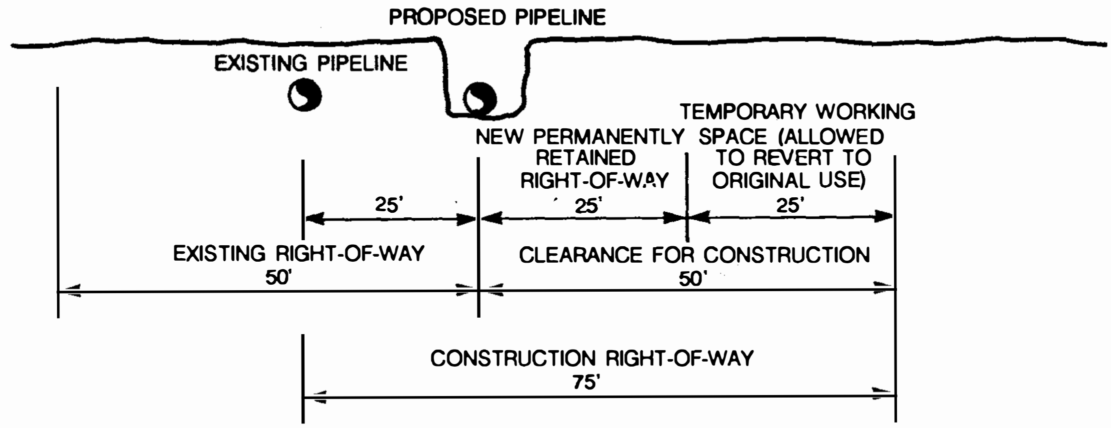


TYPICAL RIGHT-OF-WAY CROSS-SECTION FOR PIPELINE PARALLEL TO EXISTING ELECTRIC TRANSMISSION LINE

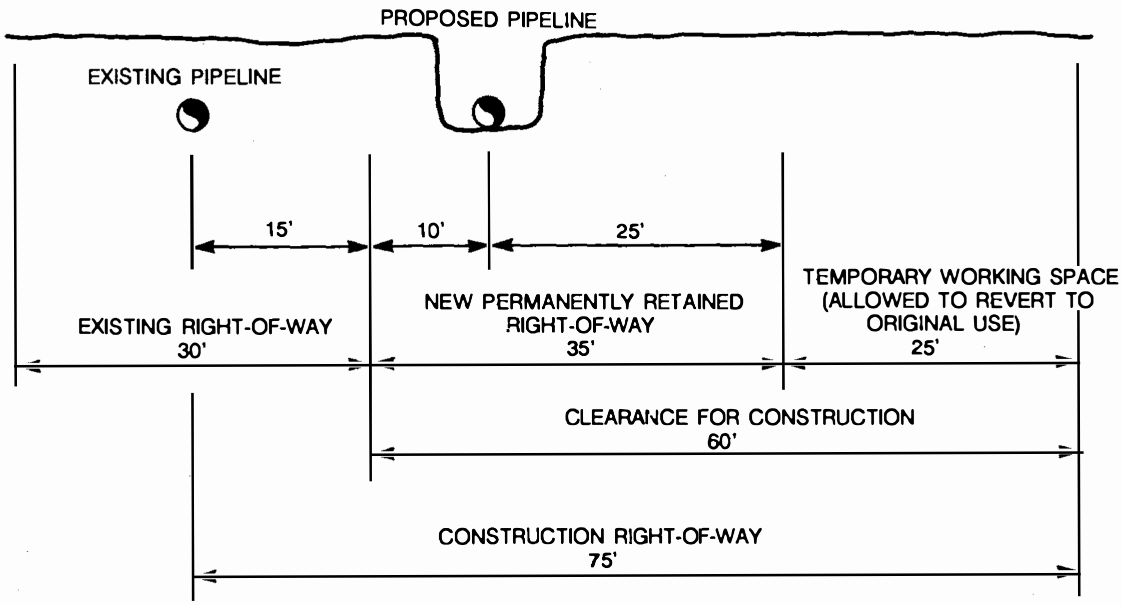
FIGURE 5.1.9-1

IROQUOIS PIPELINE
TYPICAL
RIGHT-OF-WAY SECTIONS

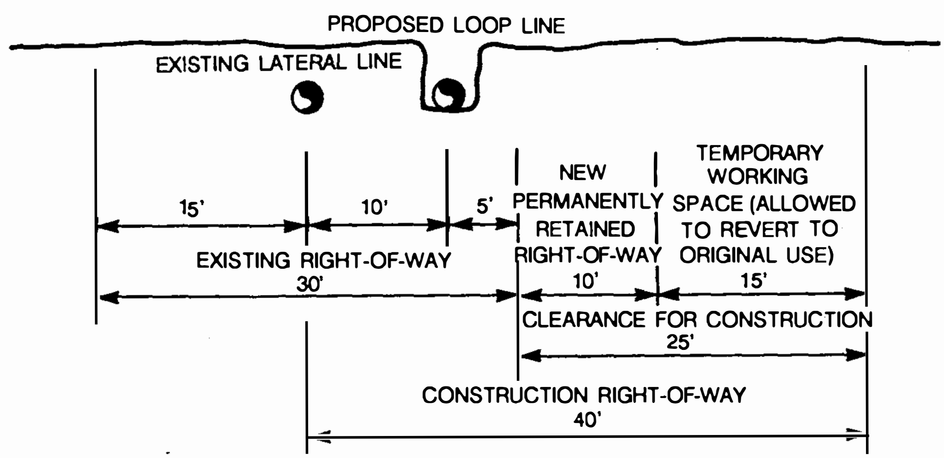
AS SHOWN



TYPICAL RIGHT-OF-WAY CROSS-SECTION FOR MAINLINE LOOPING WITH 50' EXISTING EASEMENT



TYPICAL RIGHT-OF-WAY CROSS-SECTION FOR MAINLINE LOOPING WITH 30' EXISTING EASEMENT



TYPICAL RIGHT-OF-WAY CROSS-SECTION FOR LATERAL LOOPING WITH 30' EXISTING EASEMENT

FIGURE 5.1.9-2

TENNESSEE PIPELINE
TYPICAL
RIGHT-OF-WAY SECTIONS

As Shown

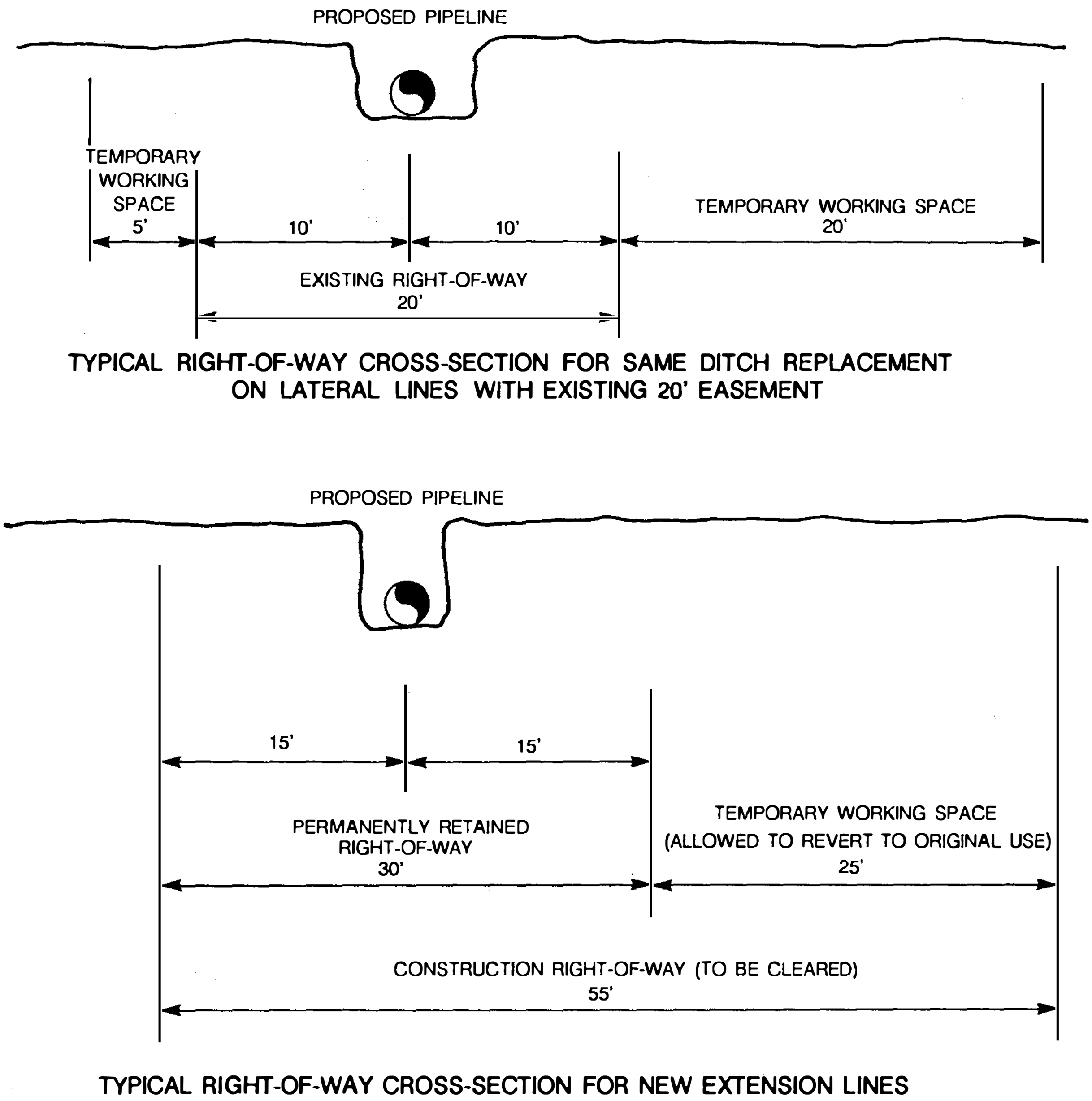


FIGURE 5.1.9-3

TENNESSEE PIPELINE
TYPICAL
RIGHT-OF-WAY SECTIONS

As Shown

would be at wide river crossings, steep slopes and side slopes. Wide river crossings could require areas as large as 16.5 acres, and side slopes, from our experience, could require an additional 50-feet of construction right-of-way over normal construction requirements.

The pipe and material storage laydown yards for Iroquois and Tennessee would generally be leased in commercially available open storage areas or in suitable zoned commercial/industrial sites. These laydown yards would also serve as parking areas for nonresident workers who would be bused daily to the work site. Contractors may also require additional shop or equipment storage locations. These facilities would be leased where possible or temporary buildings would be erected on leased land.

Woodlands cleared during construction of the pipeline represent long-term impact of the project. Although woodlands within the temporary work space would be allowed to proceed through succession to their former vegetated state, they would be considered lost for approximately 20 years or more.

Depending on the types and locations of the woodlands, right-of-way clearing may result in the loss of marketable timber for firewood and lumber or sugar maples that provide sap for maple sugar products (sugarbush). Landowners would be compensated for the loss of marketable timber or sugarbush. Merchantable timber often becomes the property of the landowner and, if the landowner requests, may be piled along the right-of-way. Since wild cherry trees are toxic to livestock, they would be stockpiled in areas that are inaccessible to livestock. Methods for mitigating impact on sugarbush include avoidance through route variations and reducing the width of the construction right-of-way.

Agricultural lands affected by the project include cropland, pasture, dairyland, nurseries, and orchards. Impact on agriculture areas during construction would include the loss of standing crops, loss of crop productivity, loss of topsoil, soil compaction, and damage to tile fields. To minimize impact, topsoil would be removed and segregated away from the areas to be excavated or used for the storage of subsurface soils. Following construction, the topsoil would be returned to its original position and the site restored as much as possible to its original contour. Construction activities should also be limited to periods when the soils are dry. To prevent damage to drainage tiles, their locations should be flagged prior to construction, even in areas not directly on the right-of-way, since heavy construction equipment can crush the clay or plastic pipes. Drainage tiles that are cut, collapsed, or displaced during construction must be replaced. The exact method of repair should be determined in consultation with the landowner. The pipeline must be installed at an appropriate depth to permit space for new tile drains where these locations are known (see section 5.1.2.1.1 for a more complete discussion).

During operation of the pipeline, cropland and pastures would be allowed to revert to their previous use. Land used for pipeline construction would take row crops out of production for up to one growing season; hay fields and pastures would take approximately 2 years to return to previous production levels. The applicants would compensate the owner for any crop damage caused during routine pipeline maintenance.

Orchards would be permanently affected since trees would not be permitted on the permanent right-of-way. To minimize the loss of individual trees, the width of the temporary right-of-way can be reduced and the permanent right-of-way can be placed closer to existing pipelines. Compensation to the landowner would be determined after restoration is completed and the extent of crop-yield reductions can be adequately assessed. Where possible, orchards must be avoided. Where unavoidable, construction right-of-way should be reduced to the maximum width of the extent possible.

Some commercial/industrial land would be affected by construction of the pipeline. Impact on these areas would generally be limited to the construction period when construction activities may cause disruption, inconvenience, and loss of potential business revenue. This impact could be minimized either by providing access to business during construction or by timing construction activities to avoid peak business periods.

Pipeline construction in residential areas would result in temporary construction impact which could include:

- inconvenience from noise and dust generated by construction equipment and personnel, and from trenching of roads or driveways;
- ground disturbance and the removal of trees, landscaping, and other plantings;
- potential damage to existing septic systems or wells; and
- the removal of any aboveground enclosed structures, such as sheds, from within the construction right-of-way.

Long-term impact associated with pipeline operation includes the land easement encumbrance for the permanent right-of-way and its restrictions. The easement encumbrance would prohibit certain types of continued residential use such as the construction of any aboveground structures (e.g., house additions, garages, patios, pools). Additionally, the necessary inspection and maintenance activities are often considered a minor nuisance. The construction and operation of the pipeline would not require the removal of any homes.

Generally, pipeline right-of-ways should avoid residential areas. Where this is not possible, the amount of residential land required for new pipeline right-of-way should be minimized through route variations or centerline adjustments. Construction practices through residential areas should minimize disruption by such methods as limiting work space requirements, reducing the size of work crews, increasing the use of fencing, and backfilling the trench as rapidly as possible. Residential construction techniques include sewer line/stove pipe construction and dragline construction. For sewer line/stove pipe construction, the trench is dug, a section of pipe is laid and welded into place, and the trench is backfilled immediately. For dragline construction, a separate work space is required for assembly of several sections of pipe. Once the trench has been dug, the sections are laid in the trench, welded into place and the trench is backfilled immediately. Either technique would limit the amount of time the trench is left open.

Residential developments have been proposed along the length of the Iroquois/Tennessee Project. Some are in the planning phase, some have been permitted, and others are under construction. Constraints associated with the location of pipeline right-of-way through proposed residential developments are often identified up to the time of construction. As they are identified, specific requirements or restrictions would be incorporated in the final pipeline design. This would require close coordination with the developer to ensure consistency with site plans.

The instrument that is used to convey right-of-way to the utility is the easement that is usually negotiated with the landowner. The easement gives the utility the right to operate and maintain the pipeline and the permanent pipeline right-of-way, and in return compensates the landowner for the use of the land. If an easement cannot be negotiated with the landowner and the project has been authorized by the Commission, the pipeline company may use the right of eminent domain granted to them under Section 7(h) of the Natural Gas Act (NGA) and the Rules of Civil Procedure to obtain a right-of-way. An applicant would still be required to compensate the landowner for the right-of-way, as well as for any damages incurred during construction. However, the level of compensation would be determined by the court. The easement negotiations between the applicant company and the landowner would cover the subjects of compensation for loss of use during construction, loss of nonrenewable or other resources, and the restoration of, or unavoidable damage to property during construction. State laws also set out procedures for the use of eminent domain once a FERC certificate is issued. In Massachusetts, the company would file a petition with Massachusetts Department of Public Utilities for the right to take by eminent domain under Chapters 79 and 164 of the General Laws. In New York, after making a final offer of compensation, the company would file an acquisition map with the County Clerk pursuant to an Order of Condemnation. In New Hampshire, pursuant to Revised Statute, Annotated, 371:15, Tennessee would file a petition and a site plan with the Clerk of the Superior Court in the county where the property is located, and then the court would appoint a commission to determine the amount of the compensations. In a Rhode Island state proceeding, a landowner may request a trial by jury on the issue of damages in the Superior Court for the county in which the property is located. In a Connecticut state proceeding, damages are awarded by the Superior Court for the judicial district in which the property is located, based on the recommendation of a committee of three disinterested citizens appointed by the court. The level of compensation determined as a result of condemnation proceedings could be the same, more, or less than the amount of money offered during earlier negotiations with the company.

Aboveground Facilities

The construction and operation of the aboveground compressor stations, metering stations, and pig launcher/receiver facilities would permanently remove the continuance of existing land use within the developed area. Unlike the pipeline right-of-way, aboveground facilities in agricultural areas would preempt crop production and use of pasture. Residences in the area of these facilities could be affected by noise and dust disturbances during construction and noise and visual intrusion during operation. Compressor station noise impact is discussed in section 5.1.8.2; visual impact is discussed in section 5.1.9.3.

5.1.9.1.2 Site-Specific Impact

Site-specific impact of the proposed Iroquois/Tennessee Project was determined from review of aerial photographs (1"=500' scale); air and ground reconnaissance; and review of comments received from Federal and state regulatory agencies, local interest groups, and private citizens. Table 5.1.9-1 shows the type and acreage of land that would be affected during construction and operation of the proposed pipeline. The acreage shown reflects the worst case impact of construction and operation (i.e., no allowances have been made for joint or partial use of existing rights-of-way). Our recommendations for specific mitigation procedures to address the issues raised during this review period or to mitigate site-specific concerns are presented in the following sections.

Iroquois

Pipeline

Construction of the proposed Iroquois pipeline would affect 4,154 acres of land, of which 2,492 acres (60 percent) would be retained by Iroquois for a 60-foot-wide permanent right-of-way. Of the typical 100-foot-wide construction right-of-way, 40 feet would be temporary and would be allowed to revert to preconstruction conditions.

Approximately 1,665 acres of woodland would be removed for construction, of which 988.5 acres would be retained for the permanent right-of-way. Since Iroquois is requiring that only 50 feet of the permanent right-of-way remain permanently cleared in forested areas, the actual area of woodland that would be maintained as low-growth vegetation would be 833 acres. Specific concerns have been raised about the effects of removal of maple sugarbushes in St. Lawrence, Lewis, and Oneida Counties, New York. Pipeline construction would remove individual trees from production and secondary effects of the cleared right-of-way may reduce sap production of some of the remaining trees. The Lewis County Planning Department has identified and mapped sugarbush locations at MP 57.7, MP 73.9, MP 74.8, MP 75.4, MP 75.9, MP 77.6, MP 78.7, MP 79.3, MP 79.6, MP 80, MP 81.6 and MP 107.2. Construction would remove approximately 100 acres from these identified stands (9 miles of sugarbush). Additional operations would be likely to occur along the rest of the pipeline route in St. Lawrence and Oneida Counties and possibly in other counties further to the south. For those sugarbush locations presently identified, Iroquois proposed route variations that we have evaluated and recommended (see section 3.6.10). Following completion of Iroquois' survey of the proposed pipeline route, additional route variations to avoid known maple sugarbushes should be submitted for our review and approval. Where avoidance would not be feasible, Iroquois should hire a consultant experienced in the identification of mature sugarbush to determine their economic value and the level of compensation for tree removal and lost production. In the New York Article VII proceeding, the Administrative Law Judge(s) (ALJ) have recommended an extra wide corridor within which Iroquois must identify and avoid sugarbush (NYSPSC, 1989).

A scoping comment raised the concern of clearing Fisher Forest Tax properties. The landowner would be required to notify the county and town tax assessors of the intention to cut for a right-of-way and pay a 6 percent tax on the stumpage value of any timber harvested. The payment of this stumpage tax would be negotiated between Iroquois and the landowner. The landowner would not be subject to any other penalty since the corridor would be cleared to establish a right-of-way for the pipeline (NYDEC, 199 Taxation of Forest Land, 199.11(a)(2)).

Approximately 2,128 acres of agricultural land would be disturbed during construction of the pipeline. Iroquois agreed to bury the pipeline 4 feet in agricultural areas. At this depth, the pipeline would not be affected by plowing or other typical farming operations. Following construction, these agricultural lands, with the exception of orchards and nurseries, would be entirely returned to their former use. Our recommendations for mitigation measures for soil and damage to drainage tile systems are addressed in section 5.1.2. Orchards and nurseries that would be affected by construction occur in New York at MP

TABLE 5.1.9-1

Land Uses Disturbed During Construction and Operation of Pipeline (Acres)

	LAND USES AFFECTED									
	Woodland		Ag. & Open		Residential		Other		Total	Total
	Const.	Perm. a/	Const.	Perm.	Const.	Perm.	Const.	Perm.	Const. b/	Perm. b/
IROQUOIS										
New York										
St. Lawrence County	281.2	168.7	346.6	208.0	3.6	2.9	8.5	5.1	640.0	384.0
Lewis County	340.6	204.3	310.3	186.1	6.0	3.6	3.6	2.2	660.6	396.4
Oneida County	80.0	48.0	136.9	82.1	3.6	2.9	1.2	.7	221.8	133.1
Herkimer County	82.4	49.4	315.1	189.0	6.0	3.6	7.3	4.4	410.9	246.5
Montgomery County	65.4	39.2	197.5	118.5	25.4	15.3	1.2	.7	289.7	173.8
Schoharie County	31.5	18.9	100.6	60.3	8.4	5.1	1.2	.7	141.8	85.1
Schenectady County	2.4	1.4	19.4	11.6	1.2	.7	1.2	.7	24.2	14.5
Albany County	48.4	29.0	167.3	100.3	12.1	7.3	0	0	227.9	136.7
Greene County	96.9	58.1	63.0	37.8	24.2	14.5	13.3	8.0	197.6	118.5
Columbia County	52.1	31.2	122.4	73.4	6.0	3.6	7.3	4.4	187.9	112.7
Dutchess County	220.6	132.3	185.4	111.2	49.6	29.8	15.8	9.5	471.5	282.9
Suffolk County	12.1	7.2	32.7	19.6	48.4	29.1	13.3	8.0	106.7	64.0
Connecticut										
Litchfield County	73.9	44.3	42.4	25.4	12.1	7.3	3.6	2.2	132.1	79.3
Fairfield County	264.2	158.5	75.1	45.0	64.2	38.5	2.4	1.5	406.1	243.6
New Haven County	13.3	8.0	13.3	8.0	3.6	2.2	3.6	2.2	35.2	21.1
Long Island Sound c/	0	0	0	0	0	0	0.	0	0	0
TOTAL	1,665.0	998.5	2128	1276.3	274.4	166.4	83.5	50.3	4,154.0	2,492.2
TENNESSEE										
Schoharie/Albany Loop	40.9	13.6	94.5	31.5	2.7	0.9	0	0	138.1	46.0
Columbia/Berkshire Loop	135.5	45.2	42.7	14.2	16.4	5.5	1.8	.6	196.4	65.5
Worcester Loop	63.6	29.7	18.2	8.5	8.2	3.8	1.8	.8	91.8	42.8
Concord Lateral	9.2	5.8	6.8	4.2	4.4	2.7	1.5	.9	21.8	13.6
Haverhill Lateral	16.9	10.6	4.8	3.0	4.8	3.0	2.9	1.8	29.6	18.5
Wallingford Lateral	11.8	0	3.6	0	13.6	0	0	0	29.1	0
Lincoln Extension	10.7	5.8	4.7	2.5	0	0	0	0	15.3	8.4
Springfield Lateral	0	0	.1	.1	.4	.2	0	0	.5	.3
TOTAL	288.6	110.7	175.4	64.0	50.5	16.1	8.0	4.1	522.6	194.8

a/ Permanent right-of-way included forested and scrub-shrub wetlands although Iroquois has agreed to let wetlands revegetate.
b/ The rights-of-way may be increased or decreased to avoid obstacles or to accommodate special construction techniques.
c/ Details on Long Island Sound crossing described in section 5.1.3.

53.6, MP 109.8, MP 234.7, MP 239, MP 245.2, MP 283.5, and MP 364.5. Approximately 3 miles are crossed. Of a potential 36.4 acres of trees removed at these locations, all would be replanted with immature trees that would be allowed to mature and produce fruit. To preserve as many mature trees as possible, we recommend Iroquois use areas outside and away from these orchards and nurseries for their construction and permanent right-of-way. Where construction would occur in orchards and nurseries, we recommend Iroquois and the landowner determine compensation for lost trees and lost production and the right-of-way be restricted to the minimum width necessary to install the pipeline across the orchard.

Since Iroquois is proposing a new pipeline right-of-way, our analysis of impact on residential lands sought to minimize the encumbrance of residential property with permanent right-of-way and to minimize construction disturbance. This is achieved by avoiding established residential properties and, where avoidance is not possible, by maximizing use of existing utility rights-of-way or by utilizing special construction mitigative techniques. The Iroquois route parallels existing electric utility rights-of-way for about 40.8 miles. In response to our March 16, 1989, data request, Iroquois indicated that it would typically use between 10 and 25 feet of existing electric utility right-of-way for temporary construction requirements. An additional 50 feet of land located adjacent to these rights-of-way would be used for permanent right-of-way (this differs from their typical 60-foot-wide permanent right-of-way). As discussed in section 3.5.1 we believe it would be feasible to make greater use of existing utility rights-of-way if certain safety precautions are taken during design and construction.

We do not feel Iroquois' typical parallel electric utility right-of-way cross-section represents the greatest achievable use of existing rights-of-way. To ensure a reasonable but greater use of existing utility rights-of-way, we recommend that where Iroquois parallels existing powerline rights-of-way their entire permanent right-of-way be placed within these rights-of-way except where terrain or other considerations prohibit joint use. We further recommend that construction right-of-way not extend more than 25-feet beyond the edge of the powerline right-of-way. Table 5.1.9-2 lists the locations where the proposed pipeline is parallel to existing overhead powerline right-of-way by milepost and our recommendation for proposed pipeline joint use of the powerline right-of-way.

Table 5.1.9-3 describes recommended mitigation techniques to minimize impact on residential properties located along the proposed pipeline route. These mitigation techniques include route variations that are identified in sections 3.6 and 3.7 (Type A); use of existing transmission line rights-of-way for all of the permanent pipeline right-of-way (Type B); use of residential construction techniques (Type C); and use of reduced construction right-of-way in the vicinity of the residence (Type D).

Table 5.1.9-4 identifies residential areas of concern and the recommended mitigation technique. In some instances, impact on residences would be reduced through the use of route variations described in sectiond 3.6 and 3.7. These route variations are in most cases recommended due to other constraints beyond just residential. Our recommendations in table 5.1.9-2 would reduce impact on three houses by placing the pipeline completely within the existing powerline right-of-way. For the remaining areas where the proposed pipeline location would be close to one or several residences or where vegetative screening would be removed, we recommend one or more of the residential construction techniques described

TABLE 5.1.9-2

Recommended Iroquois Pipeline Location When Adjacent to Overhead Powerline Rights-of-Way

Applicant/ State	Applicant's Proposed Parallel Approximate MP	Miles	Recommended Locations Approximate MP	Miles	Pipeline Right-of-Way Location
IROQUOIS					
New York	41.7 to 45.2	3.5	41.7 to 45.2	3.5	As proposed
	226.5 to 227.8	1.3	226.5 to 227.8	1.3	Within NM ROW
	236.3 to 236.9	0.6	236.3 to 236.9	0.6	Within NM ROW - Route variation - section 3.6.17
	236.9 to 241.2	4.3	236.9 to 239.7	2.8	Within NM ROW
			239.7 to 240.0	0.3	As proposed
			240.0 to 241.2	1.2	Within NM ROW
	241.6 to 244.0	3.0	241.6 to 244.0	3.0	Within NM ROW
	244.7 to 245.0	0.3	244.7 to 245.0	0.3	Within NM ROW
	248.3 to 249.6	1.3	248.3 to 249.6	1.3	Within NM ROW
	251.0 to 252.1	1.1	251.0 to 252.1	1.1	Within NM ROW
	252.1 to 253.6	1.5	252.1 to 253.6	1.5	Utilize existing ROW for temp. work space
	253.6 to 255.2	2.3	253.6 to 255.2	2.3	Within NM ROW
		-	255.2 to 255.8	0.6	Within NM ROW - Route Variation - section 3.6.18
	255.9 to 258.0	2.1	255.9 to 255.0	2.1	Within NM ROW
	259.1 to 259.4	0.3	259.1 to 259.4	0.3	Within NM ROW
	260.4 to 260.8	0.4	260.4 to 260.8	0.4	Route variation - section 3.6.21
	267.3 to 271.7	-	267.3 to 271.7	1.2	Within CH ROW on east side - Route Variation - section 3.6.22
	271.7 to 281.4	9.7	271.7 to 281.4	9.7	As proposed
	281.7 to 282.5	0.4	281.7 to 282.5	0.4	Within CE ROW - Route Variation - section 3.6.24
	360.5 to 369.4	8.9	360.5 to 369.4	8.9	Within LILCO ROW
Connecticut	293.3 to 293.8	0.4	293.4 to 294.8	0.4	Within CL&P ROW
	294.1 to 294.8	0.7	294.1 to 294.8	0.4	As proposed
	295.5 to 295.8	0.3	295.5 to 295.8	0.3	50' max. outside construction ROW
	297.1 to 298.0	0.9	297.1 to 297.5	0.4	As proposed
	297.5 to 298.0		297.5 to 298.0	0.5	Route Variation - section 3.6.27
	298.3 to 300.9	2.6	298.3 to 298.7	0.4	As proposed
	298.7 to 299.4	-	298.7 to 299.4	0.6	Brookfield Variation #1
	299.4 to 299.9		299.4 to 299.9	0.3	Brookfield Variation #1
	299.9 to 300.9		299.9 to 300.9	1.3	Brookfield Variation #1
	323.8 to 324.6	0.8	323.8 to 324.6	0.8	50' max. outside existing CL&P ROW for construction; 25' max. permanent
	325.1 to 326.1	1.0	325.1 to 326.1	1.0	50' max. outside existing CL&P ROW for construction; 25' max. permanent
	328.3 to 329.0	0.7	328.3 to 329.0	0.7	50' max. outside existing CL&P ROW for construction; 25' max. permanent
	330.0 to 330.8	0.8	330.0 to 330.8	0.8	Pipeline within ROW (50' outside for construction only) - section 3.6.33

NM = Niagara Mohawk
CH = Central Hudson Gas & Electric Corp.
CE = Consolidated Edison
CL&P = Connecticut Light & Power
LILCO = Long Island Lighting Company

TABLE 5.1.9-3

Types of Residential Mitigation Techniques

Type	Name	Description
Type A	Route Variation	See sections 3.6 and 3.7 for description of route variations.
Type B	Use of transmission ROW for pipe construction and operation ROW	See table 5.1.9-2 for FERC recommendations and section 3.6 for proposed route variations.
Type C	Residential construction techniques	Residential construction techniques would include one or more of the following: • Reduce construction right-of-way width to 50 feet. • Reduce working crew. • Use drag-line construction technique (i.e., pipe joints are welded into sections in a staging area as the trench is excavated just ahead of the pipe-laying operation, the pipe sections are lowered into the trench, welded to the previously-installed pipe, and the trench is backfilled immediately). • Same ditch replacement where applicable. • Use stove or sewer pipe construction technique (i.e., same as drag-line construction, except that no staging area is available and the pipe is laid one or two joints at a time). • Pad and work over existing pipeline right-of-way to limit temporary construction requirements. • Snow fence the work area. • Avoid removal of trees wherever possible.
Type D	Residential Construction Techniques	• Reduce construction right-of-way width to 50 feet. • Use minor realignments or reduce permanent right-of-way requirements to maintain at least 50 feet between residence and the edge of the permanent right-of-way. • Snow fence the work area. • Avoid removal of trees where possible.

TABLE 5.1.9-4

Proposed Mitigation Techniques for Residential Areas Crossed by The Proposed Iroquois and Tennessee Pipeline

Applicant/ State	Location	Approximate MP	No. of Residences	Type of Mitigation	Comment
IROQUOIS					
New York	Canton	16.8	1	A	Route Variation - section 3.6.5
	Athens	231.3	1	D	
	Clinton	257.8	1	B	
	Clinton	262.8	1	A	Route Variation - section 3.6.21
	Clinton	264.9	1	A	Route Variation - section 3.6.21
	Pleasant Valley	265.3	1	A	Route Variation - section 3.6.21
	Dover	285.7	1	D	
	Dover	286.4-286.5	4	C	
Connecticut	Sherman	287.7	2	A	Route Variation - section 3.6.26
	New Milford	289.4	1	D	
	New Milford	291.3	1	D	
	New Milford	293.9	2	D	
	New Milford	294.9	1	D	
	Brookfield	301.5	5	C	
	Brookfield	301.8	1	D	
	Brookfield	304.2	1	D	
	Brookfield	304.6	1	D	
	Brookfield	304.8	1	D	
	Shelton	322.9	1	A	Route Variation - section 3.6.32
	Shelton	325.0	1	D	
	Shelton	325.2	1	D	
TENNESSEE					
Schoharie/Albany Loop	Berne, NY	250+2.9	1	D	
Columbia/Berkshire Loop	New Lebanon, NY	254+4.0	1	D	
	Stockbridge, MA	256+4.0 to 256+4.9	5	C	Stockbridge Bowl
Worcester Loop	Sutton, MA	265+2.2	1		Loop on north near Uxbridge Road
	Sutton, MA	265+3.3 to 265+3.5	3	C	
	Sutton, MA	265+4.7	2	D	Loop to south in vicinity of Dodge Hill Road
	Northbridge, MA	265+5.6 to 265+5.7	4	C	
	Northbridge, MA	265+7.0 to 265+7.3	2	D	Loop on south in vicinity of Route 122
	Upton, MA	266+1 to 266+1.3	1	D	Loop to north
	Upton, MA	266+1.3 to 266+1.5	3	D	Loop to north immediately adjacent to street ROW when crossing front yards
Concord Lateral	Pembroke, NH	270B-105+12.1	3	C	Loop west side
	Pembroke, NH	270B-105+12.9 to 13.2	20	C	Dragline construction on west side
Haverhill Lateral	Haverhill, MA	270B-302+5.1 to 5.3	12	C	Stovepipe construction, reduce separation, crossover
Wallingford Lateral	Cheshire, CT	345A-201+0.4 to 1.2	31	C	Replacement line
	Cheshire, CT	345A-201+1.43 to 1.6	7	C	Replacement line

in table 5.1.9-3 (Types C and D) be used. In all cases, existing vegetative screening should be maintained as much as possible, and where screening must be removed for construction, we recommend the applicant work with the landowners to provide new plantings for areas not permanently maintained.

Because most of the pipeline passes through rural residential areas, there has been a great deal of concern about damage to existing wells and septic systems during construction, especially where blasting would be required. Exact locations of wells or septic systems can only be acquired from the affected landowners since records rarely exist at the town level. Iroquois has indicated they would repair any damage to wells and septic systems. We recommend that Iroquois avoid routing the pipeline in proximity to wells and septic systems and that they take into consideration any potential plans for expansion or relocation. Prior to construction, Iroquois shall submit to the Director of OPPR final construction surveys and construction plans for review and approval.

Table 5.1.9-5 lists known proposed residential developments to be crossed by the Iroquois pipeline. Route variations have been proposed wholly or in part to minimize disruption to proposed developments (see section 6.2). Potential impact during pipeline construction would be primarily scheduling conflicts between pipeline construction and the construction of the proposed development, and access for the development's construction crews across the pipeline right-of-way. This impact can be mitigated through discussions between the applicant and the developers on construction and timing methods. The long-term impacts of pipeline operation is primarily the result of encumbering the land with a permanent right-of-way thus precluding its use for any future development. It could also result in revisions to the existing site plans of the proposed developments. Methods for mitigating this impact include routing of the pipeline to avoid the proposed development, routing the pipeline to minimize the impact on proposed development's site plans and the use of a reduced construction right-of-way during construction.

As previously discussed, Iroquois proposes to install the pipeline in a 60-foot-wide permanent right-of-way and utilize a 100-foot-wide right-of-way during construction. In forested areas, the pipeline company would retain and maintain only a 50-foot-wide right-of-way. We believe, however, that in nonagricultural areas Iroquois can adequately construct and operate the proposed pipeline facilities within a 75-foot-wide construction right-of-way and a 50-foot-wide permanent right-of-way. A 75-foot-wide construction right-of-way is normal industry practice for one 30- or 24-inch-diameter pipeline. In active agricultural areas where full right-of-way topsoil stripping would be performed, a 100-foot-wide construction right-of-way would be allowed (see section 5.1.2.2). We recommend that the permanent right-of-way be limited to 50 feet with a 75-foot-wide construction right-of-way in nonagricultural areas where condemnation is required. We have no objection to Iroquois' proposed widths in areas where it can be purchased from willing sellers. However, even in these instances, clearing should be limited to 75 feet. This is intended as an overall recommendation and is not intended to preclude more specific route variations or right-of-way widths recommended elsewhere nor prohibit Iroquois from acquiring wider rights-of-way in special cases such as areas of steep sideslopes or staging areas.

Aboveground Facilities

The construction and operation of the aboveground mainline valves, metering stations, interconnection points, and pig launcher/receiver facilities would permanently preclude other

TABLE 5.1.9-5

Mitigation For Proposed Developments Known to be Crossed

Pipeline Segment	County, State	Milepost	Project or Owner's Name	Subdivision Status	Proposed Mitigation Measures
IROQUOIS	Dutchess, NY	265.5	Kara Estate	Approved 2/88	Route variation (section 3.6.21)
		270.0	JMR Custom Homes	Approved 5/23/86	Route variation (section 3.6.22)
		270.5	Trillium Gardins	Files 8/87	Route variation (section 3.6.22)
	Fairfield, CT	287.3	Smoke Ridge Farm	Approved 4/73	Coordinate with developer and submit plans
		296.8	Properties Investors	Unknown	Coordinate with developer and submit plans
		309.0	Old Farm Hill	Approved 1/85	Route variation (section 3.6.29)
		309.2	Teachers Ridge	Approval shortly	Route variation (section 3.6.29)
		312.9	Feather Meadow	Plan approved	Route variation (section 3.6.29)
		313.3	Deer Ridge	Phase I approved	Route variation (section 3.6.29)
		313.7	Cobbler's Mill Phase II	Not approved yet	Route variation (section 3.6.29)
		313.8	Mountain Manor	No plans	Route variation (section 3.6.29)
		314.5	Bernard Green Trustee	Plans not filed	Route variation (section 3.6.29)
		315.0	Sutherland Woods	Plans not filed	Route variation (section 3.6.29)
		315.4	Osbourne Hill Estate	Plans not filed	Coordinate with developer and submit plans
		316.0	Forest	Plans not filed	Route variation (section 3.6.29)
		317.1	Whispering Pines Estate	Plan approved	Route variation (section 3.6.29)
		317.5	Buckhill Estates	Plan filed	Route variation (section 3.6.29)
		317.7	Subwood Dev. Co.	Plan on file	Route variation (section 3.6.29)
		320.0	Monty Blakeman	Plan on file	Coordinate with developer and submit plans
		329.	Oronoque West	Plans on file	Coordinate with developer and submit plans
		330.5	Pin Oak Subdivision	Plans approved	Coordinate with developer and submit plans

land uses within the required area. Approximately 8.1 acres, comprising 2.9 acres of woodland, 2.2 acres of agricultural land, 2.5 acres of commercial/industrial land, and 0.5 acre of other land uses would be lost due to the construction and operation of the aboveground facilities.

Tennessee

Pipeline

Construction of Tennessee's mainline loop segments would require clearing of approximately 426.3 acres; 154.3 acres would be maintained as new permanent right-of-way adjacent to the existing rights-of-way. The loops of the lateral lines would require the additional clearing of approximately 51.9 acres, of which 32.1 acres would be required for the permanent right-of-way. For the replacement lines, 29.6 acres would be cleared for construction and revert to their previous land use once the replacement pipelines are operational. No new permanent right-of-way would be required. The new extension pipeline would require the clearing of 15.3 acres, of which 8.4 acres would be maintained for permanent new right-of-way.

Tennessee's proposed pipelines would be located primarily through woodland, with approximately 288.6 acres of woodland removed for construction. Approximately 110.7 acres would be retained for the permanent right-of-way. Impact on woodland would be minimal, since 96 percent of the proposed route would be along existing rights-of-way.

Approximately 175.4 acres of agricultural land would be disturbed during construction of the pipeline. Following construction, these agricultural lands would be entirely returned to their former use. Our recommendations for soil and damage to tile systems are addressed in section 5.1.2. When crossing livestock farms, Tennessee must relocate livestock in a holding pen during construction or provide suitable alternative arrangements to the landowner.

The most sensitive aspect of the proposed Tennessee facilities is the crossing of several residential areas located in Massachusetts, Connecticut, and New Hampshire. The number of homes within 50 feet of proposed pipeline rights-of-way in these states is shown on table 4.1.9-1. Measures proposed to mitigate impact on residences are presented on tables 5.1.9-3 and 5.1.9-4.

Tennessee's proposed Columbia/Berkshire Loop would cross a relatively congested area along Stockbridge Bowl in Massachusetts. Two dwellings would be within 50 feet of the right-of-way between MPs 256+4 and 256+4.9, and at least three others would be affected due to their proximity to the proposed route and the removal of vegetative screening. To mitigate construction impact, we recommend the construction right-of-way be reduced to maintain existing trees between the dwellings and the proposed right-of-way.

At MP 270B-105+12.1, the proposed Concord Lateral would cross about 400 feet of the Littlefield Condominium Community in Pembroke, New Hampshire. Within this area the existing pipeline crosses the main access road (River View Way) to the Phase IV development and passes within 20 feet of a six-unit condominium. To minimize disruption we recommend Tennessee bore River View Way, place the proposed pipeline on the west side of the existing pipeline, and maintain access to the adjacent parking garages.

Tennessee's proposed construction on the Concord Lateral would cross through a subdivision off of Donna Street in Pembroke, New Hampshire, between MP 270B-105+12.9 and MP 270B-105+13.2. Approximately 20 residences would be within 40 to 80 feet of the existing pipeline. This subdivision appears to have been constructed within the last 2 years and the existing pipeline is coincident with the backlot lines. In an effort to minimize the impact of construction through this area, we recommend that Tennessee locate the proposed pipeline to the west of the existing pipeline and use the drag line method of construction to limit the length of time the ditch is left open. We believe an adequate staging area is located immediately south of the subdivision in a reverting farm field. We do not believe that alternative routing would be warranted.

The Haverhill Lateral would cross a congested residential area in Haverhill, Massachusetts, between MP 270B-302+5 and MP 270B-302+5.3. The Alvanos Drive subdivision includes nine properties that would be crossed. Homes range from 15 to 60 feet from the existing pipeline. Just east of the subdivision, the existing line crosses Main Street and is located in the front yards of two homes on Jaffarian Road. To minimize disruption in the congested residential area, we recommend Tennessee use a stove pipe construction technique to traverse the Alvanos Drive subdivision and locate the proposed loop to the south of the existing pipeline to maximize distance of the proposed pipeline from adjacent homes. This would require a crossover west of the subdivision. Tennessee should also reduce the separation between the proposed and existing lines from 10 to 6 feet. East of the subdivision at MP 370B-302+5.2, we recommend a second crossover to the north side to reduce impact on homes west of Main Street and fronting on Jaffarian Road.

There are approximately 42 residences located adjacent to a 1.2-mile segment of the Wallingford Lateral between MP 345A-201+0.4 and MP 345A-201+1.6 in Cheshire, Connecticut. Landowners in this area have built up to and landscaped the existing pipeline right-of-way. To avoid disruption in this area, we initially considered a route variation, but determined it would be less desirable than following the existing right-of-way. Based on field and map review, we could not identify any alternatives that would result in less impact due to the extensive surrounding residential development and the wetlands along Willow Brook. We recommend Tennessee employ a stove pipe construction and same-ditch replacement techniques as well as a reduced crew size and small equipment to minimize disruption to residents in this area.

Aboveground Facilities

Tennessee proposes to construct seven new aboveground facilities, consisting of the Mendon Compressor Station and six metering stations (Nos. 1, 7, 8, 9, 11, and 12, table 4.1.9-3). The majority (0.69 acres) of this land is woodland and the remainder is residential (0.2 acre), agricultural (0.2 acre), and open field (0.2 acre). No adverse impact would be associated with construction of the metering stations. The Mendon Compressor Station would be located in a large forested tract adjacent to an existing meter station. No noise impact is anticipated. Noise is discussed in detail in section 5.1.8.

5.1.9.2 Recreational and Public Interest Areas

5.1.9.2.1 General Construction and Operational Impact

Recreation and public interest areas that would be crossed by the Iroquois/Tennessee Project pipelines include state forests and other state-owned land, rivers and streams used for boating and fishing, trails, golf courses, landfills, and areas of local public interest. These areas are listed in table 4.1.9-4.

One of the primary concerns in crossing recreational areas is the impact of pipeline construction and operation on the recreational activities. Disruption and noise during construction would temporarily restrict the activities of hikers, fishermen, campers, and boaters, as well as wildlife species. Since pipeline construction is generally scheduled for the summer season when recreational activities are at their peak, this impact is to a large extent unavoidable. Some mitigation is possible by timing construction to avoid peak periods of recreational use and limiting actual construction disruption in any one area to between several days and a week.

Following construction, the area would be restored as much as possible to its former use and recreational activities would continue as before construction. Removal of existing woodland for the construction of the pipeline would be the most significant long-term impact. Some mitigation is possible by reducing the size of the construction right-of-way and minimizing the amount of woodland removed. Although the temporary construction right-of-way and 10 feet of Iroquois' 60-foot-wide permanent right-of-way would be allowed to revegetate, revegetation to preconstruction conditions in forested areas would take years and those portions of the permanent right-of-way would be permanently altered.

Public comments have brought forth conflicting opinion on the ultimate public use of the new pipeline right-of-way. Although the pipeline right-of-way provides an opportunity for the development of new trails for recreational purposes, it also introduces human activity that may result in loss of wildlife, security problems for abutting landowners, and erosion problems where ORV use is heavy. To address these concerns, we recommend that for each owner or manager of woodland, the applicants offer to install and maintain at all access points one or more of the following ORV and pedestrian control measures (or others), as requested, at the completion of clean-up and reseeding:

- Install a locking, heavy steel gate with a fence that would extend a sufficient distance to prevent persons from bypassing the gate, and post appropriate signs.

- Plant conifers across the length of the right-of-way with sufficient spacing between the trees to limit access and to screen the right-of-way from view.

- Erect a slash and timber barrier across the right-of-way to restrict vehicle access.

- Where erosion could be a problem and access is desired, post "This Area Seeded for Wildlife Benefits and Erosion Control" signs at all points of desired access and along the right-of-way at intervals of less than 2,000 feet.

Areas of local interest along the length of the pipeline are often not recognized at the state or Federal level. These include land trusts, informal recreational areas, areas of local historical significance, and areas recognized by the local citizens for their scenic qualities. Mitigation in these areas can include rerouting, minimizing removal of vegetation, or development of more formalized recreational facilities in conjunction with pipeline construction.

Several landfills and hazardous waste sites are within a mile of the proposed Iroquois/Tennessee Project pipeline route. The greatest concern involving landfill or hazardous waste sites is the potential of encountering unknown hazardous substances during construction of the pipeline. Disturbance of these areas during construction could cause hazardous substances to migrate contaminants to surface and groundwaters, exposing nearby residents to potentially hazardous fugitive dust or subsidence. A secondary, but equally important concern, is the health and safety of the construction workers. Known hazardous waste areas should therefore be avoided. If hazardous wastes are encountered during construction, all construction activity in the area should stop and appropriate state and local agencies should be notified.

5.1.9.2.2 Site-Specific Impact

Significant recreational and public interest areas that would be crossed by the proposed Iroquois/Tennessee Project pipeline and any recommended measures to mitigate impact on these areas are discussed in the following sections. In many instances, the pipeline's crossing or proximity to these areas also has potential visual impact. Potential visual impact and recommended mitigative measures for these areas are discussed in section 5.1.9.3.

Iroquois

Forests and Parks

The Paugussett State Forest Reserve in Newtown, Connecticut, would be bordered for 0.7 mile by the proposed pipeline route near MP 315. Two route variations have been evaluated to avoid existing and planned subdivisions, and these route variations would result in the pipeline being placed within a portion of the western edge of the state forest. Another variation has been identified as a result of public comment which would place the right-of-way even further into the forest. These variations are discussed in sections 6.2.59, 6.2.60, and 6.2.62.

The 220-acre Roosevelt Forest owned by Stratford would be crossed resulting in permanent loss of about 1.2 acres and temporary disruption to recreational areas. Efforts would be made to schedule construction through the forest during low-use periods, and to accelerate construction and clean-up procedures. Following construction, there would be no limitations on forest use; only the presence of large trees on the permanent right-of-way would be precluded. Therefore, impacts should be minimal.

The Silver Sands State Park Reserve would be crossed by the pipeline right-of-way in Milford, Connecticut, between MPs 333.5 and 334.3. The area in which extensive landfilling occurred would be avoided. The Connecticut State Office of State Parks has raised concerns that the pipeline would interfere with the planned development of the state park reserves (Clapper, 1989). Iroquois has agreed to relocate mainline valve No. 20 closer to the proposed park maintenance building and to install the pipeline in the winter as part of its proposed Long Island Sound crossing to avoid conflicts with beach-oriented recreational uses.

Trails

Iroquois met with representatives of the NPS Appalachian Trial Project Office and local AT groups to discuss mitigation measures that would be used for the AT crossing in Sherman, Connecticut, at MP 285.7. Several route variations have been proposed in the vicinity of the trail. One alternative would traverse Leather Hill in Dover, New York, and the right-of-way would be prominently visible from the AT. The current proposed route would avoid the high elevations of Leather Hill and Gardner Hill. The NPS and Iroquois agreed to a land exchange (Mott, 1989). Furthermore, Iroquois agreed to reduce the width of the construction right-of-way from 100 feet to 50 feet in this location (McIntosh, 1987). Trail traffic would be maintained during the construction phase. Trail users may be temporarily inconvenienced during construction due to the presence of equipment, the noise and dust associated with construction and the visual intrusion. The effects, however, would be of a temporary nature. With proper mitigative methods, there will be minimal impact on the scenic values of the AT (Mott, 1989).

The proposed route for the North Country Trail would be crossed by Iroquois in Booneville, New York, at MP 108.5. The final trail alignment has not been selected and probably would not be selected prior to the commencement of pipeline construction (Gilbert, 1989). Accordingly, we feel impact of the pipeline would be minimal. The Housatonic Range Trail would be crossed twice in New Milford, Connecticut, and the Pomperaug Trail would be crossed near Boys Halfway River in Newtown, Connecticut. We have made specific recommendations to minimize visual impact at these crossings (see table 5.1.9-6).

Scenic and Recreational Water Bodies

Iroquois would cross several recreational and/or scenic rivers listed in table 4.1.9-2. Four of the rivers (West Branch Oswegatchie, Indian River, West Canada Creek, and Wappinger Creek) would be crossed in sections listed in the NRI. We have recommended specific mitigation measures at these crossings (see table 5.1.9-6). The NPS recommended that all measures be taken to prevent siltation and protect water quality during construction (Haas, 1990).

Hazardous and Solid Waste Sites

Several hazardous and solid waste disposal sites are across or near the proposed pipeline route. The applicants must route the pipeline around landfills if they were used for any other purpose than class III fill sites. If toxic materials could be near the pipeline route, water and soil sampling should be performed to ensure contaminated materials would not be disturbed.

Route variations have been recommended to avoid several of these sites. The proposed route would cross the Rose Valley Landfill, also known as J&J Trucking, at MP 134.5 in Russia, New York. Due to the uncertainty of what may be encountered during pipeline construction, we have recommended a route variation that would completely avoid

TABLE 5.1.9-6

Visually Sensitive Areas/Mitigation

Segment County/State	Visually Sensitive Area	Milepost	Visual Impact	Mitigation Recommendation
IROQUOIS				
St. Lawrence/NY	St. Lawrence River Vicinity	0.0-0.3	Low	
	Seaway Trail/Route 37	1.2	Minimal	
	Grass River	15.5-18.1	Low	Revegetate in accordance with DR Q.1a, Q.3F
	Oswegatchie River	41.4	Low	Revegetate in accordance with DR Q.1a, Q.3F
	West Branch Oswegatchie R.	48.3	Low	Revegetate in accordance with DR Q.1a, Q.3F
Lewis/NY	Indian River	65.1	Low-moderate	Limits clearing to 50 ft, revegetate in accordance with DR Q.1a, Q.3F
	Independence River	91.0	None	
	Otter Creek	92.0	Low	Minimize clearing at river banks, revegetate
	Black River	94.5	Low	Revegetate to pre-construction conditions in accordance with DR Q.3g, 0.3F
Oneida/NY	West Canada Creek	125.6	Moderate	Restoration in accordance with DRs Q.1a, Q.3F, submit detailed mitigation plan
Herkimer/NY	Mohawk River Vicinity	152-156	Low	Limit clearing to 75 feet, revegetate in accordance with DRs 1a, Q.3f.
Schoharie/NY	Schoharie Creek	187.5	Low	Minimize clearing at river banks, revegetate
Albany/NY	Basic Creek Reservoir/ Onderdonk Lake	206-214	Low	
Greene -Columbia/NY	Hudson River Vicinity	231-232.5	Moderate	Submit detailed mitigaton plan based on criteria established in DRs Q1a, Q3F, and NYS Article VII RD, page 46
Columbia/NY	Mt. Merino	232.5-233	Moderate	Submit detailed mitigation plan based on criteria established in DR Q.8e
Dutchess/NY	Wappinger Creek	265.4-266.4	Low-moderate	Limit clearing to 75 feet, revegetate in accordance with DRs Q1a, Q3F as modified by route variation (see section 3.6.21)
	Taconic State Parkway	270.2	Low-moderate	Submit detailed mitigation plan based on criteria established in DR Q1a as modified by route variation (see section 3.6.22) and NYS Article VII RD, Appendix B, page 17
	West Mountain	280	Moderate	Submit detailed mitigation plan to minimize additional width of clearing adjacent to transmission line
Fairfield/CT	Ten Mile River	284.2, 285.2		
	Appalachian Trail	286.7	Minimal	See Public Interest Area discussion, section 5.1.9.2 and Route Variation section 3.6.2.5
Fairfield/CT	Naromi Land Trust/ Wimisink Brook	287.7	Low	Submit mitigation plan to limit views from SR39 and between proposed subdivision and land trust based on criteria established in DR Q1a

TABLE 5.1.9-6 (cont'd)

Segment County/State	Visually Sensitive Area	Milepost	Visual Impact	Mitigation Recommendation
Litchfield/CT	Weantinoge Land Trust/ Morrissey Preserve	289	Low	Submit mitigation plans to limit views based on criteria established in DR Q.1a
	Stilson Road Scenic Area	289.5-291.2	Low	
	Housatonic Range Trail/	291.8	Moderate	Submit detailed mitigation plan for minimizing clearing revegetation of eastern slope
	Candlewood Mt/Pine Knob	292.9	Minimal	
	Lynn Deming Park	294	None	Submit detailed mitigation plan to reduce removal of tree screen west of the railroad right-of-way, take into account criteria identified in DR Q.1a
	Still River Nature Preserve	299.5		
Fairfield/CT	Paugussett State Forest	315.1	Minimal	Limit clearing to 75 feet
	Pomperaug Trail	318.1	Minimal	
	Boys Halfway River Caves	318.2	Minimal	
	Mean Brook Valley/ Shelton Land Trust	319.3-321.1	Low-moderate	Submit detailed mitigation plan, limit clearing in wetland to 50', limit clearing in upland forest to 75', follow criteria in DR Q.1a, Route Variation (see section 3.6.31)
	Hill & Harbor Tourist District	320.0-323	Low	Undefined area of mixed forest and farmland, limit clearing to 75 feet
	Housatonic River	330.8	Minimal	
New Haven/CT	City of Milford Open Space, Mondo Ponds	331.2	Low	Route variation (see section 3.6.34)
	Silver Sands State Park	333.5-334	None	
TENNESSEE				
Merrimack/NH	Suncook River	270B-105+10.7	Low	
Concord Lateral				

the landfill crossing (see section 6.2.19). We have also recommended a route variation in the vicinity of the Dover/ Walter Vincent Landfill located at MP 282.3 and Mica Product at MP 282.5 (see section 6.1.24). Another route variation was developed in the vicinity of the Kimberly-Clark landfill near MP 292 to avoid recently installed upgradient monitoring wells (see section 6.2.51).

The New Milford Landfill (also known as the Waste Management, Inc. Landfill) an EPA-listed hazardous waste site, would be bordered at MP 295.5. The listed site is in proximity to a major aquifer. Iroquois consulted with CTDEP and intends to develop plans to evaluate potential waste contamination at the site. In consultation with CTDEP, Iroquois would also develop a plan for determining if there is any contamination along the right-of-way that could be affected by, or could affect, project construction (May 1989 data response Q8b). We recommend that this plan be submitted for our review. The New Milford Variation was developed to provide a better alignment near the landfill; however, the variation would traverse an area downgradient of the landfill (see section 6.2.53).

We don't anticipate any adverse effects from the former landfill near the crossing of the Silver Sands State Park. Onsite monitoring wells and offsite municipal supply wells must be sampled by Iroquois. Also, soil sampling would be required within the 75-foot-wide construction right-of-way. Iroquois would design and implement a plan to prevent any contaminated leachate from entering the Long Island Sound. The plan must be submitted to FERC for approval prior to construction.

Other Public Interest Areas

Iroquois would be aligned within coastal areas adjacent to the St. Lawrence River, Hudson River, the Housatonic River, and Long Island Sound. The St. Lawrence River crossing would be at MP 0 to MP 0.2 before entering Waddington, St. Lawrence County, New York. The Hudson River crossing would begin at MP 231.9 in Athens, Greene County, New York, and end at MP 232.4 in Greenport, Columbia County, New York. The proposed Housatonic River crossing would be at MP 330.8 in Stratford and Milford, Connecticut. Iroquois would enter the Long Island Sound at MP 334.2 in Milford, Connecticut. The approximately 26-mile crossing would reach Huntington, New York, at MP 360.5. The proposed project does not appear to be inconsistent with any of New York or Connecticut's coastal resource and development policies. Final approval is dependent upon concurrence with the responsible state agencies that the proposed facilities are consistent with the coastal zone management programs. We have recommended that Iroquois' certificate be conditioned to prohibit any construction across these water bodies until coastal consistency determinations are issued.

The Iroquois pipeline would cross the Naromi Land Trust's Wimisink Valley Sanctuary for 2,000 feet through forested areas, open (wet) meadow, and scrub-shrub vegetation. Iroquois proposed a route variation through the land trust to minimize impact, which we have recommended (see section 3.6.26). This recommended crossing of the land trust's Cass Tract would be the least disruptive to the planned 8-acre pond, the wetland observation trail, and stands of swamp white oak and tamarack (Bristol, 1989). Iroquois developed a preliminary mitigation plan proposed to restore the wetland and possibly other land for donation to the land trust equal in size to the land acquired for the pipeline (Mango, 1989). Land trust officials would be consulted to develop a list of potential acquisitions. Prior to construction, we recommend that a final construction mitigation plan be reviewed and approved by the Director of OPPR.

Potential impact on the Weantinoge Heritage Land Trust (Morrissey Brook Preserve at MP 288.0 and Still River Nature Preserve at MP 299.5) include loss of habitat and specimen trees. Possible watershed and cultural resource issues were raised by the Trust (Peterson, 1989). We did not identify any significant watershed effects. Cultural resource studies are still underway by Iroquois. Iroquois has developed a preliminary mitigation plan for the Still River Preserve to minimize impact by maintaining a visual screen (see our recommendations, table 5.1.9-6), mitigative plantings, survey and protection of specimen trees, and habitat improvement. For both parcels, we recommend Iroquois develop final mitigation plans and submit them for our review.

The Shelton Land Conservation Trust would be crossed by Iroquois at MP 320.9. The proposed alignment of the pipeline would cross trails in the forest and would create a visual corridor. The pipeline right-of-way should avoid interfering with development plans for the site, such as the proposed rhododendron display area. Initially it was reported that the least disruptive crossing of the land trust would be along its border (Banks, 1989). Subsequent discussion between the land trust and Iroquois representatives indicated aligning the pipeline to follow an old gravel pit haul road may be preferable. A route variation that would avoid crossing Shelton Land Trust is evaluated in section 6.2.61.

The Candlewood Valley Country Club would be crossed at MP 297.1 in Litchfield County, Connecticut. Since construction would disrupt play on the golf course, we recommend that Iroquois coordinate closely with the owner in the development of a construction schedule to minimize disruption and to limit the amount of time construction is on the property.

The Berne Town Park would be crossed at MP 199.2. The location of the pipeline route (adjacent to the baseball field) would not result in any significant impact. The proposed location of the pipeline near the Hill and Plain School was raised during scoping. Concerns included preclusion of future expansion and safety. Pipeline safety is discussed in section 5.1.12. We believe sufficient space exists for future school expansion. Traversing the Means Brook Valley was also a concern due to wetland and open space concerns. This issue is discussed in section 5.1.7. We also evaluated a route variation in this area (see section 6.2.61).

Since we have recommended that Iroquois place the pipeline entirely within LILCO's existing right-of-way (see table 5.1.9-2), the parks that would be crossed or bordered in Huntington, New York, would be minimally affected by the pipeline. After construction, the right-of-way could be used for recreational activities.

Iroquois has proposed to implement a LPEP to purchase property and donate it to state and local organizations and to enhance properties of significance on or near the right-of-way. This $10 million program would be used to mitigate impact on public interest areas caused by construction of the pipeline. Allocations to each state would be proportional to right-of-way acquisition costs. Iroquois organized a seven-member Advisory Committee that would review all land nominated by local and state agencies and environmental groups. We feel this is a worthwhile effort and, therefore, recommend that Iroquois implement this program. Further, we recommend that Iroquois utilize a portion of the LPEP funds to finance studies regarding the effect of a new right-of-way on wildlife and habitat (see section 5.1.4.2.2).

Tennessee

State Forests

The Worcester Loop would affect 5.5 acres of Upton State Forest during construction. We recommend that Tennessee keep right-of-way construction clearing to a minimum and replant areas not used for permanent right-of-way when crossing the state forest.

Trails

Mitigative measures that would be implemented by Tennessee in order to minimize viewing distances at the Willow Brook Trail and Hanton City Hiking Trail would include vegetative buffers and reduced construction width at the crossings. We recommend that specific mitigation plans be submitted by Tennessee for each trail crossing. Mitigative measures should include plantings and limitation of clearing to 50 feet.

Scenic and Recreational Rivers

The Concord Lateral would cross the Soucook River, a salmon fishery, and Suncook River, a recreational river. No specific mitigation is recommended for these crossings other than implementation of our Procedures outlined in appendix D.

Other Public Interest Areas

The Wallingford Lateral would cross the Cheshire Land Trust, also known as Lisa's Meadow. An existing 40-foot easement for the pipeline traverses the land trust for a distance of approximately 1,000 feet. Special care should be taken to minimize impact on the wildlife sanctuary. No additional right-of-way would be required after construction of this replacement line. The right-of-way should be permitted to revegetate to its current state in the land trust. We recommend that a landscape design professional be retained to develop a plan to vegetate the banks of the Mill River, which is within the land trust, to minimize the views from the Willowbrook Trail to the residential area located to the west.

Pembroke's Memorial Field would be crossed by the Concord Lateral between MP 270B-105+10.6 and MP 270B-105+11. It is used for picnicking, fishing, and baseball. The proposed pipeline loop would cross the outfield of the primary baseball field and one secondary field. Our primary concern is that the baseball fields not be disrupted during the playing season, which is between May and September. We suggest that Tennessee not work on construction of the proposed facilities during that time or provide for alternative facilities to be used.

The Pleasant Valley Country Club would be crossed by the Concord Lateral between MP 270B-105+13.5 and MP 270B-105+13.8. The proposed loop would traverse the seventh fairway. Tennessee has not contacted the club's Board of Directors to date (Dupis, 1989). We recommend that prior to construction Tennessee develop a revegetation and restoration plan with input from the club and submit it to us for review prior to construction.

5.1.9.3 Visual Resources

5.1.9.3.1 General Construction and Operational Impact

Potential visual impact associated with new pipeline facilities is primarily of two types: that resulting from alteration of terrain and vegetative patterns due to pipeline construction and right-of-way maintenance; and that resulting from the placement of aboveground facilities such as compressor and metering stations. Factors that would influence the degree of visual impact the most include visibility resulting from contrast with surrounding landscapes (usually as a result of forestland clearing), and the number of potential viewers. The landscape quality of the area could also influence the degree of visual impact; higher quality landscapes would have greater potential to be affected. Section 4.1.9.3 describes regional landscape as distinctive, noteworthy, or common. Visual impact is influenced by both regional and site-specific factors.

Mitigative measures to minimize visual impact from the pipeline would include: following the contours and patterns of the landscape, siting along the valleys, and paralleling existing rights-of-way where possible. To mitigate impact from the aboveground facilities, siting should take into consideration existing vegetation and topography. To provide screening from potential viewers, facility design should be as compatible as possible with other structures in the area. Also, new plantings could be used to enhance the appearance of the facility within the existing landscape.

5.1.9.3.2 Site-Specific Impact

Iroquois

In general, visual impact resulting from construction of the proposed Iroquois pipeline facilities would be minimal to low. The proposed pipeline would cross landscapes of common quality, with smaller areas of noteworthy to distinctive quality. Distinctive landscapes are most often associated with river crossings such as the St. Lawrence, Black, and Hudson River or prominent land forms such as Mt. Merino. The greatest potential for impact would occur where the pipeline would be a new visual intrusion in a landscape previously unaffected by similar facilities or other manmade modifications. The pipeline would parallel existing electric, highway, and railroad rights-of-way for 20 percent of its length. In areas of new right-of-way, especially from MPs 1 to 41, MPs 46 to 52, MPs 56 to 95, and MPs 100 to 226, it would traverse more remote rural areas with low numbers of potential viewers. As the route proceeds south, surrounding development would increase. South of MP 280, the landscape consists of existing and developing residential areas. While the number of viewers would be greater, the landscape would tend to be dominated by manmade features.

To assess the visual impact of the Iroquois pipeline, we identified areas of potential visual sensitivity in proximity to the proposed facilities. We determined the degree of visual impact for each through map and field analyses and we recommended mitigative measures, where appropriate. These are listed in table 5.1.9-6.

New meter stations would be associated with the Iroquois pipeline. These facilities would be located within a fenced area of approximately 150 feet by 150 feet. The proposed location of these stations and surrounding land use are described in table 4.1.9-3. Evergreens must be planted around the fenced area, unless the landowner disagrees, to minimize visual impact from these facilities.

Tennessee

The Tennessee loops, laterals and extensions would parallel existing rights-of-way for 96 percent of the length of the proposed pipeline. Pipelines are proposed in more remote rural areas or more densely populated and commercially developed areas (Haverhill and Wallingford laterals). Only minor incremental visual impact would be associated with Tennessee pipeline facilities.

Tennessee proposes to construct one new compressor station and six meter stations at new sites. The new compressor station at Mendon, Massachusetts, would be located on a 2.1-acre site in a wooded area adjacent to existing electric and gas transmission facilities. Visual impact from this facility would be minimal. All of the meter stations would be located on sites about 0.2 acre in size. Five of the new stations would be located adjacent to existing electric transmission lines, industrial facilities, or rail facilities, as well as pipelines. We believe that visual impact would be minimal, except for meter station 1. At meter station 1, we recommend that plantings should be used to screen the facility from adjacent residents.

5.1.10 Socioeconomics

5.1.10.1 General Construction and Operational Impact

Socioeconomic impact associated with the construction and operation of the Iroquois/Tennessee Project is expected to be minimal. This is primarily due to the relatively short construction period and the relatively rapid rate construction crews would pass through any one area. Increased population from construction workers would occur for short periods of time over the length of the proposed pipeline route. Workers would not be concentrated in any one place for an extended period, which would limit local impact on housing, infrastructure services (fire, medical, education, police), and transportation. Some beneficial economic impact would 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.

Several areas of concern that were identified during the public comment period are addressed below. These concerns are general in nature and, for that reason, can only be commented upon.

<u>Secondary Growth Impact</u> - Development and growth are generally controlled at either the state level through state laws and plans or at the local level through town master plans and zoning ordinances.

<u>Tax Impact</u> - The proposed project would have a long-term beneficial effect on local tax revenues. Iroquois has estimated that its proposed pipeline would generate approximately $9 million annually in state and local taxes. Tennessee has not estimated their future tax payments related to the proposed project.

Road Damage Due to Construction Equipment - This concern may be valid but is difficult to prove. The applicants would obtain road crossing permits and would be required to construct the pipeline in accordance with permit conditions. The applicants would generally bore under major roadways, which would preclude any damage. Secondary roads may be affected by construction equipment but any damage resulting from construction may be more a result of the deteriorated condition of the road at the commencement of construction than of use by actual construction equipment. The applicants would be responsible for ensuring that local weight limitations and restrictions are adhered to at the construction areas.

Decrease in Property Value - A computerized data base literature review was conducted on the effects of pipeline easements on property values. Several studies on this subject have been conducted for electric transmission lines. These studies 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). Internal studies performed by NYPA on the effects of their 765-kV Massena Line and their Marcy-South Line on property values concluded that the proximity of the right-of-way to dwellings may limit the depth of the market of potential buyers, but the final selling price is comparable to other houses in the area which are not adjacent to the right-of-way (A. Alford, 1990). In support of their filing in Docket No. CP87-205-000, Texas Gas Transmission Corporation conducted a study comparing land sales within 0.5 mile of an existing pipeline easement versus those beyond 0.5 mile. The results of this study indicate that the pipeline right-of-way creates no measurable loss in value to lands adjacent to the right-of-way. Property owners would receive full compensation for the use of their land based on market value of the land.

Where subdivisions are proposed, developers can request property-specific routing and mitigation, including compensation for lost development potential, during the right-of-way acquisition process. We believe that the right-of-way could be aligned through the subdivision in a way that would not preclude future development.

Homeowner Property Insurance Liability Resulting From Pipeline Easements - Casualty losses to land, structure or other property, and personal injuries caused directly by the pipeline would be the responsibility of the pipeline company, or its insurance underwriter, and would require resolution 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.

Impact on Farms - Farming operations, if disrupted, could resume immediately after construction and restoration have been completed. Farmers would be compensated for any loss in production. If supplemental feed must be provided as a result of construction across a farm due to inaccessibility of a portion of the farm, the applicant would be required to compensate the farmer for the supplemental feed under terms of the easement. Compensation to the landowners for losses sustained during construction would be determined after restoration has been completed, and would cover the value of the easement and financial losses due to construction of the pipeline. If usual farm operations include the employment of farmhands, their salaries could be part of the compensation.

Impacts on 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 impact from pipeline construction would be minimal. Any effects on the local economy, housing, and community services 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 impact on 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 impact on 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.

5.1.10.2 Site-Specific Impact

Iroquois

Iroquois proposed to use four or five mainline construction spreads in New York and Connecticut, a smaller spread for the Long Island portion, and three special river crossing spreads, in addition to the Long Island Sound crossing. Iroquois estimated that its mainline construction spreads would typically require about 550 workers each, and that 150 workers would be required for each river crossing spread. Construction across the Long Island Sound would require 200 workers. The total peak construction workforce would be about 2,500. During operation, Iroquois would employ about 50 full-time workers.

Depending on skill requirements, Iroquois intends to employ construction personnel from the New York-Connecticut area. It estimates that about one quarter of pipeline construction workers would be specialists and supervisory personnel brought in from outside the local areas. The remaining workforce skill requirements would be common to major construction projects of various types, and are expected to be available from within the local labor market. Based on the high unemployment rates in the northern pipeline segments (see table 4.1.10-1), and size of the regional labor pool in the southern pipeline segments, local labor should be readily available.

Assuming one quarter of the construction workers would be nonlocal workers, 15 percent of whom would bring along two dependents, a conservative estimated influx of approximately 823 people would occur over the two-state, 369.4-mile area of mainline pipeline. Pipeline construction activities at any one location would typically take 6 to 12 weeks between initial land clearing and final restoration. The marine pipeline would be constructed during a 5-month period between January and May.

Generally, nonlocal workers prefer temporary quarters (hotels/motels, housing rental units, R.V. campsites, etc.) 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 impact would be imposed on the tourist trade or other sources of local income.

Impact on 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. For high-volume roadways and rail crossings, the crossing would be accomplished through boring and casing under the road or railway, and traffic flow would be unaffected. For lower volume roadways, where the trench method would be used, Iroquois would keep one-half of the road open at all times and would limit construction time to 1 or 2 days. Movement of construction equipment and materials from storage and laydown areas to the pipeline right-of-way could cause some temporary delays on secondary roads.

In addition to the main office in Shelton, Connecticut, three permanent district offices, each employing up to 50 people, would be established for operations; two would be located in New York and one would be in Connecticut. The available supply of housing and the existing public services in the towns where the district offices would be located would be able to accommodate office personnel. Iroquois estimates annual expenditures would reach $5.9 million.

Tennessee

Tennessee proposed to use seven construction spreads to construct the proposed pipeline segments. Each spread would employ 100 to 300 construction workers. Construction would take about 6 months. In addition to the pipeline construction crews, approximately 30 workers would be required over a 7-month period for construction of each compressor station. With the exception of a few pipeline specialists and supervisory personnel, all workers would be hired from existing local or regional labor pools.

Tennessee would not require any additional permanent operations offices. Day-to-day operations of the proposed compressor stations would require two additional permanent operating staff technicians.

5.1.11 Cultural Resources

5.1.11.1 General Construction and Operational Impact

Construction and operation of the proposed pipeline would potentially affect historic, archeological, and/or architectural properties in, or eligible for listing in, the NRHP. Project impact could include: the physical disturbance of archeological sites located within the project area during construction, including the rights-of-way, areas of pipeline staging/storage and temporary access (e.g. roads); the demolition, removal, or alteration of historic or architecturally significant structures; and the introduction of visual elements that could alter the setting associated with historic properties (compressor or metering stations, right-of-way through forested areas). Mitigative measures could include boring, looping, or rerouting of the project right-of-way to avoid historic properties; data recovery in the form of scientific excavation of archeological sites; photographic and architectural recording of standing structures; and use of vegetative screens or other landscaping devices to reduce or eliminate adverse visual effects.

To date, the applicants have completed only those portions of Phase 1 studies dealing with the identification of all previously recorded cultural resources located in or near the proposed project right-of-way. Since the identification and evaluation of previously unknown resources is still underway, a site-specific evaluation of project impact on cultural resources is not yet available. However, one of the applicants (Iroquois) has agreed to defer construction of any facilities that must be certificated until: the Commission has reviewed and approved all Phase 1 and Phase 2 reports and Phase 3 mitigation plans (if required); the Commission has considered any comments of the SHPOs and the ACHP; and the Director of OPPR has informed the applicant that construction may begin.

For each NRHP-eligible property that lies within the project area, FERC, in consultation with the appropriate SHPO, would determine if the property would be affected and if the effect would be adverse. In accordance with FERC's general operating policy, every effort would be made to avoid adverse effects on cultural resources by rerouting, or through implementation of other mitigating measures.

5.1.11.2 Site-Specific Impact

5.1.11.2.1 Archeological Resources

Iroquois

Field investigations to identify and evaluate unrecorded resources have been completed for the Long Island Sound crossing segment of the Iroquois portion of the project. The Connecticut SHPO has expressed the opinion that construction of the submarine segments of the project would have no effect on significant cultural resources located in Connecticut waters and we concur.

Because there are known archeological sites in the regions through which the proposed pipeline would pass, it is probable that as yet unidentified sites would be discovered in the right-of-way. Iroquois agreed to attempt to avoid, through rerouting, significant cultural resources identified in the right-of-way. If only a portion of the impact area would affect a significant resource, the right-of-way could be narrowed to avoid affecting the resource. In the event that impact on a site cannot be avoided, data recovery, consisting of controlled archeological excavation, would be carried out according to site-specific plans developed in consultation with, and approved by, FERC in conjunction with the comments of the appropriate SHPO and the ACHP.

As part of the state licensing procedure for the proposed project in New York, Iroquois entered into an agreement with various parties to the New York Article VII proceedings. Iroquois agreed that it would comply with certain stipulations intended to minimize project impact on cultural resources. Iroquois agreed that it would complete all required archeological investigations and any consequent mitigation before beginning construction in any area in which such studies are deemed necessary. Iroquois also agreed that it would provide basic cultural resource management training for all of its environmental inspectors in New York, and that it would ensure that they know and implement the procedures to be followed in the event that unanticipated archeological resources should be discovered in the course of construction. We believe that these additional mitigative measures should be required for all project segments, not just those in New York.

Tennessee

The Farmington Canal, which is listed in the NRHP, is the only previously recorded archeological property that has been identified within the right-of-way of the Tennessee segments of the proposed project. The Connecticut SHPO (Stone & Webster, 1989) recommended that an evaluation of project effects on the canal be undertaken. The canal crossing would be within an existing pipeline right-of-way. The applicant has not submitted information explaining how the crossing would be implemented, but has indicated that it would develop a mitigation plan and submit it for approval. If the crossing would result in any physical disturbance to the canal or associated features (such as the towpath), we would recommend that mitigative measures be implemented to avoid any adverse effects. Phase 1 studies of the proposed Tennessee segment in Cheshire, Connecticut, have been completed (Roberts, Niamir, and Stone, 1988). The Connecticut SHPO concluded, on the basis of information in the Phase 1 report, that construction of this proposed Tennessee project segment would have no effect on prehistoric archeological resources and we concur.

Three prehistoric sites and one historic archeological site have been identified in the New Hampshire segments of the proposed project right-of-way (Bunker and Potter, 1988). The applicant has not provided sufficient information to allow either FERC or the SHPO to evaluate the potential NRHP eligibility of these sites or the possible project impact on them. It is our opinion that in the absence of mitigative measures, they would be adversely affected by the proposed project. We recommend, in the event that any or all of these sites are found to meet the eligibility criteria for the NRHP, that the applicant reroute the project to avoid disturbance of eligible sites or, if avoidance is not feasible, that the applicant carry out a program of data recovery approved by FERC in conjunction with the comments received from the SHPO and the ACHP.

No field investigations have been undertaken to identify previously unrecorded cultural resources for the Tennessee segments of the proposed project in New York, Rhode Island, or Massachusetts. If such resources exist, they could be affected by the project.

5.1.11.2.2 Architectural Resources

No previously recorded architecturally significant resources have been identified in any of the areas likely to be directly disturbed by construction or operation of the proposed pipeline. However, it is possible that a number of such resources located outside the project right-of-way, but within the project viewshed, would be permanently affected. Potentially adverse effects could result from the creation of right-of-way cuts through forested areas and the presence of aboveground project structures such as metering and compressor stations. Impact could be expected in the form of alterations of the visual contexts associated with standing structures eligible for the NRHP. Techniques that could eliminate or minimize the severity of such impact include planting of vegetative screening and offsetting or feathering the edges of the right-of-way where it would exit a wooded area or descend a slope. We recommend that project certification be conditional upon the applicant's implementation of measures to reduce or eliminate, to the extent feasible, adverse visual impact on significant architectural properties.

5.1.11.2.3 Traditional Cultural Values

Consideration would be given to both direct and indirect impact on historic and archeological properties of traditional cultural value (as identified during the consultation process in accordance with 36 CFR 800.4(a)(1)(iii) and 800.1(c)(2)(iii)). FERC, in accordance with its planning processes and the ACHP regulations, would treat traditional cultural concerns as those of interested parties.

Thus, should FERC, after providing project information as outlined in section 4.1.11, be contacted by designated tribal representatives, identified interested Indian groups, and/or other identified individuals, it would inform these parties of the determinations regarding existence of culturally significant properties within the impact area of the proposed project. FERC would also notify these parties of the determination of effect.

- Iroquois and Tennessee shall complete all Phase 1 and Phase 2 reports required under the Commission's July 27, 1988, order, and forward copies to FERC and the appropriate SHPOs.

- 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 archeological sites that meet the criteria for NRHP eligibility, cannot be avoided, applicants shall prepare Phase 3 mitigative or data recovery plans and submit those plans to the SHPO and FERC for review and approval.

- Applicants shall not be permitted to construct in those portions of the right-of-way or any other areas (e.g., staging areas, access roads) that contain significant cultural resources, including archeological sites or nearby standing NRHP-listed or NRHP-eligible structures, until the Director of OPPR has reviewed all cultural resource surveys and mitigative plans, and has considered any comments by the appropriate SHPOs 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.

5.1.12 Reliability and Safety

5.1.12.1 Safety Standards

The proposed pipelines in the Iroquois/Tennessee Project would be designed, constructed, operated, and maintained in accordance with the DOT Minimum Federal Safety Standards in 49 CFR Part 192. The regulations are intended to ensure adequate protection for the public from natural gas pipeline failures. Part 192 specifies material selection and qualification, minimum design requirements, and protection from internal, external, and atmospheric corrosion.

Part 192 also defines area classifications, based on population density in the vicinity of the pipeline, which determine more rigorous safety requirements for populated areas. The class location unit is an area that extends 220 yards on either side of the centerline of any continuous 1-mile length of pipeline. The four area classifications are defined as follows:

Class 1	Location with 10 or fewer buildings intended for human occupancy.
Class 2	Location with more than 10 but less than 46 buildings intended for human occupancy.
Class 3	Location with 46 or more buildings intended for human occupancy; or where the pipeline lies within 100 yards of any building or small, well-defined outside area occupied by 20 or more people during normal use.
Class 4	Location where buildings with four or more stories aboveground are prevalent.

Class locations representing more populated areas require higher safety factors in pipeline design, testing, and operation. Pipelines constructed in Class 1 locations must be installed with a minimum depth of cover of 30 inches in normal soil, and 18 inches in consolidated rock. Class 2, 3, and 4 locations, as well as drainage ditches of public roads and railroad crossings, require 36 inches in normal soil and 24 inches in consolidated rock. Class locations also specify the maximum distance to a sectionalizing block valve--10 miles in Class 1, 7.5 miles in Class 2, 4 miles in Class 3, and 2.5 miles in Class 4. Pipeline design pressures, hydrostatic test pressures, maximum allowable operating pressure, inspection and testing of welds, and frequency of pipeline patrols and leak surveys must also conform to higher standards in more populated areas. The proposed pipeline segments in the Iroquois/Tennessee Project contain Class 1, 2, and 3 locations. The portion of the proposed Iroquois system that crosses Long Island Sound would be constructed to Class 3 specifications.

Part 192 prescribes the minimum standards for operating and maintaining pipeline facilities, including the requirement to establish a written plan governing these activities. Under section 192.615, each pipeline operator must also establish an Emergency Plan that provides written procedures to minimize the hazards from a gas pipeline emergency. Key elements of the plan include procedures for:

- receiving, identifying, and classifying emergency events - gas leakage, fires, explosions, and natural disasters;

- establishing and maintaining communications with local fire, police, and public officials, and coordinating emergency response;
- making personnel, equipment, tools, and materials available at the scene of an emergency;
- protecting people first and then property, and making safe from actual or potential hazards; and
- emergency shutdown of system and safely restoring service.

Each operator must establish and maintain liaison with appropriate fire, police, and public officials to learn the resources and responsibilities of each organization that may respond to a gas pipeline emergency, and coordinate mutual assistance in responding to emergencies. The operator must also establish a continuing education program to enable customers, the public, government officials, and those engaged in excavation activities to recognize a gas pipeline emergency and report it to appropriate public officials.

5.1.12.2 Potential Hazards

The transportation of natural gas by pipeline involves some degree of risk to the public in the event of an accident and subsequent release of gas. The greatest hazard is a fire or explosion following a major pipeline rupture.

Methane, the primary component of natural gas, is colorless, odorless, and tasteless. It is not toxic, but is classified as a simple asphyxiant, possessing only a slight inhalation hazard. If breathed in high concentration, oxygen deficiency can result in serious injury or death.

Methane has an ignition temperature of 1,000 degrees Fahrenheit and is flammable at concentrations between 5.00 percent and 15.0 percent in air. Unconfined mixtures of methane in air are not explosive. However, a flammable concentration within an enclosed space in the presence of an ignition source can explode. The specific gravity of methane is 0.55 and, therefore, it is buoyant at atmospheric temperatures.

5.1.12.3 Pipeline Accident Data

Since February 9, 1970, 49 CFR Part 191 has required all operators of transmission and gathering systems to notify DOT of any reportable incident, and to submit a written report on form F7100.2 within 20 days. Reportable incidents are defined as any leak that:

- caused a death or personal injury requiring hospitalization;
- required taking any segment of transmission line out of service;
- resulted in gas ignition;
- caused estimated damage to the property of the operator, or others, or both a total of $5,000 or more:

- required immediate repair on a transmission line;
- occurred while testing with gas or another test medium; or
- in the judgement of the operator was significant, even though it did not meet the above criteria.

DOT changed reporting requirements after June 1984 to reduce the amount of data collected. After that date, operators must only report incidents that involve property damage of more than $50,000, injury, death, release of gas, or otherwise that are considered significant by the operator. To avoid combining dissimilar data sets, only incidents reported during the 14.5-year period from January 1970 through June 1984 are used in this analysis (American Gas Association, 1986).

During the 14.5-year period, 5,862 service incidents were reported over the nationwide total of approximately 300,000 miles of natural gas transmission and gathering systems. Service incidents, defined as failures that occur during pipeline operations, have remained fairly constant over this period with no clear upward or downward trend in annual totals. In addition, 2,013 test failures were reported. Correction of test failures removed defects from the pipeline prior to placing it in service.

TABLE 5.1.12-1

Service Incidents by Cause

Cause	Percentage	Incidents/1,000 mi-yr.
Outside forces	53.5	0.70
Corrosion	16.6	0.22
Material defect	16.9	0.21
Construction defect	4.8	0.06
Other	8.2	0.11
Total	100.0	1.30

Additional insight into the nature of service incidents may be found by examining the primary factors that caused the failures. Table 5.1.12-1 provides a percentage distribution of the causal factors as well as the annual frequency of each factor per 1,000 miles of pipeline in service.

The dominant incident cause is outside forces, constituting 53.5 percent of all service incidents. Outside-forces incidents result from the encroachment of mechanical equipment such as bulldozers and backhoes; from earth movements due to soil settlement, washouts, or geological hazards; from weather effects such as winds, storms and thermal strains; and from willful damage. The breakdown of outside-forces incidents in table 5.1.12-2 shows that human error in equipment usage was responsible for approximately 75 percent of outside-forces incidents. Since April 1982, operators have been required to participate in "one call" public utility programs in populated areas to minimize unauthorized excavation activities in the vicinity of pipelines. The "one call" program is a service utilized by public utilities and some private sector companies (i.e., oil pipelines, cable television, etc.) to provide construction contractors or other maintenance workers an accurate identification of the underground location of pipes, cables and culverts prior to excavation.

TABLE 5.1.12-2

Outside Forces Incidents by Cause

Cause	Percent
Equipment operated by outside party	67.1
Equipment operated by or for operator	7.3
Earth movement	13.3
Weather	10.8
Other	1.5

Table 5.1.12-1 identifies an average annual service incident frequency of 1.30 failures per 1,000 miles per year for all natural gas transmission and gathering lines. The population of pipelines included in the data set varies widely in terms of age, pipe diameter, and level of corrosion control. Each variable influences the incident frequency that may be expected for a specific segment of pipeline.

The frequency of service incidents is strongly dependent on pipeline age. While pipelines installed since 1950 exhibit a fairly constant level of service incident frequency, pipelines installed prior to that time have a significantly higher rate, partially due to corrosion. Older pipelines have a higher frequency of corrosion incidents, since corrosion is a time-dependent process. Further, new pipes generally use more advanced coatings and cathodic protection to reduce corrosion potential.

Older pipelines have a higher frequency of outside-forces incidents partly because may be less well-known and less well-marked than newer lines. In addition, the population of older pipelines contains a disproportionate number of smaller diameter pipelines, which have a greater rate of outside-forces incidents. Small diameter pipelines are more easily crushed or broken by mechanical equipment or earth movements.

Table 5.1.12-3 clearly demonstrates the effectiveness of corrosion control in reducing the incidence of failures caused by external corrosion. The use of both an external protective coating and a cathodic protection system, required on all pipelines installed after July 1971, significantly reduces the rate of failure over unprotected or partially protected pipe. The data shows that bare, cathodically protected pipe actually has a higher corrosion rate than unprotected pipe. This anomaly apparently reflects the retrofitting of cathodic protection to actively corroding spots on pipes.

TABLE 5.12.3

External Corrosion By Level of Control

Corrosion Control	Incidents/1,000 mi-yr.
None - bare pipe	0.42
Cathodic protection only	0.97
Coated only	0.40
Coated and cathodic protection	0.11

5.1.12.4 Impact on Public Safety

The service incident data summarized in table 5.1.12-1 include pipeline failures of all magnitudes with widely varying consequences. Approximately two-thirds of the incidents were classified as a leak, and the remaining one-third classified as a rupture, implying a more serious failure. Fatalities or injuries occurred in 4 percent of the service incidents reported in the 14.5-year period.

Table 5.1.12-4 presents the annual fatalities that occurred on natural gas transmission and gathering lines from 1970 to 1987. Fatalities between 1970 and June 1983 have been separated into employees and nonemployees, to better identify a fatality rate experienced by the general public. Fatalities among the public averaged 2.5 per year nationwide over this period. The simplified reporting requirements in effect after June 1984 do not differentiate between employees and nonemployees.

The nationwide totals of accidental fatalities due to various manmade and natural hazards are listed in table 5.1.12-5 in order to provide a relative measure of the industry-wide safety of natural gas pipelines. Direct comparisons between accident categories should be made cautiously since individual exposures to hazards are not uniform among all categories. Nevertheless, the average 2.5 public fatalities per year is relatively small considering the more than 300,000 miles of transmission and gathering lines in service nationwide. Furthermore, the fatality rate is approximately two orders of magnitude lower than the fatalities from natural hazards such as lightning, tornados, floods, earthquakes, etc.

Based on approximately 311,000 miles in service, the rate of public fatalities for the nationwide mix of transmission and gathering lines in service is 0.008 per 1,000 miles per year. Applying the industry wide average to the proposed 369-mile Iroquois pipeline yields a recurrence interval of one fatality every 340 years. The proposed loops consisting of a new pipeline adjacent to an existing pipeline would cause only a slight increase in risk to the nearby public.

TABLE 5.1.12-4

Gas Transmission and Gathering System Fatalities a/, b/

Year	Employees	Nonemployees	Total
1970	1	0	1
1971	2	1	3
1972	3	3	6
1973	1	1	2
1974	1	3	4
1975	5	2	7
1976	1	6	7
1977	5	3	8
1978	1	0	1
1979	4	8	12
1980	0	1	1
1981	5	1	6
1982	4	6	10
1983	1	2	2
1984 c/	-	-	9
1985 c/	-	-	6
1986 c/	-	-	4
1987 c/	-	-	-
Annual Average	2.5	2.5	5

a/ 1970 through June 1984 - American Gas Association, 1986.

b/ U.S. DOT Hazardous Materials Information System.

c/ Employee/nonemployee breakdown not available.

5.1.12.5 Site-Specific Impact

In accordance with 49 CFR Part 192, the trench would be deeper in agricultural areas to accommodate the use of heavy farm machinery or the existence of drainage systems.

Where blasting is required, it would be performed during the day only. Blasting mats would be used in areas near homes or other structures to minimize the risk of harm to people or structures.

In the event of a fire due to a gas leak or rupture, the pipeline company would be responsible for shutting off the supply of gas to the leaking section of pipeline. For large leaks or ruptures, automatic shutoff valves would close immediately; for smaller leaks, shutoff valves would be closed manually. Once the leaking pipeline section is isolated, the fire would be allowed to burn itself out.

TABLE 5.1.12-5

Nationwide Accidental Deaths a/

Type of Accident	Fatalities
All accidents	92,000
Motor vehicles	46,000
Falls	11,600
Drowning	5,700
Poisoning	5,200
Fires and burns	4,800
Suffocation by ingested object	3,100
Tornado, flood, earthquake, etc. (1980-82 avg.)	132
Lightning (1980-82 avg.)	94
All liquid and gas pipelines (1978-87 avg.) b/	27
Gas transmission and gathering lines Nonemployees (1970-84 average) c/	2.5

a/ All data, unless otherwise noted, reflects 1984 statistics from the National Safety Council, "Accident Facts - 1985 Edition," Chicago, IL.

b/ U.S. Department of Transportation, "Annual Report on Pipeline Safety - Calendar Year 1987."

c/ American Gas Association, 1986.

Local fire and public health agencies would provide fire protection for people, structures and property around the fire.

As discussed in section 2.4 of this EIS, a contingency plan would be prepared by the pipeline company, working with local agencies, to identify personnel to be contacted, equipment to be mobilized and procedures to be performed to respond to an interruption of normal pipeline operation.

5.1.13 Polychlorinated Biphenyls (PCBs)

Tennessee's existing interstate transmission system has been exposed to liquid and vapor releases of PCBs within the pipeline. The primary concern is that the pipeline segments proposed for removal, as well as the facilities proposed for replacement in conjunction with the meter station modifications and compressor retirements, could contain PCBs on their interior surfaces.

PCBs were accidentally introduced into the systems of numerous interstate natural gas companies through the use of compressor lubricating oil that contained PCBs. PCB-contaminated gas and condensate was introduced into Tennessee's system from contaminated gas that was purchased from other interstate transmission companies. In addition, PCB-contaminated gas and condensate may have been introduced into Tennessee's system from its own use of compressor lubricating oil that contained PCBs.

5.1.13.1 Properties and Effects

PCBs are extremely stable, viscous fluids that are resistant to degradation, heat, oxidation, acids, and bases. These physical and chemical properties make PCBs valuable to industry as dielectric, heat transfer and ignition retardant fluids, and they were widely used by industry in electrical transformers and capacitors, and in lubricating oils for potentially explosive environments.

However, the chemical properties that made PCBs desirable for industrial uses also make them hazardous to human health. PCBs are extremely stable and can persist in the environment for decades with little to no degradation. PCBs are lipid-soluble (preferentially accumulate in fatty tissues) and are subject to bioaccumulation and biomagnification. Exposure to PCBs may result in skin lesions, liver and brain damage, and reproductive abnormalities.

The United States Congress recognized the dangers posed by the unregulated use of PCBs, and specifically addressed their production, use, and disposal in the Toxic Substances Control Act (TSCA) of 1976. The use of PCBs by industry was prohibited, except in a totally enclosed manner, and specific disposal requirements were established by 40 CFR 761.60.

5.1.13.2 Regulatory Requirements

In a March 17, 1988, letter, the Interstate Natural Gas Association of America requested the EPA promulgate a general policy for the removal and retirement of pipelines exposed to PCBs. EPA's June 1988, response highlighted the specific requirements of the PCB regulations that apply to pipeline abandonment and removal operations. In its June 1988, letter, EPA determined that the 13 interstate natural gas transmission companies (including Tennessee) that found PCBs in excess of 50 ppm in 1981, have not demonstrated that PCB concentrations are below 500 ppm. For regulatory purposes, EPA considers the liquids in these 13 systems to exceed 500 ppm.

Under 40 CFR 761.60(b)(5), a natural gas pipeline contaminated with condensate greater than 500 ppm PCBs may only be disposed in a TSCA-permitted incinerator or a hazardous waste landfill. However, contaminated pipelines may be stored prior to disposal for up to a year in a facility that meets the requirements of 40 CFR 761.65(b) prior to disposal. Pipelines contaminated above 500 ppm may not be abandoned in place or distributed in commerce for reuse, without an exception under 40 CFR 761.80.

Under 40 CFR 761.60(e), alternative methods of disposal are permitted for a pipeline contaminated above 500 ppm. The EPA Headquarters' Office of Toxic Substances would review applications for alternative method periods that specify procedures for excavation, removal, sampling, storage, and disposal of pipeline segments. Decontamination of the pipeline segments may be demonstrated to be an alternative to disposal.

As a result, three options may be pursued in removing pipeline facilities to comply with TSCA:

- remove and dispose of facilities in a TSCA-permitted incinerator or chemical waste landfill;
- secure an alternative disposal method permit from EPA prior to removing facilities; or
- remove and store equipment in a facility meeting the requirements of 40 CFR 761.65(b). Within 1 year of removal, dispose of facilities in a TSCA-permitted incinerator, chemical waste landfill, or by an EPA-permitted alternative disposal method.

In the event of a spill of liquids during removal operations, cleanup of any liquids, contaminated soil and impervious solid surfaces must comply with 40 CFR Part 761, Subpart G -- PCB Spill Cleanup Policy.

5.1.13.3 Site-Specific Impact

Section 2.0 of this EIS describes Tennessee's proposed facilities. Most of the proposed construction is of new pipeline and related equipment, to which PCB decontamination requirements do not apply. With regard to replacement, removal or idling of existing pipeline and related equipment, Tennessee proposes the following modifications to their existing system:

- Replacement of the Wallingford Lateral with a new 3.2-mile, 12-inch diameter pipeline.
- Retirement of three compressors at Compressor Station 261.
- Modifications to meter stations at the following locations:
    - Greenwich, CT
    - Norwalk, CT
    - Torrington, CT
    - Bloomfield, CT
    - Farmington, CT
- Replacement of sections of pipe approximately 20 feet long at each loop tie-in point.

In March 1989, Tennessee submitted to the EPA a document entitled "Permit Application for PCB Disposal by Nonthermal Alternative Methods in the Tennessee Gas

Pipeline System" in support of its application for a permit for Alternate Methods of Disposal under the TSCA, section 6(e). Upon EPA approval, Tennessee proposes to apply this permit system-wide, covering all new construction and maintenance activities involving the removal of facilities potentially contaminated with PCBs. However, Tennessee has not yet received a permit from the EPA. Therefore, we recommend that the above facilities remain in service until Tennessee has furnished copies of the application and EPA permit to the FERC for review and approval by the Director of OPPR.

5.2 RELATED NONJURISDICTIONAL FACILITIES

FERC's consideration of significant environmental impact extends to nonjurisdictional facilities when construction and operation of such facilities would not take place without the jurisdictional project. This EIS assesses the impact of related nonjurisdictional facilities on Federal-listed endangered and threatened species and cultural resources. Where we could determine the potential for other significant impact, we made recommendations as to the need for subsequent environmental reviews.

Endangered and Threatened Species Review

Section 7 of the Endangered Species Act, as amended (50 CFR Part 402), requires FERC to determine if a proposed project would jeopardize the continued existence of any Federal-listed or proposed endangered or threatened species, or result in the destruction or adverse modification of a species' designated critical habitat. FERC's responsibilities under Section 7 apply to jurisdictional and related nonjurisdictional facilities.

To comply with our Section 7 requirements, we requested information from the FWS regional and appropriate field office pertaining to the presence of Federal-listed or proposed endangered or threatened species in the proposed project area (Nickerson, 1989; USDOI, FWS, 1987). Based on this informal review, FERC determined that no Federal-listed or proposed endangered or threatened species would be affected by the construction of the related nonjurisdictional facilities and that a Section 7 biological assessment would not be required.

Cultural Resources Review

Section 106 of the NHPA requires FERC to assess the potential effect of a proposed project on any cultural property (prehistoric or historic sites, buildings, districts, or objects) listed in, or eligible for listing in, the NRHP, and to afford the ACHP an opportunity to comment on the project.

Assessment of potential impact or effects of construction and operation of the proposed pipeline would require substantive information on the historic value of each cultural property within the proposed right-of-way and the criteria used for evaluating such property.

The historic site files of the SHPOs in the Connecticut, New York, Massachusetts, and Rhode Island have been reviewed to determine if any of the proposed nonjurisdictional facilities are within, or proximate to, sites that are of known historic value.

Based on the data in these files and information developed from prior research in the vicinity of some of these properties, it would appear that archeological sites from all phases of the prehistoric, contact, and historic periods could be found within the affected area. This would include a broad range of functional types, from small single-function activity areas to major multicomponent occupation sites.

Project sponsors have initiated Section 106 consultation with the SHPOs for only the few nonjurisdictional facilities identified below. Following the review of the construction proposals by the FERC staff and each SHPO, the nonjurisdictional facility sponsor would most likely be advised through the applicant that construction of the proposed facilities could have a high probability of affecting identified and yet-to-be identified archeological resources. Should this be the case, FERC would recommend implementation of Phase I cultural resources studies (identification). If, during these identification studies, potential NRHP resources or sites that might contain such resources are identified, it would be necessary to carry out Phase 2 studies (evaluation of eligibility and potential impact). Further, any concerns expressed by the SHPOs regarding potential temporary or long-term effects on NRHP-listed or -eligible structural resources would have to be discussed and resolved.

To ensure compliance with Section 106 of the NHPA, we recommend the following conditions for certification of the jurisdictional project:

1. Each applicant or nonjurisdictional facility sponsor consult the appropriate SHPOs concerning the potential effect of project construction on cultural resources.

2. Utilizing SHPO input, the applicant or the nonjurisdictional facility sponsor should prepare work plans for review and approval. All required final Phase 1 and Phase 2 cultural resources survey reports should be filed through the jurisdictional project applicant.

3. Jurisdictional facility applicants should defer gas deliveries until we have reviewed and approved all Phase 1 and Phase 2 cultural resource survey reports and any required Phase 3 mitigation plans and reports; considered the comments of the appropriate SHPOs and the ACHP; and the Director of OPPR has informed the appropriate jurisdictional facility applicant that gas delivery may begin.

Site-Specific Assessment

The following is an assessment of related nonjurisdictional customer facilities. A map showing the general location of these facilities is contained in appendix A, figure A-1, sheet 1 of 1. Where appropriate, detailed location maps are also included in figure A-1. In many instances these facilities are undergoing state and local review. We recommend that prior to construction of the nonjurisidictional facilities the applicants certify that all necessary permits to construct and operate the nonjurisdictional facilities have been obtained.

Several shippers have identified no need for new nonjurisdictional facilities, or would need only minor accommodations. In these cases we feel no specific discussion in this EIS or further environmental review is required. These shippers include: BUG, Con Ed, Elizabethtown, New Jersey Natural, PSE&G, Boston Gas, Colonial, Connecticut Natural, Energy North, Essex County, Granite State, Southern Connecticut, and Valley Gas.

5.2.1 Iroquois Deliveries

5.2.1.1 Yankee Gas Services Company

5.2.1.1.1 Environmental Setting

Yankee proposes to construct one 0.2-mile lateral pipeline from the Iroquois mainline at MP 296.8 to serve an LDC customer in southern Connecticut (see figure A-3, sheet 1). The Yankee lateral totaling 0.2 mile would be located in medium-duty town roads. A scattered-to-moderate number of residences front on each road, and they would experience temporary minor inconveniences during the proposed construction. No other adverse effects are expected. No detailed design studies have been undertaken by Yankee to date.

5.2.1.1.2 Potential For Significant Environmental Effects

Given the limited disruption anticipated and the proposed location of the laterals in medium duty roadways, we believe there would be no significant adverse effect on the environment. Therefore, we conclude that no further NEPA review would be required.

5.2.1.2 Central Hudson Gas and Electric

5.2.1.2.1 Environmental Setting

Central Hudson operates two steam-generating stations (Danskammer Station and Roseton) on its property in Newburgh, New York. Roseton, which went into commercial operation in 1974, burns #6 oil in its two 600-MW units. Central Hudson proposes to convert both of its units to burn natural gas. In addition to fuel cost savings, this conversion would add to Central Hudson's diversity of fuel supply, and would ameliorate the sulfur and particulate emissions associated with residual fuel. To deliver natural gas to Roseton, two pipeline segments would be constructed. The 7.1-mile-long segment to the south would begin at a connection with Central Hudson's M-P gas pipeline in East Fishkill, New York, and proceed west, within the limits of an electric power line right-of-way, to the Hudson River. There it would cross to a point near the Danskammer Plant (see figure A-3, sheets 2 to 3). The 5.0-mile segment to the north would interconnect with the proposed Iroquois pipeline near the Pleasant Valley/LaGrange town line or at an Alternate location adjacent to our recommended Simon Alternative (see section 3.6.22), and proceed northwest within an existing electric power line right-of-way to a connection with Central Hudson's M-P gas pipeline.

Approximately 15 water bodies, including the Hudson River, would be crossed by the proposed pipeline segments. The proposed Hudson River crossing is in the vicinity of a recently installed submarine electric cable. Our review of that installation indicates that it was constructed in accordance with all applicable Federal and state permits. The only federally listed species known to occur in the project area is the shortnose sturgeon found in the Hudson River. However, this species would not be adversely affected, as construction would be timed to avoid migration periods.

About 10 drinking water supplies are within 1.5 miles of the proposed routes. None are known to occur within the proposed right-of-way. About 2,300 feet of wetland and 8.6 miles of forest would be crossed. Central Hudson has agreed to employ mitigation measures designed to minimize environmental impact during construction and restoration. No designated recreation areas would be affected by the pipeline routes. Several known historic or prehistoric properties listed in the SHPO's files are near the proposed routes but would not be traversed. Central Hudson would consult with the SHPO to ensure that unknown cultural resources would not be affected.

Central Hudson has applied for and received a Certificate of Environmental Compatibility and Public Need pursuant to Article VII of the New York State Public Service Law. The certificate is based on connecting with our recommended Simon Alternative.

5.2.1.2.2 Potential For Significant Environmental Effects

Based on studies completed by Central Hudson, review of the New York State Article VII administrative record, and field review, we believe that the proposed pipeline segments, if constructed in accordance with the construction and restoration practices proposed in the Article VII Recommended Decision, would not have a significant adverse effect on the environment. The conversion of both units of the Roseton plant to burn natural gas could even have beneficial effects on the environment. We recommend no further NEPA review.

5.2.1.3 Long Island Lighting Company

5.2.1.3.1 Environmental Setting

LILCO proposes to construct 6 miles of 20-inch-diameter pipe parallel to an existing 12-inch-diameter gas pipeline. The lateral line (as shown in figure A-3, sheet 5), would begin at a proposed meter station at the end of the Iroquois pipeline and follow a generally open undeveloped route through the towns of Smithtown and Huntington. The remainder of the lateral would follow residential streets as the route enters the town of Babylon. In addition to trenching and pipe laying, construction of the lateral would require a minimal amount of clearing. Construction of the pipeline would also require some road openings, resulting in temporary short-term inconveniences. Two prehistoric properties listed in the SHPO's files are proximate to the proposed lateral, and no known historic sites were identified.

LILCO is presently in the preliminary stages of design, and no environmental studies have been conducted, nor have permit applications been prepared.

5.2.1.3.2 Potential for Significant Environmental Effects

Based on submitted information and field review, we believe that construction of the proposed project would not cause significant adverse environmental effects if constructed in accordance with applicable regulations. Accordingly, no further NEPA review is required.

5.2.2 Tennessee Deliveries

5.2.2.1 JMC Selkirk, Inc.

5.2.2.1.1 Environmental Setting

JMC Selkirk proposes to construct a 79.9-MW combined cycle cogeneration facility in Selkirk, New York, at the GE plastics plant. Natural gas would be delivered to the cogeneration plant through a new 2.1-mile-long pipeline. The cogeneration plant, as shown in figure A-3, sheet 6, would be located on GE property next to the existing plant boiler house. The GE plant is located in a rural area with other adjacent industrial facilities, including a Conrail terminal. The nearest residence is approximately 3,300 feet from the proposed cogeneration plant site.

The pipeline would deliver natural gas from a new interconnection point on the existing Tennessee pipeline where it crosses Fuera Bush Road (Route 32). The pipeline route would parallel Route 32 for approximately 1 mile within the road right-of-way. The pipeline would diverge from Route 32 as it enters GE property, taking the shortest route to a plant road and then running parallel to that road until it enters the main plant building complex, where it would connect with the cogeneration plant.

The cogeneration plant would consist of a GE Frame 7 Quiet Combustor Turbine and a Heat Recovery Steam Generator with supplementary firing in a duct burner and a non-condensing steam turbine. The primary fuel would be natural gas, with up to 25 percent of the annual heat input provided by # 2 fuel oil. Nitrogen oxide emissions would be controlled with steam injection. A PSD air quality permit has been issued by NYDEC. The existing GE boilers would not operate simultaneously with the cogeneration facility, which should result in reduced annual sulfur dioxide and particulate matter emissions, and fewer NO_x and CO emissions.

The water requirements for the facility would be met using approximately 300,000 GPD of waste water from the GE plant, and a relatively small quantity of potable water (9,000 GPD). Waste water from the cogeneration plant would be treated and discharged through the existing GE system to the Hudson River. The addition of the cogenerating cycle will reduce water discharge into the river. The change in wastewater quantity and quality would require a modification to the GE NYPDES permit, which has been approved.

The impact of the cogeneration facility on noise levels has been evaluated and will demonstrate compliance with the NYPSC guidelines. The NYPSC requires that the noise levels generated by the facility not exceed 3 dBA above the minimum value of the L90 at the closest noise-sensitive receptor. This change is a barely perceptible increase in noise level.

The construction of the cogeneration facility would result in insignificant impact on wetlands and storm water runoff. Pipeline construction would require four minor stream crossings. Visual impact would be minimal, as the cogeneration facility would be located near existing GE plant buildings and stacks that are similar in size to the proposed facility. The New York SHPO's files were reviewed to determine whether historic or archeological resources were known to exist on or adjacent to the proposed cogeneration facility site and pipeline route. No significant historic sites or archeologically sensitive areas were identified.

The proposed cogeneration facility is subject to a comprehensive environmental impact review process administered by the NYDEC. This process includes the SEQRA, Part 201 Air Permit and NYPDES (see section 5.2.1.4.1). A SEQRA Negative Declaration has been issued. Securing the above permits and approvals should ensure that significant environmental effects are mitigated.

5.2.2.1.2 Potential for Significant Environmental Effects

Based on the information submitted by the project proponent and a field review of the cogeneration plant site and pipeline route, the proposed project, if constructed and operated in accordance with all relevant permits and regulations, would not have significant adverse effect on the environment and requires no further NEPA review.

5.2.2.2 MASSPOWER Inc.

5.2.2.2.1 Environmental Setting

MASSPOWER proposes to construct a 239-MW cogeneration facility at the Monsanto plant in Springfield, Massachusetts. Natural gas would be delivered to the site through a new pipeline constructed by Bay State. This new pipeline would serve several customers. Only the pipeline segments from MP 16.3 to MP 16.9 and MP 17.3 were considered in our evaluations.

The MASSPOWER cogeneration facility as shown in figure A-3, sheet 7 would be located within the Monsanto plant complex on an open parcel of land currently used for storage and parking adjacent to Monsanto's existing coal boiler. The 5-acre site is bounded on three sides by Monsanto property, with Worcester Road to the south. The nearest residence is approximately 1,500 feet from the site.

The proposed cogeneration facility would consist of two GE Frame 7 combustion turbines with heat recovery steam generators and one stream turbine. Nitrogen oxide emissions would be controlled to 9 ppm using selective catalytic reduction technology.

The Monsanto plant currently uses 4,000,000 GPD supplied by the City of Springfield for once-through cooling. The cogeneration facility would use this cooling water to meet its needs, requiring no increase in current water use. The cogeneration facility would not affect wetlands or storm water runoff, as the site has already been developed. Visual impact would be minimal, as the cogeneration facility would be located adjacent to existing Monsanto plant buildings and stacks of similar sizes.

The Massachusetts SHPO's files were reviewed to determine whether historic or archeological resources are known to exist on or adjacent to the proposed cogeneration facility. No significant historic sites were identified. The nearest archeological site is approximately 4,000 feet from the proposed cogeneration facility at Bircham Bend. This site is believed to be a prehistoric campsite of unknown cultural period.

The project proponent has filed most required applications for Federal, state, and local permits. The proposed cogeneration facility is subject to a comprehensive environmental impact review process consisting of local, state, and Federal permits and approvals. To date, the facility has received a MEPA certificate. Securing the above permits and approvals would ensure that any significant environmental effects are mitigated.

5.2.2.2.2 Potential for Significant Environmental Effects

Based on the information submitted by the project proponent and a field review of the cogeneration plant site and pipeline route, the proposed project, if constructed and operated in accordance with all relevant permits and regulations, would not have a significant adverse effect on the environment. Accordingly, no further NEPA review is required.

5.2.2.3 Pawtucket Power Associates Limited Partnership

5.2.2.3.1 Environmental Setting

Pawtucket proposes to construct a 61-MW cogeneration facility at the Colfax plant in Pawtucket, Rhode Island (see figure A3, sheet 8). Natural gas would be delivered through an existing Valley Gas pipeline adjacent to the site.

The cogeneration facility as shown in figure A-3, sheet 15 is located just north of the Colfax plant. The site is bordered on the east by railroad tracks used mainly by AMTRAK and the Boston-Providence Commuter Rail. I-95 is located on the other side of the railroad tracks. A cemetery and open field are on the western and northern site borders, respectively. The nearest residence is approximately 1,500 feet from the site.

The cogeneration facility would consist of a GE Frame 6 combustion turbine with a supplementary fired heat recovery steam generator and a 65 million Btu/hr auxiliary boiler. Nitrogen oxide emissions would be controlled to 9 ppm using selective catalytic reduction technology. Pawtucket has received the air emissions permit from the Rhode Island Division of Air and Hazardous Materials.

The cogeneration facility would use 586,000 GPD of water supplied by the City of Pawtucket. Waste water would be discharged to the Mashassuck River. Pawtucket has received approval for the water supply and wastewater discharge. The cogeneration facility's impact on wetlands was determined to be insignificant by the Rhode Island Division of Groundwater and Freshwater Wetlands.

Visual impact would be minimal as the cogeneration facility would be located near existing Colfax plant buildings and stacks of similar sizes. The Rhode Island SHPO's files were reviewed to determine whether historic or archeological resources are known to exist on or adjacent to the proposed cogeneration facility site. No significant historic sites or archeologically sensitive areas were identified.

Pawtucket has secured all necessary permits and approvals to construct the cogeneration facility. Plant construction is currently 60 percent complete with a planned in-service date of December 1990.

5.2.2.3.2 Potential for Significant Environmental Effects

Based on the information submitted by the project proponent and a field review of the cogeneration plant site, the proposed project, if constructed and operated in accordance with all relevant permits and regulations, would not have a significant adverse effect on the environment. Accordingly, no further NEPA review is required.

5.3 CUMULATIVE IMPACT

Cumulative impact could result when a new project is added to an area where other projects exist or are proposed. In such a situation, although the impact from the separate projects might be minor, the cumulative impact from all the projects in the area could be significant.

As described in section 1.0, in 1989 the Commission issued an order establishing four projects from the settlement proceeding to be discrete. Subsequently, the Commission suspended processing of the Champlain application. The discrete projects are Iroquois/Tennessee, Niagara Settlement, and ANR. The three projects involve pipelines, associated aboveground facilities, and related nonjurisdictional facilities proposed to be located in 19 states. Each is being addressed in detail in one or more environmental documents.

As shown in table 5.3-1, pipeline facilities for these three remaining discrete projects include approximately 1,654 miles of pipeline in 16 states. There are no locations where pipelines of more than one project would be constructed at the same location. However, in some instances, a new pipeline looping in one project would be extended in another project.

A total of 253,610 hp of compression would be constructed in 13 states. In a number of cases, proposed compression of one project would be added to new or existing sites proposed for compression in another project. However, the incremental impact of added compression is generally limited to air and noise resources. In no instance would these additions result in locally significant cumulative effects. Applicants must comply with Federal NSPS and PSD regulations as well as state air permit requirements. We limit noise increases to a Ldn of 55 dBA, the level which protects the public from activity interference and annoyance in residential areas.

Related nonjurisdictional facilities that are currently known include those for electric power generation, cogeneration, local distribution and system supply. Electric power generation and cogeneration plants include new plants and existing plants converting to natural gas as a primary fuel or those increasing their use of natural gas. No powerplants or cogeneration plants would be located adjacent to or close to each other within the six-state area where they are proposed. No locally significant cumulative impact would occur. New facilities for local distribution of natural gas or system supply are minor and serve discrete markets, which would preclude significant cumulative impact at the local level.

The combination of pipelines, aboveground facilities, and related nonjurisdictional facilities would have regional effects. Detailed analyses have been completed for Iroquois/Tennessee Phase I, all Niagara Settlement projects, and ANR Phase I. These comprise about 76 percent of the pipelines associated with these three discrete projects. No significant cumulative regional impact is reasonably likely for any general resource area and these are not discussed below. Sensitive resources including forestland, wetlands, endangered and threatened species, water resources, air quality, and land use are briefly discussed with respect to regional cumulative impact of the projects which have been analyzed in detail.

TABLE 5.3-1

Cumulative Facilities - Major Open Season Projects

FACILITIES	Unit	KS	MO	ID	MN	MI	WI	IL	IN	OH	KY	VA	MD	PA	NJ	NY	CT	RI	MA	NH
IROQUOIS/TENNESSEE																				
Phase 1																				
Pipelines	(Mi)														0	308.7	59.9	2.3	28.9	45
Compression	(HP)														0	5600	0	0	3050	0
Power/Cogen Plants	(No)														0	2	0	1	1	0
LDCs	(No)														0	7	4	1	4	1
Phase II																				
Pipelines	(Mi)															64.0	10.7	5.5	43.1	
Compression	(HP)															1000	12600	0	6500	
Power/Cogen Plants	(No)															0	0	1	1	
LDCs	(No)															0	3	0	2	
NIAGARA SETTLEMENT																				
SS-2																				
Pipelines	(Mi)													58.5	7.1	0				
Compression	(HP)													0	0	0				
Power/Cogen Plants	(No)													1	1	0				
LDCs	(No)													2	2	2				
TEMCO																				
Pipelines	(Mi)													15.7		60.0			2.0	
Compression	(HP)													7000		8100			0	
Power/Cogen Plants	(No)													0		0			2	
LDCs	(No)													0		3			0	
NIP																				
Pipelines	(Mi)				76.8	337.5	45.3					0		12.5	3.4	36.0	6.0	2.1	24.5	
Compression	(HP)				0	0	0					0		18750	12000	17850	0	5500	0	
Power/Cogen Plants	(No)				0	0	0					1		2	2	4	0	0	0	
LDCs	(No)				0	0	0					0		0	1	4	0	1	1	
ANR																				
Phase I																				
Pipelines	(Mi)	52.8	20.2	14.8				0		0.3			0	8.3	8.9			3.4	11.0	
Compression	(HP)	8000	3000	6000				2000		1600			9600	1200	0			0	0	
Power/Cogen Plants	(No)	0	0	0				2		0			0	0	1			1	1	
LDCs	(No)	0	0	0				0		0			0	0	1			0	0	
Phase 2																				
Pipelines	(Mi)						21.7	0	9.5	15.8	63.2	0		137.7	12.1	19.0				
Compression	(HP)						0	2200	0	66960	0	600		54500	0	0				
Power/Cogen Plants	(No)						0	0	0	0	0	0		0	0	0				
LDCs	(No)						0	0	0	0	0	0		0	0	0				
CUMULATIVE																				
Pipelines	(Mi)	52.8	20.2	14.8	76.8	337.5	67.0	0	9.5	16.1	63.2	0	0	232.7	31.5	487.7	76.6	13.3	109.5	45.0
Compression	(HP)	8000	3000	6000	0	0	0	4200	0	68560	0	600	9600	81450	12000	32550	12600	5500	9550	0
Power/Cogen Plants	(No)	0	0	0	0	0	0	2	0	0	0	1	0	3	4	6	0	3	5	0
LDCs	(No)	0	0	0	0	0	0	0	0	0	0	0	0	2	4	16	7	2	7	1

The majority of forestland clearing (1,954 acres) would take place in New York and Connecticut, primarily from the clearing of 368.6 miles of new right-of-way required for the proposed Iroquois/Tennessee Project. Both the Niagara Import Project and the SS-2 project would require the clearing of 874 acres and 376 acres, respectively, primarily in the midwest. The Temco Project is the only other project that would require substantial clearing of forestland (157 acres) in the northeast, primarily spread over 76 miles of pipeline loop in both Pennsylvania and New York. The ANR Phase I project would clear approximately 35 acres of forestland in ten mid-west and northeast states. Since the Iroquois/Tennessee Project is the only project clearing primarily new rights-of-way, we do not expect any cumulative impact due to forest fragmentation from pipeline construction in the Northeast, other than those effects described in section 5.1.4.2. As noted in section 5.1.6, approximately 33 percent of the forestland cleared during construction would be allowed to permanently revegetate to a forested condition.

The Iroquois/Tennessee Pipeline Project would to disturb 257 acres of wetland (both emergent and forested) in the Northeast, primarily in New York. Although the Niagara Import Project and the SS-2 Project would disturb 536 acres and 9 acres, respectively, this would occur primarily in Minnesota, Wisconsin, and Michigan. The Temco Project would disturb 31 acres of mixed wetland type in both Pennsylvania and New York, while ANR Phase I Project would disturb 21 acres. Since pipeline construction would not result in the loss of wetlands or an appreciable alteration of their functional value, we do not feel there would be a significant cumulative impact on this resource. Although forested wetland habitat values would change temporarily, regrowth of woody vegetation across the entire right-of-way would preclude this from being a significant cumulative impact over a 19-state area.

Five federally-listed species have been identified in the vicinity of the proposed Iroquois/Tennessee Phase I Pipeline Project. For this project, we have determined that by incorporation of our recommended mitigation measures, no affect would occur to these species or any other individuals of these federally-listed species. The same determination has been made for the projects associated with the Niagara Settlement and ANR. Consequently, there would be no cumulative impact to the populations or distributions of any federally-listed species within the United States.

A total of 380 perennial water bodies would be crossed by the Iroquois/Tennessee Project in New York and throughout New England. The Niagara Import Project would cross 228 waterbodies, primarily in the midwest, while the Temco Project would cross an additional 56 waterbodies in Pennsylvania and New York and the SS-2 project would cross 26 streams in Pennsylvania and New Jersey. The ANR Phase I Project would cross 27 streams located throughout seven midwest and northeast states. The temporary nature of the impact from pipeline construction on surface waters and the wide geographic distribution of the above mentioned projects would preclude any significant cumulative impact on the water resources of any region.

The projects analyzed in detail would have both negative and beneficial affects on air quality. No significant adverse regional cumulative effects would occur. NO_x emissions from compressor stations would total approximately 2,457 tons per year, assuming continuous operation dispersed over a 11-state area. This compares with total regional NO_x emissions of appproximately 6.3 million tons/year (EPA, 1986). However, construction of the projects would have a net beneficial effect by allowing for increased use of natural gas by local distribution companies, cogeneration, and power generation customers. For all the projects the beneficial effect of using natural gas would be to reduce emissions of NO_x by 34,900 tons per year and SO_2 by 73,200 tons per year relative to fuel oil, coal, and wood under the 100 percent subsitution scenario (see section 3.1).

Approximately 370 residences within 50 feet of the construction rights-of-way and 159 public interest areas would be affected in the 14 state area where pipelines would be constructed. Construction related effects on residential and public interest areas would be temporary and would be minimized through the mitigative techniques described in section 5.1.9. These resources are by their nature local and not regional and, therefore, regional cumulative effects would not occur.

In summary, where specific features of an individual project could be significant, we have recommended route variations or other measures to minimize potential adverse effects. Similar actions would be taken for facilities yet to be analyzed in detail. We believe that because of our recommended mitigation measures there are no resources within the 19-state area that would experience significant cumulative impact.

6.0 COMPARISON OF PROPOSED ACTIONS WITH THE ALTERNATIVES

A total of 78 route variations were addressed in the DEIS; 76 of these were associated with the proposed Iroquois route and 2 were associated with Tennessee's North Haven Extension. Since the DEIS was published, Tennessee has amended their application and has eliminated the North Haven Extension. Therefore, this section only addresses route variations associated with the proposed Iroquois route.

During the DEIS comment period, 42 new variations to the proposed Iroquois route were identified. In addition, information was provided which resulted in the reevaluation of 28 of the original 76 Iroquois variations.

Section 6.1 includes the comparative analyses presented in the DEIS for those variations that have not been modified or reevaluated. Section 6.2 includes an analysis of the route variations and modifications identified during the DEIS comment period. Variations originally presented in the DEIS that have been modified or reevaluated are so noted in section 6.1 and are also evaluated in section 6.2.

6.1 VARIATIONS TO THE PROPOSED IROQUOIS ROUTE AS EVALUATED IN THE DEIS

This section provides a description and comparison of the impact associated with the route variations to the proposed Iroquois route that were identified in the DEIS and that have not been modified or reevaluated as a result of comments. Those variations for which modifications were suggested or which were reevaluated are addressed in section 6.2. Table 6.1-1 provides a summary of the comparisons for the route variations addressed in section 6.1. Table 6.1-2 provides a summary of the comparisons for the wetland mitigation variations addressed in section 6.2.

6.1.1 St. Lawrence Wetland Variation

The St. Lawrence Wetland Variation was evaluated in the DEIS. Based on additional information received during the comment period, this variation was reevaluated. The description of the original variation and the results of the reevaluation are presented in section 6.2.1.

6.1.2 Morey Ridge Variation

The Morey Ridge Variation would be approximately 300 feet longer than the proposed route. The route variation would reduce the area of wetland disturbed by approximately 1.5 acres and would reduce the area of forest cleared by approximately 0.6 acre. The variation would, however, increase the amount of agricultural land disturbed from approximately 8.3 acres to 9.8 acres. The slight shift in the crossing of Brandy Brook would not result in any appreciable change in impact.

The NYDAM has expressed concern with this route variation because of the increased disturbance of managed farm fields. Considering the recommended mitigation, we feel that the short term impact on agricultural fields is environmentally preferable to the clearing of forested areas and the disturbance of wetlands. Consequently, in order to reduce the impact on wetlands, we recommend that this route variation be adopted.

TABLE 6.1-1

Comparison of Iroquois Proposed Route and Route Variations

Section No.	Variation Name/ Environmental Factor	Variation	Proposed Route	Comment
6.1.2	Morey Ridge MP 10 to MP 11			
	• Total miles	1.07	1.01	
	• Minor river/stream crossings	1	1	Brandy Brook
	• Streams classified for trout	1	1	walleye spawning stream
	• Wetlands (ac.)	.57	2.06	scrub/shrub
	• Forest cleared (ac.)	2.53	3.10	
	• Active or rotated cropland (ac.)	9.76	8.29	
6.1.3	Fulton Road MP 11.6 to MP 12.5			
	• Total miles	.83	.83	
	• Wetlands (ac.)	1.38	5.67	forested and scrub/shrub
	• Forest cleared (ac.)	0	1.15	
	• Active or rotated cropland (ac.)	9.99	8.49	
6.1.6	Marshville Wetland MP 30.2 to MP 31			
	• Total miles	.9	.8	
	• Areas of steep slope encountered	1	1	
	• Wetlands (ac.)	0	.48	emergent
	• Forest cleared (ac.)	1.14	.45	
	• Active or rotated cropland (ac.)	6.42	4.36	
6.1.7	Edwards MP 41.1 to MP 43.5			
	• Total miles	2.3	2.4	
	• Parallel to existing ROW (mi.)	2.3	0	
	• Areas of steep slopes encountered	1 (.9 mi)	1 (.2 mi)	
	• Minor river/stream crossings	4	3	
	• Major river crossings	1	1	
	• Wetlands (ac.)	.9	1.0	emergent, scrub/shrub and forested
	• Forest cleared (ac.)	14.92	11.2	
	• Active or rotated cropland (ac.)	4.36	11.02	
6.1.9	Harrisville MP 53.2 to MP 54.7			
	• Total miles	1.1	1.5	
	• Areas of steep slopes encountered	1	1	
	• Minor river/stream crossings	2	2	W.Branch Oswegatchie tributaries
	• Public water supply wells within .5 miles	0	3	all within 0.2 miles
	• Wetlands (ac.)	.8	1.82	forested, scrub/shrub & emergent
	• Significant habitats within 1.5 miles of pipeline centerline	2	2	osprey nest and northern cedar swamp
	• Threatened and endangered species within 1.5 miles	1	0	osprey (state-listed)
	• Forest cleared (ac.)	13.3	16.1	
	• Active or rotated cropland (ac.)	0	.5	
	• New pipeline w/in 50' of existing residences	0	2	
	• State Forest or State Parks crossed (ft.)	900	0	
	• Other: Softwood Plantation (ac.)	0	1.8	

TABLE 6.1-1 (cont'd)

Section No.	Variation Name/ Environmental Factor	Variation	Proposed Route	Comment
6.1.10	<u>Diana Sugarbush</u> <u>MP 57.7 to MP 59.1</u>			
	• Total miles	1.44	1.33	
	• Wetlands (ac.)	0	1.09	scrub/shrub
	• Forest cleared (ac.)	12.17	13.77	
	• Other: Sugarbush (mi.)	.19	.66	
	<u>Croghan Sugarbush</u> <u>MP 73.6 to MP 74</u>			
	• Total miles	.47	.41	
	• Wetlands (ac.)	1.84	1.09	forested Putnam Swamp
	• Forest cleared (ac.)	3.79	4.48	
	• Active or rotated cropland (ac.)	1.72	.92	
	• Other: Sugarbush (mi.)	0	0.2	
6.1.11	<u>Jadwin Memorial State Forest</u> <u>MP 57.3 to MP 76.3</u>			
	• Total miles	13.0	18.3	
	• Areas of steep slopes encountered (mi.)	3	2	
	• Minor river/stream crossings	13	16	
	• Streams classified for trout	6	10	
	• Public surface water supplies crossed	1	0	Indian River
	• Wetlands (ac.)	9.1	17.3	
	• Significant habitats within 1.5 miles of pipeline centerline	1	2	
	• Forest cleared (ac.)	94.6	204.7	
	• State Forest or State Parks crossed (ft.)	15,900	0	
	• Other: Sugarbush (ft.)	5,200	9,700	
6.1.12	<u>Indian Pipe State Forest</u> <u>MP 83.5 to MP 85.7</u>			
	• Total miles	1.89	2.19	
	• Areas crossed with slopes greater than 15 percent (mi.)	1	1	
	• Minor river/stream crossings	2	4	
	• Streams classified for trout	1	2	
	• Wetlands (ac.)	0	.36	scrub/shrub
	• Significant habitats within 1.5 miles of pipeline centerline	0	1	
	• Forest cleared (ac.)	16.1	20.6	
	• Active or rotated cropland (ac.)	6.9	2.9	
	• State Forest or State Parks crossed	1	0	Indian Pipe-300'
6.1.14	<u>Little Falls Watershed</u> <u>MP 142.9 to MP 144.3</u>			
	• Total miles	1.4	1.5	
	• Minor river/stream crossings	1	2	Tributary of Basic Creek
	• Streams classified for trout	0	1	
	• Public surface water supplies crossed	1	2	Little Falls
	• Wetlands (ac.)	.11	1.82	forested, emergent
	• Forest cleared (ac.)	0	5.74	
	• Active or rotated cropland (ac.)	10.79	5.97	

TABLE 6.1-1 (cont'd)

Section No.	Variation Name/ Environmental Factor	Variation	Proposed Route	Comment
6.1.15	<u>Basic Creek Wetland</u> <u>MP 213.1 to MP 213.9</u>			
	• Total miles	.8	.8	
	• Minor river/stream crossings	2	2	Basic Creek & Tributary
	• Streams classified for trout	1	1	stocked
	• Wetlands (ac.)	.11	1.58	forested
	• Forest cleared (ac.)	6.77	6.89	
	• New pipeline within 50 feet of existing residences	1	0	
6.1.16	<u>Greenport Orchard</u> <u>MP 234.5 to MP 235</u>			
	• Total miles	.5	.5	
	• Parallel to existing ROW. (mi.)	0	0	
	• Areas of steep slopes traversed (mi.)	3	0	
	• Minor river/stream crossings	1	0	intermittent
	• Forest cleared (ac.)	1.9	0	
	• Active or rotated croplands (ac.)	.69	1.03	not including orchards
	• Other: Orchard (ft.)	0	900	
6.1.21	<u>Anne's Alternative #3</u> <u>MP 260.2 to MP 265.9</u>			
	• Total miles	5.8	5.7	
	• Parallel to existing ROW (mi.)	0	.55	
	• Areas of steep slopes encountered	4	4	
	• Minor river/stream crossings	3	6	perennial streams
	• Major river crossings	1	1	Wappinger Creek
	• Streams classified for trout	1	1	Wappinger Creek, cold-water stocking
	• Wetlands (ac.)	0	3.27	forested
	• Threatened and endangered species within 1.5 miles	1	2	Blanding's turtle
	• Forest cleared (ac.)	33.2	24.9	
	• Active agriculture (ac.)	35.2	27.9	
	• Potential or existing Federal or State Wild and Scenic Rivers crossed or affected	1	1	Wappinger Creek
	• Other: Proximity to Day Care Center	0	1	
6.1.22	<u>Simon Alternative</u> <u>MP 267.3 to MP 271.7</u>			
	• Total miles	5.2	4.4	
	• Parallel to existing ROW (mi.)	4.3	0	
	• Areas of steep slope encountered (mi.)	3	5	
	• Minor river/stream crossings	3	6	
	• Public water supply wells within .5 miles	2	1	apartments
	• Wetlands (ac.)	1.9	3.27	forested, scrub/shrub
	• Significant habitats within 1.5 miles of pipeline centerline	1	1	
	• Threatened and endangered species within 1.5 miles	1	1	Blanding's turtle
	• Forest cleared (ac.)	50.0	35.5	
	• Active Agriculture (ac.)	6.8	3.4	
	• New pipeline adjacent to existing residential areas (mi.)	0.1	0.2	
	• Other: Taconic State Parkway	1	1	

TABLE 6.1-1 (cont'd)

Section No.	Variation Name/ Environmental Factor	Variation	Proposed Route	Comment
6.1.23	<u>Gidley Road</u> <u>MP 272.1 to 272.4</u>			
	• Total miles	.38	.38	
	• Parallel to existing ROW (mi.)	.38	.38	
	• Minor river/stream crossings	1	1	Tributary to Sprout Creek
	• Streams classified for trout	1	1	coldwater-trout stocked
	• Forest cleared (ac.)	2.75	2.98	
	• New pipeline adjacent to existing residential areas (mi.)	1	0	
	• Other: Taconic State Parkway	1	1	
6.1.24	<u>Dover</u> <u>MP 281.7 to MP 282.5</u>			
	• Total miles	.76	.74	
	• Parallel to existing ROW (mi.)	.34	0	
	• Areas crossed with slopes greater than 15 percent (mi.)	.02	.09	
	• Forest cleared (ac.)	5.97	4.71	
	• Active or rotated cropland (ac.)	1.15	1.15	
	• Other: Mica Products	1300	2600	Distance from
	Vincent Landfil	500	0	
6.1.27	<u>Still River</u> <u>MP 297.5 to MP 298</u>			
	• Total miles	.5	.5	
	• Parallel to existing ROW (mi.)	.2	.5	electric line
	• Minor river/stream crossings	1	1	Still River
	• Wetlands (ac.)	.45	1.21	
	• Significant habitats within 1.5 miles of pipeline centerline	1	1	
	• Forest cleared (ac.)	2.3	2.0	pasture
	• Other: Dog Pound	1	0	Conrail, electric road
	Still Rivers Meanders Natural Area	1	1	
6.1.28	<u>Algonquin</u> <u>MP 307 to MP 308.1</u>			
	• Total miles	1.38	1.36	
	• Parallel to existing ROW (mi.)	1.3	1.3	Algonquin
	• Minor river/stream crossings	2	2	unnamed
	• Wetlands (ac.)	2.8	.95	
	• Forest cleared (ac.)	14.70	15.15	
	• New pipeline within 50 feet of existing residences	1	3	
6.1.30	<u>Pootatuck River</u> <u>MP 311.0 to MP 311.4</u>			
	• Total miles	.4	.4	
	• Parallel to existing ROW (mi.)	.1	0	
	• Streams classified for trout	1	1	coldwater-stocking
	• Wetlands (ac.)	.1	.4	Federal & State
	• Forest cleared (ac.)	4	4.7	
	• New pipeline within 50 feet of existing residences	1	1	same house
	• New pipeline that would cross proposed approved subdivisions (ft.)	1900	2300	

TABLE 6.1-1 (cont'd)

Section No.	Variation Name/ Environmental Factor	Variation	Proposed Route	Comment
6.1.32	**Blakeman** MP 323.1 to MP 323.8			
	• Total miles	.7	.6	
	• Wetlands (ac.)	0	.4	Federal and State
	• Significant habitats within 1.5 miles of pipeline centerline	2	2	
	• Threatened and endangered species within 1.5 miles	1	1	plant species
	• Forest cleared (ac.)	5.2	6.7	
	• Active or rotated cropland (ac.)	1.45	0	
	• New pipeline that would cross proposed approved subdivisions	1	1	Summer Field Manor
	• Other: Parallel to proposed ROW (ft)	1800	0	
6.1.34	**Milford** MP 331.1 to MP 332.8			
	• Total miles	2.1	1.7	
	• Parallel to existing ROW (mi.)	.65	0	
	• Minor river/stream crossings	1	1	
	• Public surface water supplies crossed	1	1	Beaver Brook (inactive)
	• Wetlands (ac.)	3.78	1.95	
	• Forest cleared (ac.)	10.5	14.3	
	• New pipeline within 50 feet of existing residences	0	1	

TABLE 6.1-2

Comparison of Wetland Mitigation Variations and Proposed Route

Name	Beginning MP	Length (ft)	Type of Wetland	Wetlands a/ (ft)	Forest (ft)	Agriculture (ft)	Active b/ Other (ft)	No. of Streams Crossed
Eddie Pyrites	23.7							
Variation		3,330	PEM5E	50	1,550	1,500	280	0
Proposed		3,220	PEM5E/PFO1E	1,370	800	2,150	270	0
DeKalb Wetland	27.4							
Variation		8,700	R30WH	300	1,900	450	6,350	3
Proposed		8,400	PEM5A, R30WH	740	1,700	450	6,250	3
Hermon Wetland	32.2							
Variation		14,800	PFO1E, PFO/SS1E6	0	13,400	60	1,340	2
Proposed		15,300	PFO5/OWFB, PSSI/EMSE6	2,270	14,100	350	850	3
Pond Road Wetland	35.9							
Variation		2,700	PEM5E	150	1,800	0	900	1
Proposed		2,500	PEM5E	370	1,600	0	900	1
Firefall Wetland	38.3							
Variation		4,200	PFO5F6	400	4,200	0	0	3
Proposed		4,200	PFO1E	900	4,200	0	0	3
Wolf Lake Wetland	39.5							
Variation		2,500	-	0	2,500	0	0	0
Proposed		2,400	PFO1E	160	2,400	0	0	0
Mott Creek	47.9							
Variation		1,200	PSS1E	50	1,200	0	0	0
Proposed		1,500	PF04B, PSS1E	260	1,500	0	0	0
Route 812 Wetland	52.5							
Variation		2,100	PEM5A	50	850	700	550	1
Proposed		2,000	PEM5A	1,000	900	600	500	1
Route 3 Wetland	54.9							
Variation		8,500	PSS1E	950	5,950	0	2,550	0
Proposed		8,500	PSS1A, PFO1E, PF046/4E	2,380	6,050	0	2,450	0
Hogsback Creek	60.0							
Variation		9,700	PSS1E	200	9,700	0	0	1
Proposed		9,870	PFO1E/PSS1E	1,480	9,870	0	0	1

TABLE 6.1-2 (cont'd)

Name	Beginning MP	Length (ft)	Type of Wetland	Wetlands a/ (ft)	Forest (ft)	Agriculture (ft)	Active b/ Other (ft)	No. of Streams Crossed
Blanchard Creek	63.3							
Variation		700	-	0	700	0	0	1
Proposed		900	PFO4B	0	900	0	0	1
Indian River	64							
Variation		2,650	-	0	2,650	0	0	0
Proposed		2,600	PSS1E	260	2,600	0	0	0
Punky Swamp	66.5							
Variation		12,989	PEM5E6	700	12,989	0	0	2
Proposed		12,514	PEM5E6, PSS1, EM5E	1,900	12,514	0	0	3
Greig Wetland	93.2							
Variation		2,150	-	0	2,000	0	150	0
Proposed		2,000	ROWH, PSS1	1,000	2,000	0	0	0
Kent Creek	113.0							
Variation		4,000	-	0	0	0	4,000	1
Proposed		3,900	PFO/PSS1	370	2,000	0	1,900	1
South Kayuta Lake	119.4							
Variation		3,800	-	0	3,800	0	0	0
Proposed		3,400	PFO1	1,110	3,400	0	0	0
Cady Brook	123.2							
Variation		1,300	-	0	450	500	350	0
Proposed		1,200	PFO1	370	700	0	500	0
Big Bill Brook	138.6							
Variation		6,330	-	0	3,000	1,300	2,030	3
Proposed		5,800	PFO1	920	2,600	450	2,750	4
Mohawk River	154							
Variation		3,000	ROWH	500	1,200	1,200	600	1
Proposed		2,800	ROWH, PSS1/EM	1,160	1,350	1,100	350	1
Canajoharie Wetland	164.9							
Variation		3,500	PSS1	50	100	2,500	900	1
Proposed		3,400	PEM, PSS1	210	0	2,750	650	1
Route 162 Wetland	182							
Variation		5,100	PFO/SS1	?	500	3,250	1,350	2
Proposed		5,100	PFO/SS1	260	450	4,550	100	2

TABLE 6.1-2 (cont'd)

Name	Beginning MP	Length (ft)	Type of Wetland	Wetlands a/ (ft)	Forest (ft)	Agriculture (ft)	Active b/ Other (ft)	No. of Streams Crossed
Woodlawn Cemetery	199.0							
Variation		6,100	-	0	1,680	2,400	2,050	1
Proposed		5,800	PSS1	1,160	1,700	2,350	1,750	1
Route 133 Wetland	302.9							
Variation		1,050	0	0/300 c/	300	0	750	0
Proposed		1,400	-	0/550	1,050	0	350	0
Bound Swamp Wetland	305.1							
Variation		2,640	PEME	50/1,100 c/	1,800	0	840	1
Proposed		2,640	PF01E/POWH	840/2,000	900	0	1,740	1
Lands End Wetland	305.6							
Variation		4,220	PEME	50/1,000 c/	2,050	0	2,170	1
Proposed		4,220	PEME/PF01E	1,110/1,600	2,250	0	1,970	1

a/ Wetland length takes into account both USFWS National Wetland Inventory mapping and state-regulated wetland mapping. The greatest length combining both mapping systems has been used.

b/ Active agriculture includes cropland, hay fields and active pasture.

c/ NWI wetland/wetland based on hydric soil mapping - variations Iroquois proposed to minimize combination federal wetlands and wetlands based on Connecticut delineation procedures which rely solely on hydric soils. While we consider hydric soils alone as an adequate basis for wetland delineation if no other resources would be adversely affected we have recommended adoption.

6.1.3 Fulton Road Variation

The route variation would appear to eliminate the traversing and bordering of forested and scrub-shrub wetland for a distance of approximately 2,470 feet. However, this apparent benefit would be gained at the expense of increased disruption of agricultural areas. Upon reviewing the aerial photography, we feel that the impact on these wetlands can be avoided without resorting to the routing provided by the variation. We believe the intent of the proposed route was to avoid approximately 1,100 feet of forested wetlands by keeping the right-of-way in the agricultural areas at the edge of the wetlands. Therefore, we recommend that the proposed route be followed in this area, and no forested wetland clearing be undertaken between MP 11.7 and MP 12.2. This recommendation is in agreement with comments provided by the NYSTF.

6.1.4 Dandy Road Wetland Variation

The Dandy Road Wetland Variation was evaluated in the DEIS. Based on additional information received during the comment period, this variation was reevaluated. The description of the original variation and the results of the reevaluation are presented in section 6.2.3.

6.1.5 Canton Wetland Variation

The Canton Wetland Variation was evaluated in the DEIS. Based on additional information received during the comment period, this variation was reevaluated. The description of the original variation and the results of the reevaluation are presented in section 6.2.5.

6.1.6 Marshville Wetland Variation

Impact of this variation that is different from the proposed route is primarily related to agriculture, wetlands, and forest. The route variation would disturb a total of 6.42 acres of active agricultural land as compared with 4.36 acres along the proposed route. This includes approximately 2.3 acres of row crops that would be lost for at least one growing season. The variation would result in slightly more forest clearing but would avoid 0.5 acre of emergent wetland crossed by the proposed route. We feel the proposed route should be followed, since it is slightly shorter and affects less agricultural and forestland. The amount and type of wetland affected by the proposed route would not result in a significant impact. We note that in their comments on the DEIS, Iroquois agreed with this recommendation while the NYSTF supported the variation.

6.1.7 Edwards Variation

We assumed that if the pipeline were constructed along the variation alignment adjacent to the NYPA's 765 kV transmission line, the pipeline would be placed approximately 10 feet from the edge of the existing right-of-way. Paralleling the existing transmission line right-of-way in this area would reduce the length of the route by about 0.1 mile. The route variation would cross four minor stream courses, as compared to three along the proposed route. About 1.5 acres less wetland area would be crossed by the variation. Although the route variation would cross less wetland area, it would cross through the center of three wetland parcels including one herbaceous wetland, while the proposed route would cross through the border areas of each of the three wetlands. The proposed route would cross several agricultural fields and consequently require less forest clearing than the route variation. The route variation would, however, require blasting of rock outcrops in the immediate vicinity of transmission line towers, which could affect the structural integrity of the towers. In addition, more side slopes would be crossed with the variation, which could create the need for larger slope cuts to create a working bench for pipe installation. Considering the constraints encountered along the route variation, we recommend that the proposed route be adopted between MP 41.1 and MP 43.5.

6.1.8 Route 58 Wetland Variation

The Route 58 Wetland Variation was evaluated in the DEIS. Based on additional information received during the comment period, this variation was reevaluated. The description of the original variation and the results of the reevaluation are presented in section 6.2.9.

6.1.9 Harrisville Variation

The Harrisville Variation would be approximately 0.4 mile shorter than the proposed route. The route variation would require the clearing of approximately 13.3 acres of forest, half of which would be allowed to revert back to forest. The proposed route would require the clearing of approximately 16.1 acres of forest, including 1.8 acres of active forest plantation. The proposed route would disrupt 0.5 acre of agricultural land and would be located within 50 feet of two residences; the route variation would avoid both the agricultural land and the residences. Both the proposed route and the route variation would avoid sugarbush. Both routes would cross two unnamed tributaries. The route variation would reduce the amount of wetlands disrupted from approximately 1.82 acres to 0.8 acre.

It is apparent from the evaluation of this route variation that the more direct route through the state forestland is environmentally preferable, resulting in reduced impact in terms of disruption to forestland, wetlands, and residences. The only disadvantages of the route variation are that it would traverse the Bonaparte Cave State Forest for 2,000 feet (according to NYSTF comments highlighting recent additional acquisitions) and that it would move the right-of-way closer, but still remain more than 1 mile away, from osprey habitat (state-listed threatened species). Since we do not consider the crossing of state forestland to be environmentally detrimental, we recommend that this route variation be followed.

6.1.10 Sugarbush Variations

Impact of the Diana and Croghan Sugarbush Variations is similar to the proposed route segments they would replace. The Diana Sugarbush Variation would be similar in length, result in 1.9 acres less wetland cleared, and have 1.6 acres less forest cleared. The Croghan Sugarbush Variation would be similar in length, result in 0.7 acre less wetland cleared, have 0.69 acre less forest cleared, and disrupt 0.8 acre more of active agricultural land. However, the Diana Sugarbush Variation would reduce the amount of sugarbush cleared from 0.66 acre to 0.19 acre and the Croghan Sugarbush Variation from 2.07 acres to none. We recommend that these variations be adopted due to the smaller amount of sugarbush which would be affected without any significant effect on other resources. We note, however, that should the Commission certify the Jadwin Memorial State Forest

Variation, neither the proposed route nor the Diana and Croghan Sugarbush Variations in this area would be necessary.

We further recommend that, if our Jadwin Memorial State Forest Variation is adopted, the New Bremen Sugarbush Variation (as discussed in section 6.2.10) be modified by following the Sugarbush Connector shown on figure A-1, sheet 12 of 57.

The New Bremen Sugarbush Variation was evaluated in the DEIS. Based on additional information received during the comment period, this variation was reevaluated. The description of the original variation and the results of the reevaluation are presented in section 6.2.10.

6.1.11 Jadwin Memorial State Forest Variation

The route variation is 5.3 miles shorter than the proposed route and it affects fewer streams (13 versus 16), less wetland (9.1 acres versus 17.3 acres), less clearing (94.6 acres versus 204.7 acres), and less sugarbush (5,200 feet versus 9,700 feet). The variation would be closer to more homes and would cross both Carley Swamp, and Jadwin Memorial Forest. The proposed route would cross one class I wetland.

Both the proposed route and route variation can be improved environmentally by modifying the alignments evaluated herein. The route variations along the proposed route from MP 57.7 to MP 59.1, MP 60.0 to MP 61.9, MP 63.3 to MP 63.5, MP 64 to MP 64.5, MP 66.5 to MP 69, and a portion of a sugarbush variation between MP 73.6 and MP 74, are discussed in subsequent sections. Along the Jadwin Memorial State Forest Variation, we recommend the route be modified to avoid Carley Swamp by beginning at MP 58.2, and modified south of Erie Canal Road to avoid sugarbush by connecting with the Croghan Sugarbush Variation. The alignment of our proposed Sugarbush Connector is shown on figure A-1, sheet 12.

We concluded that the Jadwin Memorial State Forest Variation is environmentally superior to the proposed route, and we recommend its adoption. This recommendation is also consistent with the consensus among New York Article VII interested parties, who felt the proposed route to be environmentally inferior to a shorter Jadwin Memorial State Forest Route (NYPSC, 1989). Adoption of our proposed modifications for either route would not change our overall recommendation.

6.1.12 Indian Pipe State Forest Variation

The proposed route variation is approximately 0.3 mile shorter than the proposed route (1.89 miles versus 2.19 miles). The difference in impact between the variation and the proposed route is directly related to the difference in length. The route variation would require the clearing of approximately 16.1 acres of forest (half of which would revert to forest following construction); would disrupt approximately 6.9 acres of agricultural land; and would not cross any wetlands. The proposed route would require the clearing of approximately 20.6 acres of forest; would disrupt approximately 2.9 acres of agricultural land; and would traverse a scrub-shrub wetland for a distance of approximately 160 feet.

The route variation would include two stream crossings, one of which is designated for trout spawning; while the proposed route would traverse four streams, two of which are designated as trout fisheries.

According to records obtained from the NYDEC by Iroquois, the state forest preserve that would be traversed by the route variation is managed as a jack pine plantation. The variation would require clearing of approximately one acre of this plantation. The remaining forested areas along the route variation, as well as the forested areas along the proposed route, consist of northern hardwood-hemlock, and northern hardwoods-white pine forest type. These other forested areas generally have similar characteristics; the average dbh is generally greater than 8 inches, and stand density is moderate to high.

Considering the difference in length, the amount of forested acreage to be cleared, and the number and type of streams that would be crossed, we find the route variation traversing the state forest preserve to be environmentally preferable to the proposed route in this area. We, therefore, recommend that the route variation be adopted. We note, however that a new variation proposed for the Independence River crossing, if adopted, would negate the Indian Pipe State Forest Variation (see section 6.2.11).

6.1.13 Rose Valley Landfill Variation

The Rose Valley Landfill Variation was evaluated in the DEIS. Based on additional information received during the comment period, this variation was reevaluated. The description of the original variation and the results of the reevaluation are presented in section 6.2.19.

6.1.14 Little Falls Watershed Variation

Impact of this variation that is different from the proposed route is primarily associated with Beaver Creek, wetlands, forestland, and active agricultural land. The route variation would be about 500 feet shorter than the proposed route and would avoid all forestland. The proposed route would result in the clearing of 5.74 acres of forestland.

The route variation would cross one tributary of Beaver Creek, which leads to the Little Falls public surface water supply, whereas the proposed route would cross two tributaries of Beaver Creek. The other tributary, crossed only by the proposed route, is also a significant trout fishery. Potential impact on the reservoir includes siltation. However, the wetland located in between the tributary crossing and the reservoir would prevent siltation problems.

In comparison, the route variation is an environmentally superior route since it decreases the number of crossings of Beaver Creek tributaries and affects 1.71 fewer acres of wetlands. Consequently, we recommend adoption of the route variation.

6.1.15 Basic Creek Wetland Variation

The route variation and the proposed route would both be approximately the same length (0.8 miles), and would both require essentially the same amount of forest clearing (approximately 6.8 acres). In addition, both routes would cross Basic Creek, a stocked trout stream, as well as a tributary to Basic Creek.

The primary difference between the route variation and the proposed route is in regard to the amount of wetland disturbance and the proximity to residences. The proposed route and route variations would both traverse a small area of forested wetland (approximately 50 feet) associated with the Basic Creek crossing; the route variation, however, would avoid a 630-foot crossing of a state-mapped, class III forested wetland. To avoid this wetland, the route variation would shift the right-of-way to within 50 feet of a residence, whereas the proposed route would be 1,200 feet from the nearest residence.

Considering the value of the wetland that would be crossed by the proposed route, and recognizing the recommended mitigation measures for wetland crossings discussed in section 5.1.7, we feel the disturbance to the three identified residences should be given greater weight in this instance. Consequently, we reject the route variation and recommend that the alignment between MP 213.1 and MP 213.9 remain as proposed.

6.1.16 Greenport Orchard Variation

This route variation would avoid a 900-foot crossing of an orchard but would shift the right-of-way into an area of steeper, forested terrain. The route variation would require the clearing of approximately 1.95 acres of forest on steep slopes; the proposed route would avoid forested areas and steep slopes. The proposed route would disturb slightly more agricultural areas (1 acre versus 0.7 acre along the route variation), not including the 2 acres of orchard that would be disrupted by the proposed route.

Although we would prefer to avoid the orchard, we have concerns about the rugged terrain that would be crossed by the route variation. Attempts to refine the route variation proved futile, since the terrain further to the west becomes more rugged, and alignment shifts to the east would push the right-of-way back into the orchards. A review of the aerial photography indicates that the applicant has optimized the crossing of the orchard. In addition, we have recommended specific mitigation for traversing orchards (see section 5.1.9). Consequently, we find the proposed route in this area to be environmentally preferable, and therefore, reject the route variation.

6.1.17 Greenport Quarry Variation

The Greenport Quarry Variation was evaluated in the DEIS. Based on additional information received during the comment period, this variation was reevaluated. The description of the original variation and the results of the reevaluation are presented in section 6.2.38.

6.1.18 ROW Alignment Variation

The ROW Alignment Variation was evaluated in the DEIS. Based on additional information received during the comment period, this variation was reevaluated. The description of the original variation and the results of the reevaluation are presented in section 6.2.41.

6.1.19 Silver Lake Wetland Variation

The Silver Lake Wetland Variation was evaluated in the DEIS. Based on additional information received during the comment period, this variation was reevaluated. The description of the original variation and the results of the reevaluation are presented in section 6.2.42.

6.1.20 Little Wappinger Creek Variation

The Little Wappinger Creek Variation was evaluated in the DEIS. Based on additional information received during the comment period, this variation was reevaluated. The description of the original variation and the results of the reevaluation are presented in section 6.2.43.

6.1.21 Anne's Alternate #3

This route variation was evaluated by us and extensively reviewed by interested parties to the New York Article VII proceeding. Overall we found this variation would have no significant disadvantages when compared to the proposed route and would result in less impact on wetlands and residences. The route variation would be 0.1 mile longer and result in 8.4 acres more forest cleared. The number of areas of steep slope encountered would be the same for both routes. Other than one additional perennial stream crossed by the proposed route, the effect on water bodies would be similar; the Wappinger Creek crossing on the route variation, however, would be at a location where the northern bank has been previously disturbed. The proposed route would affect 3.3 acres of wetlands. The variation would avoid all wetlands, although its proximity to one state-designated wetland would require field delineation and a possible alignment shift prior to construction. Anne's Alternate #3 is within 1.5 miles of reported locations of Blanding's turtle, which has two reported locations along the proposed route.

Land use impact of each route differs. The proposed route would be closer to more residences (although more than 50 feet away), and a recently established daycare center. The route variation is further from all of these. The route variation would disrupt 7.3 more acres of agricultural land, including an orchard, but the orchard could apparently be crossed without affecting existing or future operations (NYPSC, 1989). Although the route variation is closer to the Taconic State Parkway, the pipeline's location in open lands would mitigate any potential visual effects. Our findings are substantively the same as those reached by most interested parties in the New York Article VII proceedings, which resulted in an ALJ's decision recommending adoption of Anne's Alternate #3. Given the environmental superiority of this variation, we recommend its adoption.

6.1.22 Simon Alternative

We find that the Simon Alternative would result in no significant impact if adopted. This route variation is 0.8 mile longer than the proposed route and crosses fewer, but larger, areas of steep side slopes. Fewer streams are crossed by the route variation, and 1.37 acres less of wetland would be affected. Both the route variation and proposed route are within 1.5 miles of a reported Blanding's turtle location. The most significant advantage of the Simon Alternative is that it parallels existing rights-of-way for a more substantial distance than the proposed route. Nine homeowners along the route variation would be temporarily inconvenienced by construction activities behind their backyards, and would be permanently exposed to the open cleared right-of-way in areas currently wooded.

The route variation would cross the Taconic State Parkway in a moderately visible area near the existing overhead transmission line crossing. The cleared right-of-way would be visible to motorists on the parkway, but would not significantly change the existing characteristics of this stretch of the highway.

Overall, we feel the Simon Alternative provides significant advantages, and consequently, recommend adoption of the Simon Alternative over the proposed route. This recommendation is consistent with the recommendation of the ALJs in the New York Article VII proceeding.

6.1.23 Gidley Road Variation

The Gidley Road Variation would be the same length as the proposed route and affect the same resources. The amount of forest cleared, streams crossed, and slope conditions would be similar. However by crossing the existing right-of-way further east, the pipeline would be immediately adjacent to one home. We could not determine any advantage to this route variation that would justify locating the pipeline closer to the residence and, therefore, do not recommend its adoption.

6.1.24 Dover Variation

The route variation is 0.02 mile longer than the proposed route. Impact from this variation that differs from the proposed route are related to land use issues. The route variation would parallel the existing electric transmission line right-of-way, whereas the proposed route would create a new corridor. Both routes are in proximity to two state-listed hazardous waste sites, Mica Products and the Walter Vincent Landfill. The route variation would be closer to Mica Products (1,300 feet versus 2,600 feet). However, the area traversed is composed of limestone, limiting the likelihood of contamination migration. Since the route variation would not border the Walter Vincent Landfill as would the proposed route, and would relocate the pipeline away from the land proposed for further expansion of the high school, and would parallel an existing right-of-way, we recommend the route variation. It should be noted that the route variation has been recommended by the ALJs in the New York Article VII proceedings.

6.1.25 State Route 55 Variation

The State Route 55 Variation was evaluated in the DEIS. Based on additional information received during the comment period, this variation was reevaluated. The description of the original variation and the results of the reevaluation are presented in section 6.2.45.

6.1.26 Wimisink Variation

Impact associated with this variation that is different from the proposed route is primarily associated with wetlands and land use. Based on NWI maps, the variation would cross 0.3 acre less wetland. It would cross about the same amount of the Smoke Ridge subdivision, although its alignment within the subdivision minimizes disruption of the layout of planned lots. It would come closer than the proposed route to one existing home on County Route 39. In general the alignment would avoid tamarack, white oak, and beaver locations within the sanctuary and minimize the effects of forest clearing and wetland crossing. Iroquois is preparing a mitigation plan for the Wimisink Valley Sanctuary.

Overall we feel the route variation is environmentally superior to the proposed route and recommend its adoption. Further, we recommend Iroquois maintain existing vegetation or install screening between the pipeline and the home on County Route 39. Plans showing screening measures should be submitted for our review prior to construction along with a completed mitigation plan for the Wimisink Valley Sanctuary which includes input from the Naromi Land Trust.

6.1.27 Still River Variation

The 0.5 mile Still River Variation would be about the same length as the proposed route. The variation would affect 0.8 acre less wetland. The variation alignment at the Still River crossing would be more direct and avoid the condition on the proposed route where the river is paralleled for 700 feet. Rare species known to occur in the Still River Meanders Natural Area would not be affected by the route variation. The variation would reduce the length of existing right-of-way paralleled and would be immediately adjacent to the municipal dog pound, which would not result in any significant impact.

We recommend that this variation be adopted to avoid construction parallel to the oxbow, thereby reducing riverbank clearing and the amount of sediment potentially entering the river. We further recommend that Iroquois survey the river crossing to determine the need for river plantings. The results of this survey should be submitted for our review and approval prior to construction.

6.1.28 Algonquin Variation

This variation would not significantly change the impact associated with the proposed route, since it simply shifts the proposed pipeline from the north side to the south side of the existing pipeline right-of-way. In either instance, the proposed Iroquois right-of-way would be adjacent to the existing right-of-way and would partially use the existing right-of-way for temporary work room. The variation would traverse more federally designated wetlands, but would be in proximity to only one residence, as opposed to three along the proposed route. The variation would also avoid two extra crossings of the existing Algonquin pipeline. Based on field review and review of aerial photography and maps, we have determined that the south side of the existing right-of-way would provide a better location for the proposed pipeline.

Since the impact associated with the route variation would be similar to the proposed route, and the variation would still be located along an existing right-of-way, we recommend that this variation be adopted.

6.1.29 Fairfield County Subdivision Variations

A preliminary analysis of each of the four subdivision variations proposed by Iroquois was presented in the DEIS. At that time, although we supported the intent of modifying the proposed route to minimize impact on planned or new subdivisions, we had insufficient information to support a recommendation. Since the DEIS was published, additional field work has provided information to support more complete analyses. These analyses are presented in sections 6.2.58, 6.2.59, 6.2.62, and 6.2.63.

6.1.30 Pootatuck River Variation

Although the variation would be the same length as the proposed route, only one crossing of the Pootatuck River, a coldwater fishery, would be required, versus three crossings for the proposed route. The amount of wetland crossed would be reduced by 0.3 acre; and slightly less clearing (4 acres versus 4.7 acres) would be required. The proposed route and the variation would both pass within 50 feet of the same residence. Overall, the route variation is environmentally superior to the proposed, therefore, we recommend its adoption.

6.1.31 Conrail Variation

The Conrail Variation was evaluated in the DEIS. Based on additional information received during the comment period, this variation was reevaluated. The description of the original variation and the results of the reevaluation are presented in section 6.2.61.

6.1.32 Blakeman Variation

For the most part, the Blakeman Variation would have similar effects to those of the proposed route. Both routes are similar in length and would affect neither water use nor quality. The variation would result in clearing 1.5 acres less and would affect no wetlands, whereas the proposed route would affect 0.4 acre of wetlands. No unique plant species or natural areas are within 1.5 miles of either route. Plant species of concern and significant wildlife habitats are at least 0.5 mile from either route. The variation would disrupt 1.45 acres more of cultivated land.

On balance the variation appears slightly preferable to the proposed route. It would be farther from existing residences and potentially could be more compatible with developing and future uses. We recommend this alternative pending submittal of alignment sheets for our review, showing the location of the pipeline in relation to proposed subdivision and highway layout.

6.1.33 Carroll Variation

The Carroll Variation was evaluated in the DEIS. Based on additional information received during the comment period, this variation was reevaluated. The description of the original variation and the results of the reevaluation are presented in section 6.2.68.

6.1.34 Milford Variation

This route variation would be approximately 0.4 mile longer than the proposed route. Impact associated with this variation would be similar to that along the proposed route with the exception of land use, vegetation, and wetlands. Generally, the route variation traverses more commercial and industrial land than the proposed route, and parallels existing rights-of-way (electric transmission line and railroad) for a total distance of 0.65 mile, whereas the proposed route does not parallel any existing rights-of-way. The route variation would require the clearing of approximately 10.5 acres of wooded land while the proposed route would require clearing of approximately 14.3 acres of wooded land.

Both routes would cross Beaver Brook, but the route variation would avoid most of the federally designated wetlands in this area, while the proposed route would traverse approximately 800 feet of the associated scrub/shrub wetland. The proposed route, however, would traverse 200 feet of a forested wetland and would border 1,400 feet of an intertidal, emergent wetland.

The route variation responds to the concerns raised by several scoping comments. By paralleling the existing electric transmission lines, the route variation would minimize disruption to the operations and development potential of the Beard Sand and Gravel Company. The route variation would also locate the pipeline farther away from the Mondo Ponds area and the JFK Elementary School.

On balance, we find that the route variation is environmentally preferable to the proposed route, since the route variation makes greater use of existing rights-of-way and industrial and commercial properties. However, considering the properties that would be traversed, we believe the following additional restrictions would be necessary to minimize impact along the route variation:

- Existing vegetative screens would be maintained at the rear of the industrial and commercial properties; particularly between the residential development and commercial properties to the west of Bic Drive.

- The construction right-of-way would be restricted to 75 feet to minimize the amount of clearing.

- Vegetative screens would be planted at all road crossings for the entire width of the right-of-way to restrict access and limit line-of-sight views of the permanent right-of-way.

- The alignment and construction through parking lots would be designed and carried out with the objective of minimizing the extent and duration of disruption; all parking areas would be restored to as found condition or better.

6.1.35 Variations Developed as Wetland Mitigation

A total of 34 route variations were evaluated in the DEIS solely to avoid or minimize wetland impact. The 9 variations that were modified or reevaluated as a result of comments are addressed in section 6.2. The remaining 25 variations which are unchanged from the DEIS are presented in table 6.1-2. We recommend that the 25 route variations shown in table 6.1-2 be adopted.

6.2 SELECTED ROUTE VARIATIONS IDENTIFIED DURING DEIS COMMENT PERIOD

This section addresses 42 new route variations that were identified during the comment period and 28 of the original 76 variations that were modified or re-evaluated. Other variations that we rejected as being obviously less preferable than the proposed route are presented in responses 3.5-27 to 3.5-40.

6.2.1 St. Lawrence Wetland Variation

The St. Lawrence Wetland Variation as originally described in the DEIS would be approximately 1,000 feet longer than the proposed route and would affect 1.84 acres more forestland while avoiding active cropland. The route variation would avoid a state-mapped wetland but would still cross 800 feet of FWS-designated wetland; the proposed route would require an apparent 1,600-foot wetland crossing. The route variation would be in proximity to three residences while the proposed route would only pass within 250 feet of the nearest residence. We recommended this variation in the DEIS to minimize impact on a state-mapped forested wetland between MP 0.7 and MP 1.5 (see figure A-1, sheet 1 of 57).

Since the DEIS was prepared, Iroquois has conducted further field surveys to delineate wetlands using the Federal multi-parameter methodology. Based on the results of those surveys, it appears that the original proposed route would represent less impact. The results of the field survey indicate that the original proposed route would affect 0.9 acre less wetland than the variation (4.3 acres versus 5.2 acres), would cross 0.9 acre less wooded wetland (3.2 acres versus 4.1 acres), and would avoid a northern white cedar stand.

Since the original intent of the variation was to minimize impact on wetlands, the original proposed route is preferable to the variation. Therefore, we recommend that the proposed Iroquois pipeline be constructed along the original proposed route in this area.

6.2.2 Lisbon Wetland Variation and Modification

The Lisbon Wetland Variation was originally proposed by Iroquois to avoid NYDEC Wetland LI-6. We concluded in the DEIS that the variation was environmentally preferable to the proposed route. Since that time, Iroquois has conducted field surveys and proposes a modification to that variation to further reduce potential impact on wetlands as well as reduce impact on agricultural drainage tiles and a planned sugar bush. Iroquois based this proposal on the results of consultations with landowners and field surveys of wetland limits and vegetation.

The proposed modification would deviate from the proposed route approximately at MP 7.0, or approximately 1.1 miles further north than the point of departure of the original variation. The modification would parallel the proposed route at a distance of approximately 300 feet to 500 feet for about 1.5 miles where it would intersect the original variation, and follow the original variation for approximately 1.2 miles to the point where it rejoins the proposed route at MP 9.6 (see figure A-1, sheet 2 of 57).

From MP 7.0 to the point where the modification would rejoin the original variation, both the modification and the proposed route would be the same length (1.5 miles) (see table 6.2-1). The modification would impact less wetland than the proposed route (1.4 acres versus 3.4 acres), but would affect more forestland (13.0 acres versus 12.6 acres). The modification would affect more agricultural land (4.8 acres versus 4.1 acres); however, the modification would affect less area of actively cultivated land and more pasture. Potential affects on other resources would be approximately the same for the two alignments.

Based on the fact the original intent of the variation was to minimize impact on wetlands and the modification would better achieve these goals without significantly affecting

TABLE 6.2-1

Comparison of Iroquois Proposed Route/Variation and Variation/Modification

Section No.	Variation Name		Variation/ Modification	Proposed Route Variation
6.2.2	**Lisbon Wetland Modification**			
	MP 7.0 to 9.6			
	Total length	(mi.)	1.5	1.5
	Parallel to existing ROW	(mi.)	-	-
	Minor stream/river crossings	(no.)	-	-
	Major river crossings	(no.)	-	-
	Wetlands disturbed	(ac.)	1.4	3.4
	Forest cleared	(ac.)	13.0	12.6
	Crop and pasture land	(ac.)	4.8	4.1
6.2.3	**Dandy Road Wetland Modification**			
	MP 12.6 to 14.1			
	Total length	(mi.)	1.54	1.42
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	0	1
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	0.8	3.4
	Forest cleared	(ac.)	6.0	5.5
	Crop and pasture land	(ac.)	11.8	8.3
6.2.4	**Line Creek**			
	MP 13.9 to 15.5			
	Total length	(mi.)	1.61	1.63
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	0	0
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	5.7	5.6
	Forest cleared	(ac.)	6.3	6.1
	Crop and pasture land	(ac.)	7.6	7.9
6.2.5	**Canton Wetland Modification**			
	MP 16.1 to 17.2			
	Total length	(mi.)	1.07	1.04
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	0	0
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	0.4	0.9
	Forest cleared	(ac.)	3.6	3.1
	Crop and pasture land	(ac.)	8.9	8.5
6.2.6	**Grass River**			
	MP 17.8 to 19.3			
	Total length	(mi.)	1.52	1.56
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	0	0
	Major river crossings	(no.)	1	1
	Wetlands disturbed	(ac.)	2.8	3.4
	Forest cleared	(ac.)	5.7	5.4
	Crop and pasture land	(ac.)	9.3	9.8
	Wildlife Management Area within 1.5 miles	(no.)	1	1
6.2.7	**Route 11**			
	MP 21.3 to 23.7			
	Total length	(mi.)	2.75	2.85
	Parallel to existing ROW	(mi.)	0.05	0.05
	Minor stream/river crossings	(no.)	1	1
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	6.7	6.7
	Forest cleared	(ac.)	2.2	5.3
	Crop and pasture land	(ac.)	23.8	22.0

TABLE 6.2-1 (cont'd)

Section No.	Variation Name		Variation/ Modification	Proposed Route Variation
6.2.8	**Justintown Road Modification**			
	MP 25.3 to 25.7			
	Total length	(mi.)	0.63	0.63
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	0	0
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	0.5	1.2
	Forest cleared	(ac.)	1.7	0.0
	Crop and pasture land	(ac.)	5.4	6.4
6.2.10	**New Bremen Sugarbush Modification**			
	MP 76.5 to 78.6			
	Total length	(mi.)	1.99	2.18
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	2	2
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	1.0	2.1
	Forest cleared	(ac.)	9.2	9.3
	Crop and pasture land	(ac.)	13.4	14.4
6.2.12	**Lyons Falls**			
	MP 98.1 to 101.3			
	Total length	(mi.)	3.22	3.19
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	1	1
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	0.7	4.3
	Forest cleared	(ac.)	21.0	17.2
	Crop and pasture land	(ac.)	16.9	16.7
	Rare and endangered plant within 1.5 mi.	(no.)	1	1
6.2.13	**Wingate Swamp Modification**			
	MP 109.6 to 111.8			
	Total length	(mi.)	2.11	2.14
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	1	2
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	2.4	2.3
	Forest cleared	(ac.)	19.2	19.2
	Crop and pasture land	(ac.)	3.9	3.6
6.2.14	**Route 28**			
	MP 115.1 to 116.6			
	Total length	(mi.)	1.61	1.63
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	5	5
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	1.4	1.0
	Forest cleared	(ac.)	15.9	16.5
	Crop and pasture land	(ac.)	2.3	2.3
6.2.15	**Kayuta Lake Wetland Modification**			
	MP 117.2 to 118.7			
	Total length	(mi.)	1.47	1.49
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	3	3
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	0.9	1.0
	Forest cleared	(ac.)	16.4	9.8
	Crop and pasture land	(ac.)	0.4	7.3

TABLE 6.2-1 (cont'd)

Section No.	Variation Name		Variation/ Modification	Proposed Route Variation
6.2.16	**Remsen Wetland Modification**			
	MP 120.3 to 122.2			
	Total length	(mi.)	1.52	1.66
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	0	0
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	2.2	2.2
	Forest cleared	(ac.)	15.1	16.4
	Crop and pasture land	(ac.)	1.1	1.4
6.2.17	**Trenton Wetland Modification**			
	MP 124.0 to 125.0			
	Total length	(mi.)	1.02	1.01
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	1	1
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	2.5	5.5
	Forest cleared	(ac.)	6.5	6.3
	Crop and pasture land	(ac.)	3.4	0.0
	Pond	(no.)	0	1
6.2.18	**King Quarry**			
	MP 131.9 to 132.5			
	Total length	(mi.)	0.75	0.60
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	1	1
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	0.3	0.3
	Forest cleared	(ac.)	5.2	3.2
	Crop and pasture land	(ac.)	3.6	4.9
6.2.19	**Rose Valley Landfill Modification**			
	MP 132.5 to 135.5			
	Total length	(mi.)	2.7	2.7
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	1	1
	Major river crossings	(no.)	-	-
	Wetlands disturbed	(ac.)	-	-
	Forest cleared	(ac.)	18.2	17.5
	Crop and pasture land	(ac.)	6.6	7.6
6.2.20	**Fairfield**			
	MP 141.0 to 142.5			
	Total length	(mi.)	1.5	1.4
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	-	-
	Major river crossings	(no.)	-	-
	Wetlands disturbed	(ac.)	-	-
	Forest cleared	(ac.)	0.0	2.9
	Crop and pasture land	(ac.)	14.7	12.8
6.2.21	**Manheim**			
	MP 148.1 to 150.8			
	Total length	(mi.)	2.7	2.5
	Parallel to existing ROW	(mi.)	0.2	0.0
	Minor stream/river crossings	(no.)	1	1
	Major river crossings	(no.)	-	-
	Wetlands disturbed	(ac.)	0.0	0.3
	Forest cleared	(ac.)	4.8	2.8
	Crop and pasture land	(ac.)	15.6	22.6

TABLE 6.2-1 (cont'd)

Section No.	Variation Name		Variation/ Modification	Proposed Route Variation
6.2.22	**Route 5**			
	<u>MP 151.2 to 153.2</u>			
	Total length	(mi.)	2.20	2.10
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	1	3
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	2.2	2.7
	Forest cleared	(ac.)	1.8	3.7
	Crop and pasture land	(ac.)	19.4	16.3
6.2.23	**Minden**			
	<u>MP 160.6 to 164.3</u>			
	Total length	(mi.)	3.76	3.60
	Parallel to existing ROW	(mi.)	0.8	0.0
	Minor stream/river crossings	(no.)	6	4
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	0.4	0.7
	Forest cleared	(ac.)	12.0	12.7
	Crop and pasture land	(ac.)	33.1	28.3
	Orchards	(ac.)	0.0	2.2
6.2.24	**Deflection No. #10**			
	<u>MP 167.5 to 171.4</u>			
	Total length	(mi.)	3.9	3.9
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	2	3
	Major river crossings	(no.)	1	1
	Wetlands disturbed	(ac.)	0.0	0.0
	Forest cleared	(ac.)	11.4	10.1
	Crop and pasture land	(ac.)	18.0	28.2
6.2.25	**Flat Creek**			
	<u>MP 174.2 to 175.6</u>			
	Total length	(mi.)	1.2	1.2
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	-	-
	Major river crossings	(no.)	-	-
	Wetlands disturbed	(ac.)	-	-
	Forest cleared	(ac.)	4.0	2.4
	Crop and pasture land	(ac.)	9.7	12.7
6.2.26	**Route 146**			
	<u>MP 192.0 to 194.8</u>			
	Total length	(mi.)	2.8	2.8
	Parallel to existing ROW	(mi.)	0.8	2.1
	Minor stream/river crossings	(no.)	4	3
	Major river crossings	(no.)	-	-
	Wetlands disturbed	(ac.)	-	-
	Forest cleared	(ac.)	12.1	12.7
	Crop and pasture land	(ac.)	20.9	19.1
6.2.28	**Eight Mile**			
	<u>MP 208.3 to 209.0</u>			
	Total length	(mi.)	0.7	0.7
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	0	0
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	0.0	0.0
	Forest cleared	(ac.)	9.0	8.0
	Crop and pasture land	(ac.)	0.0	0.0

TABLE 6.2-1 (cont'd)

Section No.	Variation Name		Variation/ Modification	Proposed Route Variation
6.2.29	**Westerlo**			
	<u>MP 210.9 to 211.7</u>			
	Total length	(mi.)	0.9	0.9
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	0	0
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	0.0	0.0
	Forest cleared	(ac.)	5.2	4.9
	Crop and pasture land	(ac.)	5.0	5.0
6.2.30	**Greenville**			
	<u>MP 217.3 to 218.0</u>			
	Total length	(mi.)	0.7	0.7
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	2	2
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	0.0	0.4
	Forest cleared	(ac.)	4.2	3.2
	Crop and pasture land	(ac.)	2.2	3.9
6.2.31	**Route 81**			
	<u>MP 221.6 to 222.0</u>			
	Total length	(mi.)	0.3	0.3
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	0	0
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	0.0	0.0
	Forest cleared	(ac.)	3.3	2.7
	Crop and pasture land	(ac.)	0.0	0.0
6.2.32	**Athens**			
	<u>MP 225.1 to 225.9</u>			
	Total length	(mi.)	0.8	0.8
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	0	0
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	0.2	0.5
	Forest cleared	(ac.)	5.9	2.4
	Crop and pasture land	(ac.)	2.7	5.8
6.2.33	**Athens Airport Wetland Modification**			
	<u>MP 228.8 to 230.0</u>			
	Total length	(mi.)	1.6	1.5
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	1	1
	Major river crossings	(no.)	-	-
	Wetlands disturbed	(ac.)	0.9	0.7
	Forest cleared	(ac.)	3.8	4.2
	Crop and pasture land	(ac.)	-	-
6.2.34	**Leeds Road Variation**			
	<u>MP 231.0 to 231.5</u>			
	Total length	(mi.)	0.6	0.5
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	1	0
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	0.0	0.0
	Forest cleared	(ac.)	6.9	1.6
	Crop and pasture land	(ac.)	0.6	2.0

TABLE 6.2-1 (cont'd)

Section No.	Variation Name		Variation/ Modification	Proposed Route Variation
6.2.37	**Greenport Ravine**			
	MP 233.2 to 234.5			
	Total length	(mi.)	1.2	1.3
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	0	0
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	0.2	2.3
	Forest cleared	(ac.)	6.2	7.2
	Crop and pasture land	(ac.)	4.4	4.0
6.2.39	**Livingston**			
	MP 241.2 to 241.6			
	Total length	(mi.)	0.3	0.4
	Parallel to existing ROW	(mi.)	0.3	0.0
	Minor stream/river crossings	(no.)	0	0
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	0.0	0.0
	Forest cleared	(ac.)	0.0	0.0
	Crop and pasture land	(ac.)	3.6	4.8
6.2.40	**Milan**			
	MP 252.3 to 253.6			
	Total length	(mi.)	1.5	1.3
	Parallel to existing ROW	(mi.)	1.5	0.0
	Minor stream/river crossings	(no.)	2	2
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	0.0	0.0
	Forest cleared	(ac.)	13.8	14.5
	Crop and pasture land	(ac.)	0.0	0.0
6.2.42	**Silver Lake Wetland Modification**			
	MP 255.6 256.1			
	Total length	(mi.)	0.4	0.4
	Parallel to existing ROW	(mi.)	0.25	0.25
	Minor stream/river crossings	(no.)	0	0
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	0.7	2.4
	Forest cleared	(ac.)	3.4	3.4
	Crop and pasture land	(ac.)	-	-
6.2.43	**Little Wappinger Creek Modification**			
	MP 257.7 to 258.4			
	Total length	(mi.)	0.7	0.7
	Parallel to existing ROW	(mi.)	0.0	0.3
	Minor stream/river crossings	(no.)	1	1
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	0.5	2.3
	Forest cleared	(ac.)	1.9	3.7
	Crop and pasture land	(ac.)	-	-
6.2.45	**Route 55**			
	MP 282.9 to MP 286.6			
	Total length	(mi.)	3.6	3.75
	Parallel to existing ROW	(mi.)	0.0	0.7
	Minor stream/river crossings	(no.)	2	4
	Streams classified for trout	(no.)	1	1
	Wetlands disturbed	(ac.)	0.7	-
	Significant habitats within 1.5 miles of pipeline centerline	(no.)	1	1
	Threatened and endangered species within 1.5 miles	(no.)	1	1
	Forest cleared	(ac.)	26.3	16.1
	Active or rotated cropland	(ac.)	9.3	13.5
	New pipeline within 50 feet of existing residences	(no.)	1	7
	Other: Nursery	(no.)	-	1

TABLE 6.2-1 (cont'd)

Section No.	Variation Name		Variation/ Modification	Proposed Route Variation
6.2.49	**Stilson Hill**			
	MP 289.0 to 290.5			
	Total length	(mi.)	1.59	1.44
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	2	1
	Major river crossings	(no.)	-	-
	Wetlands disturbed	(ac.)	1.1	2.5
	Forest cleared	(ac.)	10.6	11.9
	Crop and pasture land	(ac.)	8.5	3.0
	Residences within 50 feet	(no.)	0	1
6.2.50	**East Stilson Road**			
	MP 288.9 to 292.9			
	Total length	(mi.)	3.8	3.9
	Parallel to existing ROW	(mi.)	0.0	0.0
	Minor stream/river crossings	(no.)	3	3
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	0.0	0.0
	Forest cleared	(ac.)	32.4	28.0
	Crop and pasture land	(ac.)	5.9	9.4
	Residences within 50 feet	(no.)	2	2
6.2.53	**New Milford**			
	MP 294.5 to 297.7			
	Total length	(mi.)	3.3	3.2
	Parallel to existing ROW	(mi.)	1.5	0.8
	Minor stream/river crossings	(no.)	1	1
	Major river crossings	(no.)	1	1
	Wetlands disturbed	(ac.)	1.5	1.5
	Forest cleared	(ac.)	9.3	15.3
	Crop and pasture land	(ac.)	11.3	5.6
	Residences within 50 feet	(no.)	0	1
6.2.58	**Old Farm Hill Subdivision**			
	MP 308.3 to 310			
	Total length	(mi.)	1.8	1.7
	Parallel to existing ROW	(mi.)	-	-
	Minor stream/river crossings	(no.)	3	1
	Major river crossings	(no.)	0	0
	Wetlands disturbed	(ac.)	0.4	0.8
	Forest cleared	(ac.)	21.8	20.6
	Crop and pasture land	(ac.)	-	-
6.2.59	**Newtown Subdivision**			
	MP 312.2 to 315.2			
	Total length	(mi.)	3.3	3.0
	Parallel to existing ROW	(mi.)	0.2	-
	Minor stream/river crossings	(no.)	7	7
	Major river crossings	(no.)	-	-
	Wetlands disturbed	(ac.)	1.0	1.7
	Forest cleared	(ac.)	37.6	32.0
	Crop and pasture land	(ac.)	-	-
6.2.60	**Paugussett State Forest**			
	MP 315.2 to 315.9			
	Total length	(mi.)	3.3	3.0
	Parallel to existing ROW	(mi.)	0.2	-
	Minor stream/river crossings	(no.)	7	7
	Major river crossings	(no.)	-	-
	Wetlands disturbed	(ac.)	1.0	1.7
	Forest cleared	(ac.)	37.6	32.0
	Crop and pasture land	(ac.)	-	-

TABLE 6.2-1 (cont'd)

Section No.	Variation Name		Variation/ Modification	Proposed Route Variation
6.2.61	**Conrail**			
	MP 316.8 to MP 323.7			
	Total length	(mi.)	7.4	6.9
	Parallel to existing ROW	(mi.)	5.5	0
	Minor stream/river crossings	(no.)	8	9
	Watershed crossed	(mi.)	.5	3.6
	Community wells within 1.5 miles	(no.)	23	23
	Significant habitats within 1.5 miles of pipeline centerline	(no.)	6	5
	Wetlands	(ac.)	2.0	8.6
	State parks crossed	(no.)	1	0
6.2.62	**Forest View Subdivision**			
	MP 315.8 to 316.3			
	Total length	(mi.)	0.4	0.5
	Parallel to existing ROW	(mi.)	-	-
	Minor stream/river crossings	(no.)	-	-
	Major river crossings	(no.)	-	-
	Wetlands disturbed	(ac.)	-	-
	Forest cleared	(ac.)	4.8	6.1
	Crop and pasture land	(ac.)	-	-
6.2.63	**Monroe Subdivision**			
	MP 316.7 to 318.2			
	Total length	(mi.)	0.81	0.76
	Parallel to existing ROW	(mi.)	-	-
	Minor stream/river crossings	(no.)	-	-
	Major river crossings	(no.)	-	-
	Wetlands disturbed	(ac.)	-	-
	Forest cleared	(ac.)	9.8	9.2
	Crop and pasture land	(ac.)	-	-
6.2.65	**Housatonic Valley**			
	MP 326.8 to 331.5			
	Total length	(mi.)	5.7	5.4
	Parallel to existing ROW	(mi.)	1.8	2.9
	Minor stream/river crossings	(no.)	5	9
	Major river crossings	(no.)	1	1
	Wetlands disturbed	(ac.)	3.9	5.1
	Forest cleared	(ac.)	32.7	45.5
	Crop and pasture land	(ac.)	24.2	7.3

other resources, we recommend that the Lisbon Wetland Variation with the modification be adopted.

6.2.3 Dandy Road Wetland Variation and Modification

The Dandy Road Wetland Variation was originally proposed in the DEIS to avoid a 1,580-foot-wide crossing of Federal- and state-designated wetlands. Approximately 1.6 acres of forestland would have been cleared along this variation, half of which would have been allowed to revegetate. Construction would also have disrupted about 6.1 acres of agricultural land during one growing season. Similarly, less than 0.5 acre of emergent wetland would have been crossed by this variation during construction.

This route variation would have been approximately 0.17 mile longer than the proposed route and would have required two additional stream crossings and two additional road crossings. The variation would also have required temporary disruption of the driveway of one residence. The variation would have made greater use of agricultural land, where impact would be temporary.

The major advantage of this route variation would have been that it completely avoids disturbing 2.85 acres of a forested wetland. The amount of nonwetland forest disturbed would have been the same for both the variation and the proposed route (approximately 1.5 acres).

The Dandy Road Wetland Variation was recommended in the DEIS. However, based on additional field surveys, Iroquois proposes a modification to that variation.

The proposed modification would deviate from the proposed route at MP 12.6, avoid a wetland, and cross the proposed route and Dandy Road. It would then generally parallel the west side of Dandy Road and rejoin the proposed route at MP 14.1 (see figure A-1, sheet 3 of 57). The modification would be approximately 0.1 mile longer than the proposed route (1.5 miles versus 1.4 miles), would require one less crossing of Dandy Road (1 versus 2) and eliminate the crossing of Rowen Road, would affect less wetland (0.8 acre versus 3.4 acres), and would avoid residential properties on the east side of Dandy Road (see table 6.2-1). The modification would affect 0.5 acres additional forestland (6.0 acres versus 5.5 acres) and 3.5 acres additional agricultural land (11.8 acres versus 8.3 acres). This modification addresses concerns specified by the NYSTF.

Because the modification would result in less overall impact and would also address the concerns of the NYSTF, we recommend that the Dandy Road Wetland Modification be adopted.

6.2.4 Line Creek Variation

The Line Creek Variation was under study when the DEIS was prepared in November 1989. Initially, this variation was proposed by Iroquois to avoid a septic sludge disposal area, which was identified as a result of landowner consultations, and to avoid wetland impact (see figure A-1, sheet 3 of 57).

The results of subsequent field investigations indicate that the variation (MP 13.9 to 15.5) would affect more total wetlands than the proposed route (5.7 acres versus 5.6 acres);

however, total clearing of the wooded wetlands can be reduced by routing the variation adjacent to an existing dirt road through one wetland. The variation would also require slightly more clearing of forested areas (6.3 acres versus 6.1 acres), but the variation would affect less active and rotated agricultural land (7.6 acres versus 7.9 acres) (see table 6.2-1).

We feel that avoidance of the septic disposal area is necessary. Therefore, we conclude that the variation is preferable to the proposed route and we recommend its use. We further recommend that if the Dandy Road Wetland Modification is adopted that the Line Creek Variation extend from approximate MP 14.2 of the Dandy Road Wetland Modification.

6.2.5 Canton Wetland Variation and Modification

The Canton Wetland Variation was originally identified in the DEIS to minimize impact on agricultural land and wetland areas (see figure A-1, sheets 3 and 4 of 57). The variation would have crossed 200 feet to 300 feet more agricultural lands than the proposed route (5.2 acres versus 4.7 acres) and, more importantly, would have shifted the alignment from that of the proposed route, which is closer to field edges, to an alignment traversing field centers. In doing so, the variation would have avoided all wetlands including 0.6 acre of Federal-designated scrub-shrub wetland.

The NYDAM objected to Iroquois' variation on two grounds. First, the variation would have increased agricultural impact in terms of amount and location. Second, they objected to the location of both the proposed route and the variation because neither would have corresponded to the alignment of NYDAM's Routing Deflection No. 3, which they contended was stipulated in the New York Article VII proceedings (NYDAM, 1989). We believed that because the route variation would have avoided all wetlands and would not have significantly increased agricultural impact, it would have been environmentally preferable. Further field studies, however, resulted in a modification to this variation that would apparently satisfy the concerns of New York.

Based on the results of field surveys, Iroquois proposed a modification to the variation to reduce impact on wetlands, forested areas, and an extensive agricultural tile drainage system. The NYSTF concurs with this proposed modification.

The proposed modification would be approximately the same length as the variation (1.0 mile) and its location would be indistinguishable from that of the variation on figure A-1, sheets 3 and 4 of 57. The proposed modification would affect less wetland (0.4 acre versus 0.9 acre) and more forestland (3.6 acres versus 3.1 acres) (see table 6.2-1). The proposed modification would cross slightly more agricultural land (8.9 acres versus 8.5 acres), but impact on the tile drainage system in that area would be avoided. Other environmental impact of the modification would be negligible.

Because the Canton Wetland Modification would meet the original objectives of the Canton Wetland Variation and, in addition, avoid the tile drainage system, we find the Canton Wetland Modification preferable and recommend its use.

6.2.6 Grass River Variation

The Grass River Variation was identified by Iroquois during the comment period to avoid a county farm cemetery located in the vicinity of MP 18.0 and to reduce the amount of wetland crossed. The variation would diverge from the proposed route at MP 17.8 and generally parallel the proposed route for approximately 1.5 miles before rejoining the proposed route at MP 19.3 (see figure A-1, sheet 4 of 57). The variation would cross the Grass River approximately 250 west of the proposed route and would generally be within 200 feet of the proposed route for the remainder of its length.

The variation would be approximately 0.1 mile shorter than the proposed route (1.5 miles versus 1.6 miles) and would affect less wetland (2.8 acres versus 3.4 acres) and agricultural land (9.3 acres versus 9.8 acres) (see table 6.2-1). Although the variation would avoid a cemetery, the crossing of the Grass River would be at a location that is wider than that of the proposed route (250 feet versus 155 feet).

Since the variation would reduce wetland impact and would avoid the cemetery, we find that the Grass River Variation is preferable to the proposed route and recommend its use. We note that the potential impact associated with this new crossing location would be similar to that associated with the proposed crossing, and the specific revegetation measures identified in table 5.1.9-6 remain applicable.

6.2.7 Route 11 Variation

The Route 11 Variation was under study when the DEIS was issued. The variation (MP 21.3 to MP 23.7; see figure A-1, sheets 4 and 5 of 57) was identified to minimize impact on wooded wetlands along Church Brook, reduce impact on residential land use in the vicinity of O'Hord Road, and to provide a crossing of Route 11 which increases the distance between the pipeline and existing residences.

Field studies indicate that the variation would traverse 2.2 acres of upland deciduous forest in comparison with the 5.3 acres traversed by the proposed route (see table 6.2-1). Both the variation and the proposed route would affect the same amount of wetlands (6.7 acres); however, the variation would completely avoid forested wetland while the proposed route would affect approximately 2.6 acres of forested wetland. The variation would affect more agricultural land (23.8 acres versus 22.0 acres).

Since the variation would minimize impact on upland forest, wooded wetland areas, and residential areas in the vicinity of O'Hord Road and Route 11, we believe that the variation is environmentally superior to the proposed route. We, therefore, recommend that the Route 11 Variation be adopted.

6.2.8 Justintown Road Wetland Variation and Modification

We recommended adoption of the Justintown Road Wetland Variation in the DEIS. The purpose of the variation was to minimize impact on wetlands. Iroquois proposes a modification to the Justintown Road Wetland Variation to further minimize impact on wetlands, to avoid a stand of pine trees, and to reduce impact on agricultural fields. The modification was proposed based on Iroquois' consultation with landowners and after initial field surveys were completed for actual wetland boundaries and vegetation cover types.

The modification would deviate from the proposed route at MP 25.3 and rejoin the proposed route at MP 25.7 (see figure A-1, sheet 5 of 57). At the map scale in figure A-1, the location of the modification is indistinguishable from that of the original variation. The modification would affect less total wetland than the variation (0.5 acre versus 1.2 acres) and less wooded wetland (0.1 acre versus 0.9 acre) (see table 6.2-1). The modification would also affect less agricultural land (5.4 acres versus 6.4 acres).

We feel that the modification improves the Justintown Road Wetland Variation as originally adopted, and we recommend the adoption of the Justintown Road Wetland Modification.

6.2.9 Route 58 Wetland Variation and Modification

The original Route 58 Wetland Variation was proposed in the DEIS to reduce the length of wetlands crossed. Impact of this variation that would have been different from those of the proposed route was primarily related to agriculture, wetlands, and forest. The route variation would have disturbed a total of 1.0 acre of agricultural land and approximately 3.5 acres of forest; the proposed route would disturb 0.5 acre of agricultural land and 3 acres of forest. The length of emergent forested and scrub-shrub wetlands traversed or bordered would have been reduced from 800 feet to 50 feet with the variation. The greatest disadvantage of the route variation would have been that a new corridor would have been created for its entire length. The proposed route would be located adjacent to an existing transmission line for approximately 1,500 feet.

We noted in the DEIS that the proposed route was preferred by NYDAM and NYDEC. We found in the DEIS that the proposed route was preferable to the variation.

Iroquois has proposed a modification (MP 43.2 to MP 43.7; see figure A-1, sheet 8 of 57) to the original variation that would shift the northern portion of the variation approximately 200 feet to the north. Based upon field data, this modification would reduce the amount of forested wetland crossed and would move most of the variation to reverting agriculture fields. This proposed modification appears to be consistent with the recommendation made by the NYSTF during the comment period to utilize a parallel alignment several hundred feet to the northwest.

We feel that this modification eliminates some of our concerns about the original variation and makes the Route 58 Wetland Modification preferable to the proposed route. Therefore, we recommend adoption of the modified variation.

6.2.10 New Bremen Sugarbush Modification

The New Bremen Sugar Bush Variation was a 9.3-mile-long variation between MP 74.3 and MP 83.5, which Iroquois proposed to avoid commercial sugarbushes after consultation with Lewis County and the Lewis County Maple Sugar Producers' Association. That variation was evaluated in the DEIS. Impact of the New Bremen Sugarbush Variation would have been similar to the proposed route (see table 6.2-1). The 9.3-mile-long variation would have been slightly longer than the 9.2-mile-long proposed route. Each would have traversed rural forested areas. The variation would have resulted in the clearing of 45.8 acres versus 53.2 acres for the proposed route, not including sugarbush. No areas of steep side slope conditions occurred along either route. The route variation would have crossed

12 water bodies versus 13 for the proposed route. Three on each are considered exceptional fishery resources. No municipal water supplies would have been within 1.5 miles of either route. The variation would have affected 1.09 acres of palustrine wetland, while no wetlands would have been affected by the proposed route. The variation would have affected 4.88 more acres of active agricultural land. The only land use differences would have been greater proximity of the route variation to High Falls Natural Area and 2.8 miles less sugarbush. There would have been no expected effects resulting from pipeline proximity to the natural area. We recommended in the DEIS that the variation be adopted.

Additional field studies since the publication of the DEIS have indicated inaccuracies in the maps showing the location of sugarbush along a portion of the New Bremen Sugarbush Variation. As a result of recent field surveys and consultations with landowners, the location of a commercial sugarbush has been verified to be farther east than originally believed. Accordingly, Iroquois proposes a modification to a portion of the variation between MP 76.5 and MP 78.6 to avoid that location (see figure A-1, sheet 13 of 57). This modification also addresses similar concerns noted by the NYSTF during the comment period.

The modification would diverge from the variation at Old State Road and would cross Beaver Creek approximately 400 feet east of the crossing by the original variation. The modification would rejoin the alignment of the variation at a powerline right-of-way south of Belfort Road.

The modification would be shorter than the corresponding portion of the variation (2.0 miles versus 2.2 miles) and would affect less forested land (1.0 acre versus 2.1 acres), less wetland (9.2 acres versus 9.3 acres), and less agricultural land (13.4 acres versus 14.4 acres) (see table 6.2-1). The modification would cross Beaver River in a narrower location than the original variation (220 feet versus 250 feet). The modification would also avoid the proposed location for cottage developments near the inlet to High Falls Pond.

The modification permits the original intent of the variation to be met. In addition, the modification provides various other advantages over the original New Bremen Sugarbush Variation. Therefore, we recommend adoption of the New Bremen Sugarbush Variation and Modification.

6.2.11 Anne's Independence River Alternate

Dr. Anne Meuser (GASP Coalition) has suggested an alternative alignment between MP 84.6 and MP 92.9 to make greater use of an electric transmission line corridor and provide an environmentally preferable crossing of the Independence River (MP 91.0). This alternative crossing was reviewed but eliminated from detailed consideration in the DEIS (see section 3.6.37.1). However, continued interest in this area and additional information provided in conjunction with public comments have compelled us to reevaluate the route in this area.

The alternative alignment would deviate from the proposed route at MP 84.5 and proceed to the east along Muncy Road for a distance of approximately 1.5 miles. At this point, the alternative alignment would cross under the existing 765 kV and 230 kV transmission lines and continue south along the eastern edge of the existing right-of-way for a distance of approximately 6.3 miles. At this point, the alternative would follow the alignment of the original Alternative 1B (identified in the 1986 Environmental Report prepared by Iroquois), crossing Otter Creek and rejoining the proposed route at approximately MP 92.9 (see figure A-1, sheets 14, 14A, and 15 of 57).

In support of this alternative, Dr. Meuser indicated that Muncy Road is a gravel road with limited traffic, the crossing of the Independence River would be in a location already disturbed by the transmission line right-of-way, and the crossing of Otter Creek would be on property owned by Adirondack Hydro Development Corp. Further, Mr. G. Cataldo has pointed out that there appears to be 125 feet of uncleared (our information indicates an uncleared width of 112.5 feet), unused right-of-way to the east of the 230 kV transmission lines; this is the area proposed for routing the pipeline.

We find the proposed alternative alignment to have merit. The previous alternative in this area (Alternative 1B) was aligned along the west side of the existing right-of-way, adjacent to the 765 kV transmission line. We have noted the problems associated with such an alignment (see section 3.5.1.1) and based our previous rejection of the alternate Independence River crossing on these concerns. However, these concerns are reduced with an alignment along the east side of the existing right-of-way, adjacent to the 230 kV transmission lines.

Our review of the alternative alignment and the proposed route indicate that both routes are similar in regard to potential environmental impact. Both alignments would require five perennial stream crossings. Both routes would traverse primarily forested areas of similar topography; however, the extent of additional clearing required along the existing right-of-way is not known. Both alignments appear to be similar in all other respects, except the alternative alignment parallels an existing right-of-way for approximately 70 percent of its length; however, the alternative alignment would be approximately 1.1 miles longer than the proposed route (9.5 miles versus 8.4 miles). We note that Iroquois, in response to comments to the COE, has reiterated their concerns and reluctance to an alignment adjacent to the 765 kV transmission line.

Considering the advantages and disadvantages of both alignments, we find both to be environmentally acceptable. However, because of its greater use of existing right-of-way and the avoidance of a new crossing of the Independence River, we recommend adoption of Anne's Independence River Alternate, with several caveats. The pipeline should be placed, to the extent possible, within the existing powerline easement with minimal clearing outside the existing easement. Discussions with Niagara Mohawk (owner-operator of the 230 kV transmission lines) should provide for adequate consideration of the future use of this right-of-way.

Our only uncertainty with the alternate concerns the potential for creating an "island" of vegetation between the existing cleared right-of-way and the new clearing for the pipeline. If the future plans of Niagara Mohawk require the pipeline to be placed at the outer edge of the existing right-of-way easement, it would be unnecessary and undesirable to clear the entire 112-foot-wide unused portion of the existing right-of-way. However, leaving a 37- to 62-foot-wide strip of vegetation between two cleared rights-of-way may also be undesirable. Therefore, we recommend that Iroquois construct its pipeline immediately adjacent to the existing cleared area within the Niagara Mohawk right-of-way. The pipeline shall be located no more than 25 feet from the edge of the existing clearing. Further, Iroquois shall prepare an environmental management and construction plan for this alternative alignment, identifying the location of the pipeline relative to the existing right-of-way, and any technical constraints and environmental consequences. This construction plan must be submitted to the Director of OPPR for review and approval prior to construction in this area.

The use of Anne's Independence River Alternate eliminates the need for the previously recommended Indian Pipe State Forest Variation.

6.2.12 Lyons Falls Variation

The Lyons Falls Variation was identified during the comment period to minimize impact on wetlands, increase the distance between the pipeline and residences in the Village of Lyons Falls, and increase the distance between the pipeline and historic homes on Route 12A.

The variation would diverge west from the proposed route at MP 98.1, cross Route 12 approximately 1,300 feet north of the point of crossing by the proposed route, and rejoin the proposed route at MP 101.3 (see figure A-1, sheets 16 and 17 of 57). The variation would be approximately the same length as the corresponding segment of the proposed route (3.2 miles), would affect fewer acres of wetland (0.7 acres versus 4.3 acres), would affect slightly more agricultural pasture (16.9 acres versus 16.7 acres), and more forested area (21.0 acres versus 17.2 acres) (see table 6.2-1). Both the proposed route and the variation are within 1.5 miles of a rare plant species. Because the location is to the east of the proposed route, the variation is further from that site.

We conclude that Iroquois' proposal has merit and we recommend the adoption of the Lyons Falls Variation.

6.2.13 Wingate Swamp Wetland Variation and Modification

The Wingate Swamp Wetland Variation was originally identified in the DEIS as a wetland mitigation variation to minimize impact on NYDEC wetland B-11. Iroquois proposes to modify the original variation to avoid new residential developments (subdivisions) along the original proposed route and the original Wingate Swamp Wetland Variation.

The Wingate Swamp Wetland Modification would deviate from the proposed route to the east at MP 109.6 (or 1 mile north of the point where the Wingate Swamp Wetland Variation deviated), would continue parallel to and within 2,000 feet of the proposed route, and would rejoin the proposed route at MP 111.8 (see figure A-1, sheet 18 of 57). This modification takes into consideration the results of field surveys that were undertaken by Iroquois to verify the location of the limits of wetland B-11 and other wetlands.

Roads between MP 110.0 and MP 111.0 which appear as unimproved on the USGS-base maps in figure A-1 sheet 18 of 57 have been improved and lands adjacent to these roads have been subdivided and homes have been constructed. The modification avoids these areas.

The modification varies significantly from the original Wingate Swamp Wetland Variation. Therefore, a comparison of characteristics of the Wingate Swamp Wetland Modification and the corresponding segment of the proposed route are made rather than a comparison with the Wingate Swamp Wetland Variation. The modification would be approximately the same length as the proposed route (2.1 miles), would affect more wetland

(2.4 acres versus 2.3 acres), the same amount of forestland (19.2 acres), and more agricultural land (3.9 acres versus 3.6 acres) (see table 6.2-1).

Although construction of the Wingate Swamp Wetland Modification would result in slightly more impact on natural resources, it would avoid subdivided land and an area of new homes. We concur with Iroquois' evaluation that the development of new subdivisions in the area preclude the construction of both the proposed route and the original Wingate Swamp Wetland Variation. We recommend the adoption of the Wingate Swamp Wetland Modification.

6.2.14 Route 28 Variation

The Route 28 Variation was under study at the time the DEIS was issued. The objective of the Route 28 Variation (MP 115.1 to MP 116.6; see figure A-1, sheet 19 of 57) was to avoid commercial development adjacent to Route 28. Based on recent field surveys, Iroquois has modified the variation as originally included in the DEIS to avoid additional residences.

The variation would be approximately the same length as the original proposed route (1.6 miles) and would affect the same area of agricultural land (2.3 acres) (see table 6.2-1). The variation would affect more wetland (1.4 acres versus 1.0 acre). Both the variation and the proposed route would traverse primarily forestland, although the variation would affect less (15.9 acres versus 16.5 acres) than the proposed route.

Since residential and commercial development impedes utilization of the proposed route and environmental impact of the variation is negligible, we recommend adoption of the Route 28 Variation.

6.2.15 Kayuta Lake Wetland Modification

Iroquois proposed the original Kayuta Lake Wetland Variation to avoid NYDEC wetland FO-4. In the DEIS we recommended that variation be adopted as a wetland mitigation variation. Iroquois now proposes a modification to that variation to avoid new residences along Kayuta Park Road and to avoid an agricultural field south of Kayuta Park Road.

The proposed modification would diverge to the west from the original variation at a point just north of Dustin Road at MP 117.2. The modification would parallel the variation within 200 feet for approximately 0.5 mile until crossing to the east of the variation. The modification would then parallel the variation to the east before rejoining the proposed route at MP 118.7 (see figure A-1, sheet 19 of 57).

The modification would be approximately the same length as the variation (1.5 miles) and would affect less wetland (0.9 acre versus 1.0 acre) and agricultural land (0.4 acre versus 7.3 acres) (see table 6.2-1). The modification would affect an additional 6.6 acres of forestland (16.4 acres versus 9.8 acres).

Based on the fact that the modification is consistent with the original intent of the variation and that new residences would be avoided, we find the Kayuta Lake Wetland

Modification environmentally preferable to the original Kayuta Lake Wetland Variation and recommend its use.

6.2.16 Remsen Wetland Modification

The Remsen Wetland Variation (MP 120.3 to MP 121.8; see figure A-1, sheet 20 of 57) was originally proposed by Iroquois to minimize impact on NYDEC wetland R-8. We recommended adoption of that variation in the DEIS. Based on additional field work, Iroquois proposes a refinement to the original variation to shorten the route without increasing impact on wetlands.

The modification would deviate to the south from the original Remsen Wetland Variation at an approximate milepost of 0.5 on the original variation. The modification would continue in roughly a straight line, cross the original variation at an approximate milepost of 1.2 on the variation, and rejoin the proposed route at MP 122.2. The variation is shorter than the original variation (1.5 miles versus 1.7 miles), would affect less forestland (15.1 acres versus 16.4 acres) and agricultural land (1.1 acres versus 1.4 acres), and would affect the same amount of wetlands as the original variation (2.2 acres).

We find that the Remsen Wetland Modification is environmentally superior to the original Remsen Wetland Variation and the corresponding segment of the proposed route. Therefore, we recommend the adoption of the Remsen Wetland Modification utilizing the initial 0.5-mile-long segment of the Remsen Wetland Variation.

6.2.17 Trenton Wetland Modification

The Trenton Wetland Variation (MP 124.5 to MP 125.2) was originally proposed by Iroquois to avoid NYDEC wetland R-31. We recommended the adoption of that variation in the DEIS. Subsequent to the publication of the DEIS, Iroquois conducted field surveys and determined that the wetland areas in this location were more extensive than originally indicated. Consequently, Iroquois proposes a modification to the original variation which would minimize the length of wetlands crossed and avoid the crossing of a newly constructed pond.

The modification would deviate from the proposed route at MP 124.0, approximately 0.5 mile north of the point of departure of the original variation. The modification would roughly parallel the proposed route at a distance of approximately 500 feet for a distance of 1.0 mile before intersecting the original variation. The modification would be coincident with the variation for approximately 0.2 mile, at which point the modification would rejoin the proposed route at MP 125.0 (see figure A-1, sheet 20 of 57).

The modification would be the same length as the variation and the additional segment of the proposed route, would cross 3.2 acres less wetland (2.3 acres versus 5.5 acres), would require 2.3 acres less forest clearing (7.3 acres versus 9.6 acres), and would avoid crossing the pond (see table 6.2-1). The modification would affect an additional 3.2 acres of agricultural land (3.2 acres versus 0.0 acre).

Based on the facts that the modification would avoid areas at the request of landowners and that the modification would further the original intent of the variation, we recommend the adoption of the Trenton Wetland Modification.

6.2.18 King Quarry Variation

The King Quarry Variation was identified during the comment period in response to information received from a landowner regarding plans for a new limestone quarry. The proposed route would pass directly through the quarry.

The variation would deviate from the proposed route to the north at MP 131.9 and would continue parallel to and within 300 feet of Military Road for approximately 3,000 feet before turning south and rejoining the proposed route at MP 132.5 (see figure A-1, sheet 22 of 57). The variation would be slightly longer than the proposed route (0.75 mile versus 0.70 mile), would affect more forestland (5.2 acres versus 3.2 acres), and would affect less agricultural land (3.6 acres versus 4.9 acres).

Notwithstanding the increased impact on forestland, we recommend the adoption of the King Quarry Variation to avoid impact on the planned limestone quarry.

6.2.19 Rose Valley Landfill Variation and Modification

The Rose Valley Landfill Variation was evaluated in the DEIS and was originally proposed by Iroquois to avoid traversing a potentially contaminated former dump site. The Rose Valley Landfill Variation would have been approximately 500 feet longer than the proposed route. Impact of this variation that was different from the proposed route is primarily associated with land use. Construction of the variation would have disrupted less woodland (18.9 acres versus 20.7 acres) and agricultural land (9.2 acres versus 11.5 acres) but more streams (4 versus 3). The route variation would not have crossed the landfill and would not have been located away from the estimated direction of groundwater flow from the landfill based on review of EPA studies.

It is apparent from the evaluation of this route variation that the Rose Valley Landfill variation would have been environmentally preferable to the proposed route, resulting in less impact in terms of disturbance to the landfill, forestland, and agricultural land. We recommended the adoption of this variation in the DEIS.

In their comments, the NYSTF states that this variation may not be necessary and that routing concerns in the landfill were addressed in the state licensing process. The NYSTF recommended that if no hazardous waste is found on the site, the proposed route, as certified in the New York State Article VII proceeding, should be followed. As the result of landowner consultations, Iroquois proposes to modify the original variation to avoid several natural springs, a sugarbush, and an agricultural field.

The proposed modification would deviate from the proposed route at MP 132.5, approximately 0.1 mile northwest of the departure point of the original variation. The modification would generally parallel the variation, crossing the variation four times before rejoining the proposed route at the same location as the variation at MP 135.5 (see figure A-1, sheet 22 of 57). The modification would be separated from the original variation by a maximum of 500 feet.

The modification would be approximately the same length as the variation (2.7 miles) and would cross the same number of streams (1) (see table 6.2-1). The modification would affect less agricultural land (6.6 acres versus 7.6 acres), but would affect more forested land (18.2 acres versus 17.5 acres).

The original objective of adopting the Rose Valley Landfill Variation was to avoid the potentially contaminated Rose Valley landfill, and we note that several local landowners raised this concern during our scoping process. Although the comment from the NYSTF may be valid, the variation and modification are preferable to the proposed route for environmental reasons in addition to the avoidance of the landfill. Therefore, we recommend the Rose Valley Landfill Modification.

6.2.20 Fairfield Variation

The Fairfield Variation was identified by Iroquois during the comment period to avoid certain lands associated with the water supplies of the communities of Middleville and Little Falls.

The proposed variation would deviate from the proposed route to the east at MP 141.0, generally parallel the proposed route within 500 feet for a distance of approximately 1.0 mile, cross the proposed route to the west, and then rejoin the proposed route at MP 142.5 (see figure A-1, sheet 23 of 57). The variation would be slightly longer (1.5 miles versus 1.4 miles) than the proposed route and would traverse less forestland (0.0 acres versus 2.9 acres) and more agricultural land (14.7 acres versus 12.8 acres) (see table 6.2-1). No new property owners would be affected by the variation.

We find the Fairfield Variation preferable to the proposed route because it would avoid the water supplies of two communities and reduce clearing of forest. We, therefore, recommend adoption of the Fairfield Variation.

6.2.21 Manheim Variation

The Manheim Variation was identified by Iroquois during the comment period to address the concerns of landowners in the Town of Manheim, New York. The proposed modification would avoid proposed building lots and freshwater springs. No landowners would be affected by the variation that would not be affected by the corresponding segment of the proposed route.

The Manheim Variation would deviate to the west of and be within 1,500 feet of the proposed route between MP 148.1 and MP 150.8 (see figure A-1, sheets 24 and 25 of 57). The variation would be longer than the proposed route (2.7 miles versus 2.5 miles) and would affect less agricultural land (15.6 acres versus 22.6 acres) (see table 6.2-1). The variation would require 2.0 acres of additional forestland to be cleared (4.8 acres versus 2.8 acres). Neither the variation nor the proposed route would traverse wetlands.

We believe that the benefits of this variation outweigh the additional impact and we recommend adoption of the Manheim Variation.

6.2.22 Route 5 Variation

The Route 5 Variation was identified by Iroquois during the comment period to resolve several concerns between MP 151.2 and MP 153.2 in Herkimer County, New York.

These concerns include: a forested wetland (MP 151.7); agricultural drainage tiles (MP 151.5); a small cemetery; a large cattle watering area (MP 151.9); a tiled agricultural field (MP 152.1); a family burial site (MP 152.6); and a difficult approach (a high bluff) to the north side of the crossing of Route 5 (MP 152.8).

The variation would deviate from the proposed route to the east at MP 151.2. It would generally parallel the proposed route at a distance of 200 feet for about 0.7 mile before it diverges to approximately 1,000 feet to the east of the proposed route. The modification would cross Route 5 at a point approximately 750 feet east of the crossing point of the proposed route and rejoin the proposed route at MP 153.2 (see figure A-1, sheet 25 of 57). In addition to avoiding the seven items of concern noted above, the modification would be 0.05 mile shorter (1.93 miles versus 1.98 miles), would traverse fewer streams (1 versus 3), and would affect less wetland (2.2 acres versus 2.7 acres) and forest (1.8 acres versus 3.7 acres) than the proposed route, but would affect more agricultural pasture land (19.4 acres versus 16.3 acres) (see table 6.2-1).

Considering the number of factors representing potential impact along this segment of the proposed route, we feel that the proposed modification represents a reasonable attempt to resolve a majority of the issues and to reduce overall impact. We conclude that the Route 5 Variation is superior to the proposed route and we recommend its use.

6.2.23 Minden Variation

The Minden Variation was identified by Iroquois as the result of landowner consultation during the comment period to avoid a woodlot on the banks of Otsquago Creek and a small cemetery. This variation also incorporates portions of an alignment that was proposed by NYDAM during the New York State Article VII proceedings. That alignment was referred to as the "Agricultural and Markets (NYDAM) Deflection No. 10" in those proceedings. (Those portions of the NYDAM Deflection No. 10 not included as part of the Minden Variation are included as the Deflection No. 10 Variation and Flat Creek Variation addressed below.) The purpose of the NYDAM Deflection No. 10 was to avoid the addition of a pipeline right-of-way through farmlands where several other rights-of-way, including powerline rights-of-way, were located. The NYDAM Deflection No. 10 would also maximize the use of old fields and pastures of marginal quality, as well as lands that have idled to shrub and tree growth.

The Minden Variation would deviate from the proposed route at MP 160.6 and would roughly parallel the proposed route within 800 feet to the west for 1.9 miles, would cross the proposed route at MP 162.4, and would roughly parallel the proposed route within 600 feet to the east for 1.8 miles before rejoining the proposed route at MP 164.3 (see figure A-1, sheets 26 and 27 of 57). The variation would parallel an existing powerline right-of-way for approximately 0.8 mile (see table 6.2-1).

The route variation is approximately 0.14 mile longer than the proposed route (3.76 miles versus 3.62 miles) and would affect more active or rotated cropland (33.1 acres versus 28.3 acres), more streams (6 versus 4), and less forestland (12.0 acres versus 12.7 acres). The variation would also affect less wetland (0.4 acre versus 0.7 acre) and orchards (0.0 acres versus 2.2 acres) than the proposed route.

Of the wetlands which are crossed, the variation would require no clearing of forested wetlands while the proposed route would require clearing in one forested wetland. The variation would also avoid areas of steep slopes at the crossing of Highway 80 as well as an area of eroding bank at the crossing of Otsquago Creek. In that segment of the existing powerline right-of-way which the variation would parallel, a meandering stream crosses the right-of-way diagonally. Construction of the variation in that location would require construction activities to occur within 50 feet of the stream for a distance of approximately 1,300 feet.

We conclude that the variation is environmentally superior and recommend that the variation be adopted; however, prior to construction, Iroquois must present a plan to the FERC staff that would indicate how the crossing of the creek under the powerline would be achieved to minimize overall impact.

6.2.24 Deflection No. 10 Variation

This variation was identified by Iroquois during the comment period and incorporates a portion of the Agricultural and Markets Deflection No. 10 as discussed under the Minden Variation. The objective of the Deflection No. 10 Variation is to minimize impact on active agricultural lands.

The Deflection No. 10 Variation would deviate from the proposed route at MP 167.5 and would roughly parallel the proposed route for approximately 3.9 miles and rejoin the proposed route at MP 171.4 (see figure A-1, sheet 28 of 57). The variation would be within 1,800 feet of the proposed route for its entire length.

The variation is the same length as the corresponding segment of the proposed route. The variation would cross fewer streams (2 versus 3) and less active agricultural land (18.0 acres versus 28.2 acres) (see table 6.2-1). Although the variation would traverse fewer cleared agricultural areas, it would require more clearing of forested areas (11.4 acres versus 10.1 acres).

Considering the value placed by New York on its agricultural resources and because the variation would reduce overall impact on those resources and streams with minimal additional effect on forests, we recommend that the Deflection No. 10 Variation be followed. We note that this variation is consistent with comments provided by the NYSTF.

6.2.25 Flat Creek Variation

This variation was identified by Iroquois during the comment period and incorporates a portion of the NYDAM Deflection No. 10 that was recommended to reduce impact on actively cultivated agricultural lands.

The Flat Creek Variation would deviate from the proposed route at MP 174.2 and would rejoin the proposed route at MP 175.6 (see figure A-1, sheet 29 of 57). The variation would be approximately 0.1 mile shorter (1.2 miles versus 1.3 miles) than the proposed route and would affect 2.1 fewer acres of active farmland (7.5 acres versus 9.6 acres) (see table 6.2-1). A consequence of moving the variation out of agricultural land is that the variation would require clearing 1.6 acres more of wooded areas (4.0 acres versus 2.4 acres).

We note that the Minden Variation, Deflection No. 10 Variation, and the Flat Creek Variation are all part of the alignment identified during the New York Article VII proceedings as the NYDAM Deflection No. 10. In most instances, given a choice of routing a pipeline through unimproved agricultural land or forestland, we would recommend the former. However, given the fact that the Flat Creek Variation is part of the larger variation which has undergone extensive review, we see no compelling reason not to recommend the adoption of the variation. Therefore, we recommend its adoption.

6.2.26 Route 146 Variation

The Route 146 Variation was identified by Iroquois during the comment period to align the proposed pipeline a greater distance from residences. The proposed route is located adjacent to the west side of an existing Tennessee right-of-way between MP 192.0 and 194.8 (see figure A-1, sheet 32 of 57). The variation would align the proposed pipeline to the east side of the existing pipeline right-of-way at a greater distance from residences.

The variation and the proposed route would each be approximately 2.8 miles in length (see table 6.2-1). The variation would require less clearing of forestland (12.1 acres versus 12.7 acres) than the proposed route. The variation would cross one more stream (4 versus 3) and would affect more agricultural land (20.9 acres versus 19.1 acres).

The difference in potential impact between the variation and the proposed route is minimal. Since the variation would align the pipeline at a greater distance from residences without resulting in significant additional impact, we recommend use of the Route 146 Variation.

6.2.27 Wright Wetland Variation

The Wright Wetland Variation was originally recommended to avoid a NYDEC wetland at MP 196.0 (see figure A-1, sheet 32 of 57). Additional field work by Iroquois has indicated that the variation would cross an unmapped deciduous forest wetland with pockets of standing water.

Since the variation would affect more wetland area than the proposed route, we believe that the proposed route is preferable in this area, and that the Wright Wetland Variation should not be adopted.

6.2.28 Eight Mile Variation

The Eight Mile Variation was identified by Iroquois during the comment period at the request of a landowner to avoid impact on a residence and horse trails and to more closely follow property lines between MP 208.3 and 209.0 (see figure A-1, sheets 34 and 35 of 57). No new property owners would be affected by the variation which were not affected by the proposed route.

The variation and proposed route would be of equal length (0.7 mile) (see table 6.2-1). The variation would affect more forestland (9.0 acres versus 8.0 acres); however, all other resources would be affected equally by both the variation and the proposed route.

Since the variation would minimize impact on residential land use and other environmental impact would be negligible, we recommend adoption of the Eight Mile Variation.

6.2.29 Westerlo Variation

The Westerlo Variation was identified by Iroquois during the comment period as a result of recent landowner consultations and field investigations between MP 210.9 and 211.7 (see figure A-1, sheet 35 of 57). The variation would avoid springs and a sidehill. No new landowners would be involved as a result of the variation.

The variation would be the same length as the proposed route (0.9 mile), would affect the same amount of agricultural land (5.0 acres), and would affect more forested land (5.2 acres versus 4.9) (see table 6.2-1). The variation and proposed route would be similar in all other impact.

Since no additional significant impact would be associated with use of the variation, we find the Westerlo Variation to be preferable and recommend its adoption.

6.2.30 Greenville Variation

The Greenville Variation was identified by Iroquois during the comment period as a result of landowner consultations and field surveys. The variation would avoid water supply springs and a deep cut at a road crossing between MP 217.3 and MP 218.0 (see figure A-1, sheet 36 of 57). No new landowners would be affected by the variation.

The variation and the corresponding segment of the proposed route would be of equal length (0.7 mile) and would cross an equal number of streams (2) (see table 6.2-1). The variation would affect more forestland (4.2 acres versus 3.2 acres) and less agricultural land (2.2 acres versus 3.9 acres).

Since the variation would avoid springs without significantly affecting other resources and would address concerns of the landowners without affecting additional landowners, we recommend the adoption of the Greenville Variation.

6.2.31 Route 81 Variation

The Route 81 Variation was identified by Iroquois during the comment period to increase the distance of the proposed pipeline from residences adjacent to Route 81 at MP 221.9 of the proposed route. The proposed route would pass between two relatively new residences not shown on topographic maps.

The variation would diverge from the proposed route to the east at MP 221.6, parallel the proposed route at a distance of approximately 250 feet, and rejoin the proposed route at MP 222.0 (see figure A-1, sheet 37 of 57). The variation and the proposed route would be of equal length (0.3 mile) (see table 6.2-1). Other than the fact that the variation would avoid the homes and affect more forestland (3.3 acres versus 2.7 acres), the variation and the proposed route are comparable in terms of potential impact.

Since the variation reduces impact on residential land use and additional environmental impact is negligible, we recommend adoption of the Route 81 Variation.

6.2.32 Athens Variation

Iroquois identified the Athens Variation during the comment period to avoid private septic systems and increase the distance between the pipeline and existing homes, some of which are within 50 feet of the proposed route. Iroquois proposes this variation at the request of landowners.

The variation would depart from the proposed route at MP 225.1, roughly parallel the proposed route, and rejoin the proposed route at MP 225.9 (see figure A-1, sheet 37 of 57). The variation and the proposed route are each 0.8 mile long (see table 6.2-1). The variation would affect less wetland (0.2 acre versus 0.5 acre) and less agricultural land than the proposed route (2.7 acres versus 5.8 acres) but would require more clearing of forestland (5.9 acres versus 2.4 acres).

We believe that the benefits of minimizing wetland crossing and avoidance of impact on residential land use outweigh the impacts of clearing forested land. Therefore, we recommend adoption of the Athens Variation.

6.2.33 Athens Airport Wetland Modification

We recommended the adoption of the Athens Airport Wetland Variation in the DEIS. The objective of the variation was to minimize impact on wetland resources between MP 228.8 and MP 229.3 in the Town of Athens, New York. Iroquois proposes a modification to that variation to avoid areas of proposed development and reduce the area of woodland traversed.

The modification would depart from the proposed route to the east at approximately the same location as the original variation. The modification would continue directly east for about 250 feet to avoid building lots adjacent to Route 9W. The modification would turn southeast, cross a narrow area of a wetland, and then cross the original variation. The modification would pass along the west edge of a woodlot that would be crossed by the original variation, and turn south at a point approximately 450 feet south of the Athens Airport. In this area the proposed route would cross a corner of the airport and potentially conflict with plans to add a second runway to the airport. The modification would rejoin the proposed route at MP 230.0. For its entire length, the modification would be located within 500 feet of the original modification or proposed route (see figure A-1, sheet 38 of 57).

The proposed modification would be slightly longer than the proposed route (1.6 miles versus 1.5 miles) and would affect slightly more wetland (0.9 acre versus 0.7 acre); however, the modification would require the clearing of less forestland (3.8 acres versus 4.2 acres) (see table 6.2-1).

Given the possible conflicts between the proposed route and possible development in the area, we recommend adoption of the Athens Airport Wetland Modification.

6.2.34 Leeds Road Variation

Iroquois identified the Leeds Road Variation during the comment period to avoid existing, new, and planned residences adjacent to and east of Leeds Road. The proposed route presently crosses the foundation for a new home.

The proposed variation would diverge from the proposed route to the south at MP 231.0 and would traverse Leeds Road approximately 520 feet west of the crossing by the proposed route. The variation would continue roughly parallel to the proposed route for about 1,500 feet, cross the proposed route to the east at MP 231.4 and rejoin the proposed route at MP 231.5 (see figure A-1, sheet 38 of 57).

The variation would affect less agricultural land (0.6 acre versus 2.0 acres) than the proposed route, but would be longer (0.6 mile versus 0.5 mile), would cross one more stream (1 versus 0), and would affect more forestland (6.9 acres versus 1.6 acres) (see table 6.2-1).

In this case, we feel that the benefits of avoiding impact on residential land use outweigh impact on forestland. Therefore we recommend the adoption of the Leeds Road Variation.

6.2.35 Mt. Merino I Variation

Comments on the DEIS included a request from Mr. Carl G. Whitbeck, Jr. to evaluate two variations in the vicinity of his home on Mt. Merino (MP 232.5). Mr. Whitbeck's home, the Oliver Wiswall House, is listed in the National Register of Historic Places and he is concerned that the clearing of the right-of-way will affect the visual setting of his home. Based on Mr. Whitbeck's comments, we developed two variations for evaluation. The first, Mt. Merino I Variation, is discussed here, and the second, Mt. Merino II Variation, is discussed below.

Mt. Merino I Variation would deviate from the proposed route at MP 232.4, pass to the south of the Whitbeck home between the home and the existing powerline right-of-way, and rejoin the proposed route at MP 232.7 (see figure A-1, sheets 38 and 39 of 57). The variation would require construction in an area with steeper side slopes than the proposed route, potentially resulting in greater erosion problems. Blasting which would be required in areas adjacent to the powerline right-of-way represents a potential threat to the foundations of the transmission towers and a consequent threat to the operational integrity of the powerline. In addition, construction of the pipeline between the house and the powerline would require the removal of the majority of the existing vegetation between the house and the existing powerline, resulting in a wider cleared right-of-way and potentially greater visual impact.

Iroquois has indicated that the location of the proposed route in the vicinity of the Whitbeck house was incorrectly mapped in the DEIS. Iroquois' intent is to locate the proposed route approximately 300 feet north of the Whitbeck house, midway between the Whitbeck house and the next residence to the north. The location of the proposed route has been corrected on the map.

We conclude that this variation offers no advantages in light of the fact that the correct location of the right-of-way is approximately 300 feet from the Whitbeck house and the variation would result in potentially greater impact and technical constraints. In addition, we note the requirement for Iroquois to provide a detailed mitigation plan to address potential visual impact from the proposed route. Therefore, we do not recommend the adoption of this variation.

6.2.36 Mt. Merino II Variation

The Mt. Merino II Variation would deviate from the proposed route at MP 232.4 to the north. It would generally parallel Mt. Merino Road between the road and the wetland to the north. The variation would then cross the road and rejoin the proposed route at MP 232.9 (see figure A-1, sheets 38 and 39 of 57).

The sideslopes between the road and wetland are in excess of 26 percent. Iroquois has indicated that the pipeline could not be constructed under those conditions. Given these considerations, the proposed route is preferred over this variation and we do not recommend its use.

6.2.37 Greenport Ravine Variation

The Greenport Ravine Variation was identified by Iroquois during the comment period to avoid a steep ravine and to generally improve the proposed pipeline alignment through an area of rugged terrain. This variation was the result of landowner consultations and field surveys. Only those landowners affected by the proposed route would be affected by the variation.

The variation would depart from the proposed route to the west at MP 233.2. It would generally parallel the proposed route at a maximum distance of 600 feet for a distance of approximately 1.2 miles before rejoining the proposed route at MP 234.5 (see figure A-1, sheet 39 of 57).

The variation would be shorter than the proposed route (1.2 miles versus 1.3 miles), affect less wetland (0.2 acre versus 2.3 acres), and require less clearing of forestland (6.2 acres versus 7.2 acres) (see table 6.2-1). The variation would affect slightly more agricultural land (4.4 acres versus 4.0 acres). Potential impact on other resources would be comparable.

Since no new landowners would be affected and impact on wetlands and forest would be reduced, we recommend adoption of the Greenport Ravine Variation.

6.2.38 Greenport Quarry Variation and Modification

The Greenport Quarry Variation was originally recommended in the DEIS to avoid a portion of a quarry between MP 236.3 and MP 237.0 (see figure A-1, sheet 39 of 57). The original route variation would have been slightly longer than the proposed route (0.75 mile versus 0.70 mile) but would make use of an existing overhead electric transmission line for approximately 85 percent of its length (3,350 feet). The route variation would have required the clearing of approximately 0.5 acre of wooded area and would have disrupted approximately 6.7 acres of agricultural land along and under the transmission line. This impact would have been similar to those along the proposed route, which would require the clearing of approximately 0.2 acre of forest and the disruption of 5 acres of agricultural land. The route variation would have also increased the distance between the proposed right-of-way and the Mount Pleasant Church and cemetery, and would totally avoid the active sand and gravel quarry. The route variation would have moved the proposed right-of-way closer to three residences, but it would still have remained on the opposite side of the transmission line from them. The route variation would also have eliminated wetland crossings whereas the proposed route would disturb 6.42 acres of forested wetlands.

Iroquois proposes a modification which would avoid a steep gully within and directly adjacent to the existing powerline right-of-way which the variation would have paralleled. No new landowners would be affected by this modification. The modification would shift a 1,000-foot-long segment of the variation at the crossing of Route 31 approximately 175 feet to the east side of the existing powerline right-of-way (see figure A-1, sheet 39 of 57).

The proposed modification is minor, would resolve an engineering difficulty that could result in increased erosion if not properly resolved, would result in no additional impact, and would affect no additional landowners. Therefore, we recommend the adoption of the Greenport Quarry Modification.

6.2.39 Livingston Variation

Iroquois identified the Livingston Variation during the comment period to avoid impact on an active quarry. The variation would replace the proposed route between MP 241.2 and MP 241.6 (see figure A-1, sheet 40 of 57). It would be located adjacent to an existing powerline right-of-way and along an existing haul road through the quarry.

The proposed variation would be shorter than the proposed route (0.3 mile versus 0.4 mile) and would affect less agricultural land (3.6 acres versus 4.8 acres) than the proposed route (see table 6.2-1). The variation would also parallel 0.3 mile of existing powerline right-of-way and cross approximately 80 feet of quarry. No other resources would be affected.

Although the variation would traverse a short segment of quarry adjacent to the powerline right-of-way, we feel that the variation would represent less potential long-term constraints to the further development of the quarry than would the proposed route, which would limit further expansion of the quarry to the east. The variation also limits impact on actively cultivated agricultural fields. Therefore, we find the Livingston Variation to be preferable and recommend its adoption.

6.2.40 Milan Variation

The Milan Variation was identified by Iroquois during the comment period to avoid conflicts with planned residential developments and to avoid the creation of two separate cleared rights-of-way through a forested area. The Milan Variation would deviate from the proposed route to the east at MP 252.3 and would maintain an alignment adjacent to the existing powerline right-of-way. The variation would rejoin the proposed route at MP 253.6 where the proposed route intersects the existing powerline right-of-way (see figure A-1, sheet 42 of 57) (see table 6.2-1).

Since the variation would parallel existing right-of-way and not create any additional impact, we recommend the adoption of the Milan Variation.

6.2.41 ROW Alignment Variation

In the DEIS we evaluated and recommended the ROW Alignment Variation (see figure A-1, sheet 42 of 57). The two routes would have been similar. The ROW alignment route variation would have been 0.02 mile shorter than the proposed route. For example, both routes would have crossed two tributaries of Wappinger Creek, 50 feet of forested wetlands, and 0.10 mile of areas with slopes in excess of 15 percent. The only disadvantage of the route variation is that it would have removed 0.11 acre more forestland during the construction phase. The route variation would have been parallel to an existing right-of-way, thus avoiding the establishment of a new cleared corridor.

Iroquois has since conducted detailed field engineering studies of the variation. These studies have identified areas of rugged rocky terrain and rock outcrops that would require blasting and a wider-than-normal right-of-way to accommodate construction on the steep side slopes. Based on this engineering review of the variation, Iroquois recommends the original proposed route rather than the variation.

As indicated in section 6.1.18, resources affected by the proposed route and the variation are similar, and our primary basis for recommending the variation was to eliminate the need for clearing a second separate right-of-way. However, since terrain conditions would reduce the benefits achieved through parallel use of the powerline right-of-way, we accept Iroquois' analysis and find the original proposed route preferable.

6.2.42 Silver Lake Wetland Variation and Modification

Iroquois originally proposed the Silver Lake Wetland Variation to avoid a state-designated wetland. We evaluated the variation in section 6.1.19 of the DEIS and found it to be less desirable than the proposed route. The route variation would have been slightly shorter than the proposed route (0.42 mile versus 0.46 mile) but would have deviated from an existing electric transmission line's right-of-way. The proposed route would be parallel to the existing right-of-way for 80 percent of its length whereas the route variation would have paralleled it for only 9 percent of its length.

The route variation would have by-passed 650 feet of the state-designated RC-12 wetland that would be crossed by the proposed route. However, the route variation would have crossed 1,050 feet of a wetland determined by Iroquois to be PSS1.

The deviation from the existing right-of-way would have placed the pipeline closer to the residential development off Lamoree Road and would have created a new visual corridor, removing 3.44 acres of forestland. In addition, wetlands crossings would have only been minimized by approximately 6 feet. We concluded in the DEIS that the proposed route was preferred over the route variation.

Iroquois proposes a modification to the original variation to avoid areas of side slope and the majority of a wetland.

The Silver Lake Wetland Modification would deviate from the proposed route at MP 255.6 and parallel the proposed route at a distance of approximately 150 feet for about 0.6 mile, at which point the modification would rejoin the proposed route at MP 256.1 (see figure A-1, sheet 42 of 57). The modification would follow the same general alignment as the proposed route except that the proposed route would cross to the east side of the existing powerline right-of-way and the modification would parallel the west side of the powerline right-of-way. By paralleling the west side of the powerline, an area of steep side slope on the east side of the powerline right-of-way at MP 256.07 would be avoided.

Both the modification and the proposed route have similar characteristics (see table 6.2-1). They both are of the same length (0.4 mile) and would require the same amount of forest clearing (3.4 acres). The modification would cross 0.7 acre of wetland while the original variation would cross 2.4 acres.

Iroquois' proposed modification alleviates many of the concerns which we originally had with the Silver Lake Wetland Variation. The modification would keep the pipeline further from the residential development on Lamoree Road and would not create a new visual corridor. We feel that the modification is preferable to the original variation and offers advantages over the proposed route. We, therefore, recommend adoption of the Silver Lake Wetland Modification.

6.2.43 Little Wappinger Creek Variation and Modification

The Little Wappinger Creek Variation was originally proposed by Iroquois to avoid crossing a forested wetland in the Town of Clinton, New York. The Little Wappinger Creek Variation would have been the same length as the segment of the proposed route that it would replace. Impact on Wappinger Creek, a coldwater fishery, and areas of steep slope would have been similar for both routes. Impacts of this variation that would be different from the proposed route are primarily related to land use and wetlands. The proposed route would be parallel and adjacent to an existing electric transmission right-of-way for 0.2 mile, while the route variation would have created a new corridor resulting in a 0.5-acre increase in forestland to be cleared. The amount of wetland traversed by the proposed route would have been decreased by the variation (2.91 acres versus 1.38 acres), but a class I forested wetland would not have been entirely avoided. The major difference is that the route variation would have been within 50 feet of a dwelling. We rejected that variation on the basis that it would create a new corridor near the existing powerline right-of-way and would be located within 50 feet of a residence.

Recent field studies and consultation with an affected landowner have resulted in Iroquois processing a modification which would minimize impact on a residence located on the northeast side of the intersection of Enterprise Road and the powerline. The Little Wappinger Creek Modification would deviate to the east of the proposed route at MP 257.7 and would parallel the proposed route within 500 feet. It would then cross the proposed route at MP 258.1 and parallel the proposed route to the west before rejoining the proposed route at MP 258.4 (see figure A-1, sheet 43 of 57). Both the proposed route and the modification would be the same length (see table 6.2-1). The modification would affect 1.8 acres fewer wetlands (0.5 acre versus 2.3 acres) and 1.8 acres less forestland (1.9 acres versus 3.7 acres).

Since this modification would reduce impact on the affected residence and on wetland and forest resources, we recommend adoption of the Little Wappinger Creek Modification.

6.2.44 Maple Lane Variation

During the scoping process, a resident of Clinton, New York, proposed a variation to avoid a ravine that is subject to flooding during storms. The Maple Lane Variation would diverge from the proposed route at MP 259.1 and rejoin the proposed route at MP 259.5 (see figure A-1, sheet 43 of 57). The variation would be approximately 250 feet shorter than the corresponding segment of the proposed route (1,700 feet versus 1,950 feet) and would result in no apparent additional impact. Therefore, we recommend use of the Maple Lane Variation.

6.2.45 State Route 55 Variation

The State Route 55 Variation between MP 282.9 and MP 286.6 was evaluated in the DEIS (see sections 3.6.25 and 6.1.25 and figure A-1, sheet 47 of 57). The proposed 3.6-mile route variation is based on Reroute No. 31 as presented by the applicant in the first Routing Amendment report of October, 1987; however, whereas the original Reroute No. 31 continued into Connecticut, this route variation ends at approximately the New York-Connecticut border where it rejoins the proposed route. The route variation would replace a comparable 3.75-mile portion of the proposed route.

The area traversed by the route variation is similar to the area traversed by the proposed route. The route variation would require the clearing of approximately 26.3 acres of forestland; the proposed route would require 16.1 acres of forest clearing. The route variation would disrupt approximately 9.3 acres of active agriculture, whereas the proposed route would disrupt 13.5 acres of active agriculture. The route variation would traverse one state-mapped wetland (approximately 0.7 acre); the proposed route would not traverse any regulated wetlands. The proposed route would be located closer to more residences (7 versus 1), and both routes would be in proximity to potential bog turtle habitat.

The primary advantages of the route variation are that it would avoid a crossing Deuel Hollow Brook, would avoid the need for potentially difficult construction along SR 55 (along with the associated impact on residences), and would avoid traversing an active nursery. The route variation would traverse more wetlands and forestland than the proposed route. The advantages of the proposed route are that it would traverse more open, agricultural areas and would parallel a roadway, minimizing potential visual impact. Both routes would require two crossings of Tenmile River and would require recommended surveys for protected species prior to construction. The route variation would not affect the proposed crossing of the AT, which has been accepted by the Appalachian Trail officials.

At that time, we concluded that both routes were comparable; however, considering the stipulations reached by the various New York State agencies and the information before us, we recommended in the DEIS that the proposed route be adopted.

Public debate concerning this route has continued, resulting in numerous comments concerning our recommendation. The public debate concerning the alignment in this area focuses not only on the potential environmental impact associated with each route, but also on the status of individual landowners in the area and the appearance of political influence in determining the alignment. In our review of the alignment in this area we have ignored landowner status and have instead focused on the merits of each alignment and the public comments we have received.

Comments submitted by the NYSTF and Dr. Anne Meuser (GASP Coalition) point out that our statement regarding the stipulation to the proposed route (Reroute No. 37A) was inaccurate (particularly in regards to the inclusion of NYDEC in the stipulation) and our reliance on this apparent agreement was misplaced. Additional comments, including those from the Town of Dover, have pointed out the recent construction and development plans along the proposed route to the west of Cricket Hill Road (County Route 26), and have indicated the lack of such plans for the property along the route variation to the east of Cricket Hill Road. Other comments have highlighted the potential impact of the proposed route to residences and vegetation along SR 55.

Overwhelming public sentiment in this area favors the route variation over the proposed route. We note that the route variation also has the official support of the Town of Dover (including the Conservation Advisory Commission and the Planning Board) and the Dutchess County Environmental Management Council.

Based on additional information made available through the comments we received, as well as our further field review of the alignments in January and March 1990, we believe the State Route 55 Variation is preferable both in terms of environmental impact and public support. Therefore, we reject the proposed route in this area and recommend adoption of the route variation. We further recommend that Iroquois work with the property owners between MP 283.0 and MP 284.0 (i.e., the east side of Cricket Hill Road) to provide an alignment through their property that minimizes potential disruption of future development plans. We note that an alignment along the eastern edge of that property appears to be best. In addition, we have recommended that Iroquois identify potential bog turtle habitat and conduct appropriate surveys to avoid impact on bog turtles in this area.

6.2.46 Dover/Sherman Variation

The State of Connecticut and local citizens suggested evaluation of a pipeline route parallel to an existing electric powerline corridor that runs in an east-west direction through Dover, New York, and Sherman, Connecticut, approximately 1 mile north-northwest of the proposed pipeline route. One suggestion was to follow this existing powerline right-of-way with the pipeline across the Housatonic River to the intersection of the powerline right-of-way with a Conrail right-of-way in New Milford.

This existing powerline corridor was examined in detail during our original routing analyses and was dismissed for several reasons. Proceeding east from where the proposed pipeline route deviates from the powerline in Dover, the existing powerline right-of-way crosses several wetland areas before crossing Tenmile River, and additional wetland areas are also crossed in the vicinity of Ellis Pond. The existing powerline right-of-way then crosses several areas of side slope approaching the first of three separate crossings of the Housatonic River, two of which are associated with severe slopes. The impact associated with constructing a pipeline along this existing right-of-way, including the increased right-of-way width required to traverse the side slopes and the multiple river crossings, outweighs the apparent benefits of parallel rights-of-way. Therefore, we do not recommend this variation.

6.2.47 Route 55/Route 39 Variation

The HVA and others suggested that the pipeline follow SR 55 from the New York/Connecticut border to its intersection with County Route 39, then continue south along SR 39 to its intersection with the proposed route (see figure A-1, sheets 47 and 48 of 57). This alternative would supposedly avoid the impact associated with traversing the Smoke Ridge Subdivision and the Wimisink Sanctuary. The feasibility of this alternative was evaluated during a field review in March 1990.

SR 55 and, to a lesser extent, County Route 39 are major two-lane roadways with limited shoulders. In order to maintain the integrity of the pipeline and avoid potentially significant traffic impact, it is inadvisable to place the pipeline directly in the roadbed of SR 55 or County Route 39. Therefore, our investigations focused on the areas parallel and adjacent to the roadways. Our conclusion is that these corridors offer no opportunity for the suitable routing of the proposed pipeline. SR 55 is a relatively narrow road that follows the contours of the steep terrain in this area. In many places, the roadway has been cut into embankments, while in other locations the topography drops and forms small isolated wetland areas. Mature, wooded areas generally line both sides of the road, punctuated by occasional dwellings. Construction of the pipeline along either side of this roadway would result in significant impact.

Similarly, the area along County Route 39 offers limited routing opportunities. Construction along the east side of the roadway would require clearing of mature trees and would disrupt several residences; construction along the west side of the roadway would not eliminate impact on the Naromi Land Trust.

Considering the impact, particularly in comparison to the proposed route, we do not recommend routing along the Route 55/Route 39 corridor.

6.2.48 Wimisink Brook Variation

The HVA and the Naromi Land Trust (R. Donohue) both suggested an alternative alignment along the western and southern edge of the wetland system of the Wimisink Sanctuary. This alternative would intersect County Route 39 at the crossing of Wimisink Brook, then continue north along County Route 39 to the proposed route (see figure A-1, sheets 47 and 48 of 57). The objective of the Wimisink Brook Variation is to minimize impact on the wetland system by traversing its edge rather than its center.

Our evaluation of this suggested variation indicates that its impact outweighs its apparent benefits. The variation would be 0.7 mile longer than the proposed route, including a new right-of-way of approximately 3,600 feet along the edge of the wetland system as opposed to the proposed 1,600-foot crossing. This new right-of-way would most likely require the clearing of more forested area. The problems associated with following the County Route 9 corridor are similar to those discussed in section 6.2.47.

We recognized the potential disruption to the wetland associated with the proposed route and recommended a route variation in the DEIS (see section 6.1.26). We investigated the recommended route through this area in March 1990. The recommended route, which incorporates the previous Wimisink Variation, would follow a hedgerow but would not require the clearing of the hedgerow. The Naromi Land Trust concurs that this alignment would avoid a stand of native tamaracks. Our previous recommendations concerning the preparation of a site-specific mitigation plan in conjunction with the land trust, as well as our recommended wetland crossing procedures, would further serve to minimize long-term impact.

Considering the advantages and disadvantages of both routes, we continue to recommend the previous Wimisink Variation as the preferred alignment through this area.

6.2.49 Stilson Hill Variation

In response to continued local involvement, Iroquois has identified the Stilson Hill Variation between MPs 289.0 and 290.5. The proposed variation would shift the route to the west, increasing the distance between the proposed right-of-way and residences along Stilson Hill Road (see figure A-1, sheet 48 of 57). The route variation would make greater use of agricultural land and pasture, and would require less forest clearing (10.6 acres versus 11.9 acres) (see table 6.2-1). It is recognized that the telephone right-of-way which provided the basis for the original route in this area has been abandoned and no longer presents a routing opportunity.

We visited this variation in March 1990, and it appears to favorably address the concerns of local residents. We have, however, several recommendations about the implementation of this variation. The variation would pass to the west of a potentially significant historic residence on Church Road. In this area we recommend that the applicant maximize the distance between the proposed right-of-way and this residence, while at the same time limiting the amount of clearing of mature conifers further to the west. In addition, we recommend that the crossing of Morrissey Brook be aligned to avoid the mature sycamores that are located in this area.

We believe the Stilson Hill Variation responds to the concerns of local residents and represents an improved alignment in this area. We recommend that this variation be followed, including the incorporation of our site-specific mitigation measures.

6.2.50 East Stilson Hill Variation

The HVA and the Town of New Milford identified this route variation to the east of Stilson Hill Road between MPs 288.9 and 292.9 to reduce visual impact. This variation would diverge from the proposed route, ascend a steep slope, and continue roughly parallel and to the east of Stilson Hill Road. The variation would continue to the east of an existing trailer park and proceed parallel to and approximately 300 feet from SR 7 (see figure A-1, sheet 48 of 57). The variation would be approximately the same length as the proposed route.

The variation would traverse mostly forested areas, resulting in approximately 32.4 acres of clearing, compared to approximately 28.0 acres along the proposed route (see table 6.2-1). The variation would cross the same number of streams, but would disrupt less agricultural land (5.9 acres versus 9.4 acres). The variation would potentially impose less visual impact since the only severe slope that would be traversed is northwest facing, and would not be visible from any major roadways or populated areas. The variation would result in potentially greater disruption to a number of residences and properties along SR 7. In addition, while the variation would avoid the steep cut on Pine Knob (which would also be minimized by the Kimberly-Clark Variation proposed by Iroquois), the East Stilson Hill

Variation would be located downgradient from the Kimberly-Clark Landfill, causing greater concern in regard to potential problems from groundwater movement from the landfill.

Considering the potential impact of this variation and the routing variations recommended in this area (see sections 6.2.49 and 6.2.51), we do not recommend the East Stilson Hill Variation.

6.2.51 Kimberly-Clark Variation

The Kimberly-Clark Variation is proposed by Iroquois to avoid recently installed upgradient monitoring wells at the Kimberly-Clark Landfill. The variation, which deviates from the proposed route at MP 291.1, would also provide an improved alignment down the face of steep terrain in a saddle along the ridge of Pine Knob/Candlewood Mountain (see figure A-1, sheet 48 of 57). Both the variation and proposed routes cross the Candlewood Trail and both routes traverse heavily forested areas.

We reviewed the proposed variation with respect to the Kimberly-Clark Landfill and potential views of the right-of-way from SR 7 in March 1990. We agree that this variation has merit. However, we maintain our previous recommendation that Iroquois submit a detailed mitigation plan for minimizing clearing and revegetating the eastern slope of Pine Knob/Candlewood Mountain (see table 5.1.9-6). Considering this recommendation, we believe the Kimberly-Clark Variation represents an improvement of the routing in this area, and recommend that this variation be adopted.

6.2.52 Route 7 Variation

The HVA and New Milford suggested that the use of the SR 7 corridor be investigated, particularly between MP 293.0 and the New Milford/Brookfield town line (approximately MP 301.0). This corridor was suggested as a means of avoiding the Waste Management, Inc., Landfill (MP 295.5), the Candlewood Valley Country Club (MP 297.1 to 297.6), and the Still River Meanders (MP 297.6) (see figure A-1, sheet 50 of 57).

We are familiar with the SR 7 corridors, having traveled this road on numerous occasions during our field review and scoping meetings. SR 7 through New Milford is a two-lane, major arterial with unrestricted access. The capacity of the roadway is limited by the lack of turning lanes, signalized intersections, and numerous curb cuts associated with commercial developments. The shoulder along most of the roadway is narrow and unpaved.

Construction of the pipeline within the roadway of SR 7 is considered infeasible because of the relatively high traffic volumes and the limited work area along the roadway. Restricting the width of the travel lanes or closing a lane during construction would result in severe traffic impact and would probably be opposed by state and local transportation officials.

The areas adjacent to SR 7 also present severely limited routing opportunities. Construction along either side of the roadway would disrupt existing commercial developments and in some locations would require the removal or displacement of existing structures. Alignments to the rear of some properties appear feasible; however, an alignment that avoids all structures along this corridor would most likely require numerous crossings of

SR 7 and would be extremely circuitous. An alignment along the SR 7 corridor could disrupt existing underground utilities.

South of MP 297.0, the development along SR 7 becomes less concentrated, and the opportunities for routing the pipeline along this corridor are greater. However, the proposed route between MP 297.0 and the New Milford/Brookfield town line is located along an existing electric transmission line and no clear advantage would be provided by following SR 7 in this area.

Considering the limitations posed by the roadway and the development along the corridor, we believe that alternative alignments along the SR 7 corridor are infeasible and continue to recommend the proposed route between MPs 293.0 and 301.0 (including the previously recommended Still River Variation).

6.2.53 New Milford Variation and Alternate

The HVA and the Town of New Milford identified an alternative alignment that would deviate from the proposed route at approximately MP 294.5, proceed in a southeasterly direction across SR 7, and join the Conrail right-of-way at the Still River. From that point, the alternative would continue along the railroad and join the proposed route at the Still River Variation at MP 297.7. Two separate alignments across SR 7 were provided, identified on figure A-1, sheet 49 of 57, as the New Milford Variation and the New Milford Variation Alternate. The proposed variation (and the alternate) would avoid the Waste Management, Inc. Landfill, the Hill and Plain School, the Candlewood Valley Country Club, and the Still River Meanders.

The variation would be approximately 0.1 mile longer than the proposed route (see table 6.2-1). The proposed New Milford Variation would affect more agricultural land (11.3 acres versus 5.6 acres) and would require less forest clearing (9.3 acres versus 15.3 acres). The variation would parallel the Conrail right-of-way for a distance of approximately 1.5 miles, whereas the proposed route would parallel an existing electric transmission line for approximately 0.8 mile.

Based on our field review of these alignments in April 1990, both the New Milford Variation and Alternate would result in distinct impact not associated with the proposed route. The variation and alternate would traverse the Sunny Valley Foundation farm to the west of SR 7. The alternate would then cross SR 7 in the vicinity of commercial establishments and would pass to the south of the Kimberly-Clark industrial park through an area that appears to be undergoing development. The variation would cross SR 7 to the north of a shopping plaza in a very congested area. East of SR 7 the variation would traverse an area that appears to be an abandoned or neglected nursery. The alternate and variation converge to the west of the Still River.

The crossing of the Still River by the variation would also be problematic. The crossing in this location, particularly the required staging areas, would be constrained by the Conrail railroad, Harrybrooke Park (a private park located generally between the railroad tracks and the Still River), and residential development to the east of the railroad tracks.

On balance, the impact associated with the New Milford Variation and Alternate (i.e., impact on Sunny Valley Foundation Farm, disruption to commercial and residential areas, and impact on the Still River crossing) appear greater than the impact associated with the proposed route. Therefore, we do not recommend adoption of the New Milford Variation or Alternate.

6.2.54 Brookfield Variation #1

Iroquois proposed a route variation between MPs 300.4 and 300.9 to provide a crossover of the Conrail and existing powerline right-of-way, aligning the pipeline along the eastern edge of the powerline right-of-way and providing greater distance between the pipeline and the Still River Gorge (see figure A-1, sheet 50 of 57). We reviewed this suggested variation in the field in March 1990, and agree that it represents an improvement in this area.

We recommend this variation. We also recommend, as we did previously in this area, that Iroquois use the existing powerline right-of-way for the location of the pipeline.

6.2.55 Brookfield Variation #2

Iroquois proposed a route variation between MPs 301.8 and 302.8 that would align the pipeline along the west side of the Conrail right-of-way, avoiding the potential wetland areas along the proposed route on the east side of the Conrail tracks (see figure A-1, sheet 50 of 57). This variation would negate the previously recommended Brookfield Wetland Variation (see section 6.1.35) and would also respond to the comments raised by Mr. R. Waidelich and Ms. J. Williams, property owners along the proposed route. We reviewed this variation in the field in March 1990 and agree that the proposed variation has merit. The variation would make use of an abandoned railroad grade, and would avoid a tree farm and several small wetland areas. The variation would, however, place the pipeline in proximity to four residences and the Brookfield Post Office.

Based on an analysis of the issues, we recommend that this variation be adopted with the added provision that the restoration in this area include landscaping and revegetation to minimize the effects of clearing between MPs 301.8 and 302.2.

6.2.56 Brookfield Variation #3

Iroquois proposed a variation between MPs 303.6 and 303.8 that would align the pipeline along property lines and avoid an area of future expansion of the Brookfield Jewish Cemetery (see figure A-1, sheet 50 of 57). We have reviewed this minor realignment and recommend that it be adopted, with the added provision that the existing vegetation screen between the cemetery and the undeveloped portion of the industrial park be maintained.

6.2.57 Newtown Conrail Variation

HVA suggested that various alignments along the Conrail right-of-way through Newtown be evaluated as means of minimizing environmental impact. This basic variation would begin at approximately MP 305.4 and could extend to MP 308.9 (see figure A-1, sheets 50 and 51 of 57), rejoining the proposed route by using an old railroad grade. Alternatively, this variation could continue on the Conrail right-of-way in a southeasterly direction rejoining the proposed route at MP 317 or continuing as part of the Conrail Variation through Monroe.

Our analysis of this suggested alignment indicates that the environmental impact associated with constructing the pipeline along the Conrail right-of-way in Newtown would be greater than the impact associated with the proposed route. From MP 305.4 to MP 308.5 the Conrail right-of-way is paralleled on the north side by an electric transmission line. The pipeline would have to be placed along the south side of the tracks, requiring construction through several wetland areas. In addition, several road overpasses present serious restrictions for an alignment (i.e., construction) along the tracks. It should be noted that the corresponding portion of the proposed route is located entirely adjacent to an existing Algonquin right-of-way.

The Newtown Conrail Variation between MPs 308.5 and 317.0 would similarly result in greater environmental impact. Wetlands would be traversed in the areas south of I-84, south of the Fairfield State Hospital, and east of the Pootatuck River in the vicinity of Pine Swamp. After crossing the Newtown/Monroe town line, the Conrail right-of-way parallels the Halfway River, offering virtually no opportunity for routing the pipeline.

Considering the potential environmental impact and technical constraints, as well as the other route variations developed along this portion of the proposed route, we do not find the Conrail right-of-way through Newtown to offer any advantages over the proposed route. Therefore, we recommend the use of the proposed route.

6.2.58 Old Farm Hill Subdivision Variation

A route variation between MPs 308.3 and 310.1 was originally considered but rejected in the DEIS, pending further evaluation. Since that time, Iroquois consulted with the developer of the Old Farm Hill Subdivision and town officials, as we had requested, and conducted a field review of the alignment in this area. This additional analysis resulted in minor refinements to the original variation; the variation currently proposed by Iroquois is shown on figure A-1, sheets 50 and 51 of 57.

The modified variation would be slightly longer than the corresponding portion of the proposed route, resulting in slightly more forest clearing (21.8 acres versus 20.6 acres) but less wetland disruption (0.4 acre versus 0.8 acre) (see table 6.2-1). The modified variation would also traverse less hydric soils.

Considering the similarity in the potential impact of the variation and proposed route, but recognizing the intent to minimize the disruption to the planned subdivision, we recommend that the Old Farm Hill Subdivision Variation, including the recent modification, be adopted.

6.2.59 Newtown Subdivision Variation

A route variation between MPs 312.2 and 315.2 was originally proposed to provide for a better alignment through a number of subdivisions that are planned or undergoing construction. Since that time, Iroquois has continued to pursue discussions with the developers and local officials, and has provided a refined alignment. Their currently proposed route in this area is shown on figure A-1, sheets 51 and 52 of 57.

Our review of this variation as currently proposed indicates that the variation minimizes the disruption to the existing and planned subdivision. The variation would be slightly longer than the originally proposed route (3.3 miles versus 3.0 miles) and would result in more forest clearing (37.6 acres versus 32.0 acres) (see table 6.2-1). However, the extent of wetland disturbance would be reduced from approximately 1.7 acres along the originally proposed route to approximately 1.0 acres along the modified variation. The modified variation would also traverse less hydric soils.

Based on our analysis, we recommend that the Newtown Subdivision Variation, as currently proposed, be adopted. We note that the Paugussett State Forest Variation, if adopted, would deviate from the Newtown Subdivision Variation near MP 314.5.

6.2.60 Paugussett State Forest Variation

Several residents in Newtown suggested that the route in the general area between MPs 314.7 and 316.4 be shifted further east to make greater use of the Paugussett State Forest. General concerns raised included aesthetics, disruptions to private property, and the potential problems associated with increased public access via the new right-of-way. We also received several comments suggesting that the state forest be avoided.

Following discussions with the Town of Newtown, Iroquois evaluated potential alignments in the Paugussett State Forest and identified an alignment that would avoid potential wetland areas within the state forest (see figure A-1, sheets 51 and 52 of 57). They have conducted a reconnaissance-level survey of this alignment, and have met with the regional forester. In their response to comments to the COE, Iroquois has indicated that the town supports the concept of a route further into the state forest and is pursuing such a route with CTDEP.

We have reviewed the potential variation and found that the potential impact of both routes is similar. The variation would be located approximately 500 to 2,000 feet to the east of the proposed route, and both routes would be located entirely within forested areas. The length of the two routes would be approximately the same; however, whereas the proposed route (incorporating the Forest View Subdivision Variation) would traverse state forest land for a total distance of nearly 4,000 feet, the Paugussett State Forest Variation would traverse approximately 8,000 feet of state forestland (see table 6.2-1). The proposed route is approximately 150 to 200 feet away from the residences in the Osborn Hill Section; the variation would increase this distance to approximately 800 feet. This variation would provide approximately 500 feet of separation between the proposed right-of-way and the Forest View Subdivision.

The major difference between the proposed route and the Paugussett State Forest Variation would be the proximity of the route to the residences bordering the state forest. Both routes would result in a new right-of-way through a forested area and both routes have the potential for providing increased access to the resources of the state forest. The question is one of balancing the degree of disruption to the state forest with the potential disruption to the adjacent residences.

According to our discussions with the regional forester, the Paugussett State Forest is currently managed for forest resources (timber and firewood sales), hunting, and passive recreation (hiking). Access to the western portion of the state forest is limited to a 50-foot-wide easement from Leopard Drive, and it was indicated that, in general, the road system in the state forest is underdeveloped. While it was recognized that the pipeline right-of-way could serve to improve access to this area of the state forest, no official position was provided, nor was a preference indicated for one route over the other (Milne, Babcock, 1990).

We feel the concerns of the residents are legitimate. A pipeline right-of-way along either alignment in this area would likely increase access by hunters and hikers and would possibly be used for limited vehicular access associated with timber and firewood sales. Considering these potential uses, the separation between the residences and the proposed right-of-way (generally 150 - 200 feet, but in several locations, 50 feet) is not considered adequate. Properly constructed and maintained, the pipeline right-of-way developed along the variation route could serve to further the management objectives of the state forest by improving access, opening additional areas for timber sales, and providing a firebreak and fire service road.

Therefore, considering the potential benefits that could be realized by the state forest and the potential disruption to the area residences, we recommend that the Paugussett State Forest Variation be utilized in this area. We also recommend that Iroquois prepare a long-term right-of-way management plan for this portion of the pipeline in consultation with CTDEP and submit this plan to the Director of OPPR for review and approval prior to construction in this area.

6.2.61 Conrail Variation

We have received many comments on the analysis of the Conrail Variation presented in the DEIS. We have reevaluated this potential route variation, conducting additional site visits along both the Conrail Variation and the corresponding proposed route segment that would traverse Means Brook wetland, the Shelton Land Trust, and a protected watershed. To better determine its feasibility we met with representatives from both Iroquois and Conrail's engineering department in the field to review the engineering, construction, and operational aspects of utilizing this variation. In addition, we reviewed the environmental factors along the routes, including potential impact on wellfields and watersheds, wetlands, and significant natural resource areas such as Boys Halfway River Caves. The following discussion focuses first on issues associated with utilization of the railroad right-of-way. It then addresses issues that were raised concerning the corresponding proposed route segment.

Engineering and Construction - Several severely limiting engineering and construction constraints on the use of the Conrail Variation were identified during our analysis. The most severe constraints (i.e., those with the lowest probability of being overcome) include the need to case the pipeline, traversing areas of nearly impassable terrain, unstable slopes and railbed, and limited available workspace along the variation.

Conrail has developed construction specifications for pipeline occupancy of railbeds to ensure the operational safety of both the railbed and the pipeline (Conrail, 1976). These specifications have been approved and adopted by the American Railway Engineering Association (AREA). They require that any pipeline carrying oil, gas, or other petroleum products or highly flammable substances under pressure, located within 25 feet of the railbed or within 45 feet of a bridge supporting a railbed, will be encased in a welded, steel casing pipe. This is specified to contain and vent or drain away from the railbed, any potential leaks of highly flammable substances. The steel casing pipe is laid and the carrier pipe is pulled through and welded. To ensure the integrity of the cathodic corrosion protection system, it is imperative that the carrier pipe and the casing pipe walls do not touch one another and cause an electrical short.

This encasement requirement is generally not a problem with construction of pipelines that cross railbeds perpendicularly, or that parallel railbeds for short, straight distances. However, encasing a 24-inch-diameter pipeline for a distance of approximately 6 miles would be impossible due to the numerous sidebends, sags, and overbends that would be required to cover the terrain along the tracks. The pipeline company would not be able to ensure the integrity of the cathodic corrosion protection system and leaks could develop. Since the pipeline would be encased, it would not be easy to determine where the leaks were occurring, and it would be very difficult to repair them.

Upon a thorough field inspection of the Conrail right-of-way, Iroquois determined that there is not sufficient room along the railbed to locate the pipe more than 25 feet away from the railbed. Consequently, the pipeline would have to be cased for a distance of approximately 6 miles. The alternative to this would be major grading and terracing of the steep embankments for the entire length of the variation to gain sufficient distance away from the tracks. We do not consider such grading to be reasonable.

Several areas of nearly impassable terrain were identified by Iroquois along the potential variation and viewed during the staff's field reconnaissance. These are areas where construction would result in significant environmental impact and unacceptable levels of risk, both during construction and during railroad operation after construction. These areas are located at MP 1.7, MP 4.6, MP 5.0, and MP 5.7 of the Conrail Variation which begins at MP 316.8 of the proposed route (see figure A-1, sheets 52 and 52A of 57). Each one of these sites has a narrow railbed, abutted by a very steep slope, varying between 37 degrees and 85 degrees, on one or both sides. In order to construct the pipeline greater than 25 feet away from the railbed so encasement would not be required, the railbed area would have to be widened by excessive blasting and regrading of the abutting slope. In the area located at MP 1.7, the existing railbed is terraced into a very steep side-slope that would require dangerous blasting procedures and excessive regrading of the upper slope. It is questionable whether the upper slope could be made stable after construction.

The areas located at MPs 4.6, 5.0, and 5.7 are adjacent to the Housatonic River. Two of the areas would require extensive blasting and regrading on the western (upslope) embankment, which would result in newly cut rock faces between 22 feet and 100 feet high. The western embankment at both MP 4.6 and MP 5.7 currently supports the Indian Well State Park roadway. Stabilization of this roadway after construction, especially at MP 5.7 which has a sheer rock (85 degree) embankment, could probably not be accomplished. We could not find alternative routes off of the Conrail right-of-way to avoid these impassable areas, primarily due to the steep embankments.

The amount of blasting and regrading that would be required, not only at the four sites described above, but throughout the length of the Conrail right-of-way would seriously destabilize much of the railway along this proposed route. Two features of specific concern are the steep embankment areas abutting the tracks (as described above) and the false fill railbeds that were incorporated into the original railbed construction and stabilized over many years (Conrail, 1990). Iroquois has indicated that they could not guarantee the long-term stability of the side-slope embankments or the false fill embankments once normal rail operations resumed. Conrail representatives indicated that normal rail traffic along this route consists of approximately four trains per day with average weight per hopper car exceeding 100 tons. The obvious high loading on the railbed during rail operations would greatly exacerbate any instabilities incurred during pipeline blasting and trenching. According to Conrail representatives (Conrail, 1990) an unstabilized embankment can go undetected for many years, but could eventually fail, resulting in disruption of rail service and possibly a catastrophic train derailment. Considering the steep embankments traversed in this section of right-of-way, and the proximity to the Housatonic River, an accident that could involve loss of life and considerable environmental impact on the river has to be considered. Any slope failure associated with the railroad would also have a high probability of affecting the stability and safety of the proposed gas pipeline.

Iroquois would have to haul out all spoil material blasted or graded from the right-of-way and trench spoil removed during trenching operations to temporary offsite locations. Not only would this significantly increase the time for construction, it would increase the disruption to Conrail services and further impact Conrail customers. In addition, one or more temporary offsite spoil storage yards would have to be identified that would be large enough to handle the large volumes of spoil material excavated from the right-of-way. This would result in increased heavy equipment construction traffic along local roadways.

Operation - Conrail has indicated that construction of the proposed pipeline along its right-of-way under any scenario would seriously disrupt Conrail's operations. As mentioned above, Conrail currently operates an average of four or five trains per day along this route. The trains that utilize these tracks carry primarily construction materials (i.e., sand, gravel, cement) with average weight per hopper car of 100 tons, some of the heaviest rail tonnage in the United States. Some of the trains run locally for New England customers, while many continue west through Albany to Chicago and California. Conrail has indicated that to detour trains on this rail line, it would have to alter schedules and reroute the entire Conrail network. To interrupt service along this line would result in serious economic impact on both Conrail Corporation and its customers.

Protected Watershed - Approximately 3.6 miles of Iroquois' proposed route crosses the watershed of Means Brook. Means Brook, a water-course channelized by the Bridgeport Hydraulic Company (BHC), feeds the Means Brook Reservoir which in turn feeds Trap Fall Reservoir. Means Brook Reservoir is not directly a public water source. Much of the land traversed along Means Brook is watershed protected by BHC, which has responsibility for managing and protecting water resources within the larger watershed. The primary concerns of BHC are limiting contamination of water supplies during construction due to sediment runoff or spills of hazardous materials. Adherence to our recommendations for construction outlined in appendices C and D would significantly reduce the possibility of impact from sediment runoff or hazardous spills.

During operation of the pipeline the greatest concern would be increased unauthorized access along the pipeline right-of-way which could either destroy vegetative cover or lead to dumping of wastes (Gliesing, 1989). BHC is not opposed to the location of Iroquois' proposed route in this area if strict construction and operational procedures are followed.

Means Brook Wetland - Iroquois' proposed route crosses approximately 2,890 feet of forested wetland and borders it for an additional 1,300 feet in the vicinity of MP 320. This wetland is reported to be the largest forested wetland in the vicinity of Shelton, Connecticut (Cook, 1989).

Our field reconnaissance identified several features that would help minimize impact on this wetland. Several 1- to 2-acre ponds (apparently for retention of runoff from an adjacent subdivision) have recently been constructed at MP 321. Construction of these ponds indicated a thin layer of organic soils 1 to 2 feet thick, underlaid by sand deposits. These characteristics appear to extend into the forested wetland indicating that surface and subsurface soils would be able to support construction equipment provided that temporary synthetic pads were laid over the natural ground surface and covered by granular soils. To reduce the extent of wetland clearing while preserving the integrity of the large wetland expanse, we recommend that Iroquois realign the route to the eastern edge of the wetland. In accordance with our wetland and stream crossing procedures (see appendix D), stump removal would be limited to the area over the trench and the entire wetland would be allowed to revegetate to a woody condition. These conditions would reduce wetland impact on acceptable levels.

Boys Halfway River Caves - The Boys Halfway River caves in the vicinity of MP 318 have been identified in scoping and again during the comment period as an environmentally sensitive area. The area consists of collapsed limestone caves and associated calcareous soils that have the potential to support unique and possibly rare plant species. The area could also support a population of bats, although this has not been determined. Currently no significant habitats or unique ecosystems have been specifically identified or designated in this area. Our experience indicates that with appropriate surveys, scheduling of construction and centerline realignment could mitigate impact on these resources, if required.

Conrail Variation Summary - From a construction, operation, safety, and environmental aspect, the Conrail Variation is not practicable or acceptable. Our review of the area has identified no other feasible routing option other than Iroquois' route, modified as appropriate. With a detailed program of environmental surveys and studies, centerline realignment through Means Brook wetland, and construction and operational procedures to be followed as a condition of certification, Iroquois' proposed route would be environmentally acceptable. We recommend the following measures for Iroquois' proposed route between MP 316.8 to MP 323.7. For construction and operation of pipeline facilities within the watershed, Iroquois would develop a specific SPCCP addressing no construction during wet periods, spill prevention and cleanup, storage of materials, right-of-way maintenance and inspection, and measures to prevent unauthorized access and dumping. To minimize impact on forested wetlands associated with Means Brook, alignment sheets showing a minimum length of route through the eastern edge of the wetlands based on field delineation would be submitted for our review and approval. A specific construction plan would be developed showing clearing and construction procedures, access points, and material laydown areas. The feasibility of construction during winter would be addressed. We recommend plant and wildlife surveys be undertaken in the vicinity of Boys Halfway River caves. Results of this survey should be submitted to FERC. If species of concern are identified, a mitigative plan including, but not limited to, centerline realignment would be submitted for the review and approval of the Director of OPPR.

6.2.62 Forest View Subdivision Variation

A route variation was originally proposed in the DEIS between MPs 315.8 and 316.3 to provide an alignment along the border of the Forest View Subdivision and avoid impact on recently subdivided residential lots. Both the proposed route and the variation would traverse forested areas; however, the variation would be approximately 0.1 mile shorter than the proposed route and would affect less forest (see table 6.2-1). This variation would result in less impact than the proposed route; however, both the proposed route and the variation are less desirable than the Paugussett State Forest Variation, which extends from approximately MP 314.5 to MP 316.4 (see section 6.3.6). We recommend the Paugusett State Forest Variation rather than this variation.

6.2.63 Monroe Subdivision Variation

A route variation was originally proposed between MP 316.7 and MP 318.2 to provide an improved alignment through two planned subdivisions. A review of original aerial photography with more recently provided aerial photography indicated that the variation only extends from MP 317.0 to approximately 317.8. Both the proposed route and the variation would cross SR 34 and Halfway River at the same location (see figure A-1, sheet 52 of 57).

Both routes are approximately the same length, and both would traverse primarily forested areas undergoing clearing and development (see table 6.2-1). Iroquois indicated that they have continued to consult with the developers and that the proposed variation would result in less impact on residential lots since it would follow property lines rather than pass through residential lots.

Based on our review of these two alignments, we recommend that the Monroe Subdivision Variation be adopted.

6.2.64 Shelton Pipeline Variation

The Shelton Pipeline Variation was suggested by the Town of Stratford and subsequently endorsed by the HVA and the State of Connecticut. This variation would deviate from the proposed route at approximately MP 327.2 and proceed east to a junction with the existing Tennessee pipeline right-of-way. The suggested variation would then continue along Tennessee's right-of-way and cross the Housatonic River in the vicinity of the existing pipeline (see figure A-1, sheet 53A of 57). On the east side of the river, the variation would proceed to the south through Milford along the Boston and Maine (Conrail) right-of-way and rejoin the proposed route near MP 331.5. This variation would bypass the Town of Stratford completely and would avoid Cranberry Pond and the Farmill River.

We evaluated this route and agree that the variation on the east side of the Housatonic River appears to have merit. A field visit in April 1990 resulted in the conclusion that the suggested alignment along the existing Tennessee right-of-way would entail significant impact on the residential development on each side of the existing pipeline on Mustang Drive and would probably require condemnation and removal of several residences. Following the Shelton Pipeline Variation (i.e., the existing Tennessee right-of-way) as proposed is therefore rejected; however, the Housatonic Valley Variation has been developed to provide an alternative alignment through Shelton and the crossing of the Housatonic River (see section 6.3.65).

6.2.65 Housatonic Valley Variation

Iroquois identified the Housatonic Valley Variation in response to the general comments and concerns raised by the Town of Stratford, the HVA, and the State of Connecticut. This variation would deviate from the proposed route at MP 326.8 and continue in an easterly direction through an area of mixed light industrial, residential, and agricultural land uses (see figure A-1, sheets 53, 53A, and 54 of 57). The variation would cross the existing Tennessee pipeline just west of SR 110, then proceed across the Housatonic River to the south of Tennessee's pipeline, continuing south along the Boston and Maine railroad corridor. According to Iroquois, the pipeline could not be placed in the railroad bed, but would be located adjacent to, but outside of, the railroad easement. The land use along the railroad is a mixture of agricultural, industrial, and scattered residential uses. We reviewed this alignment along the railroad tracks in March 1990.

The route variation would be slightly longer than the proposed route (5.7 miles versus 5.4 miles) but less of it would be parallel to existing rights-of-way (1.8 miles versus 2.9 miles) (see table 6.2-1). The variation would cross fewer streams (5 versus 9), but the Housatonic River crossing would be approximately 1,300 feet wide (including the tidal wetland area on the east bank) as compared to only 750 feet wide on the proposed route. Fewer wetlands (3.9 acres versus 5.1 acres) and forested areas (32.7 acres versus 45.5 acres) would be traversed by the route variation, but more agricultural land would be traversed (24.2 acres versus 7.3 acres). Two landfill areas with possible contamination problems are located along the railroad corridor that would be paralleled by the route variation.

The route variation would have several distinct disadvantages. Officials with the Connecticut Coastal Resources Management Division (CCRMD) indicated a concern with the Housatonic River crossing. The proposed crossing for the route variation would cross a boatyard on the west bank, and a tidal wetland on the east bank. State officials are concerned about potential diminished use of the boatyard facilities and habitat disruption within the tidal wetland crossing. In addition, while the variation would only generally parallel the railroad corridor, the proposed route, based on our previous recommendations, would be located within an existing electric transmission line right-of-way for a distance of approximately 1.5 miles.

In their responses to comments to the COE, Iroquois indicated that the variation would traverse two areas where there have been reports of plant species of concern. In addition, they indicated two areas of proposed developments that may be affected; one located north of SR 110 in Shelton and the other located south of the Merritt Parkway in Milford.

On balance, however, the Housatonic Valley Variation provides an environmentally preferable alignment for the proposed Iroquois pipeline. We reviewed the variation alignment on the west side of the Housatonic River in March and April 1990 and note that the right-of-way would traverse generally open areas of modest slopes. In response to the concerns raised by CCRMD, we note that the existing Tennessee pipeline currently traverses the boatyard. In addition, construction of the Iroquois pipeline would be in the months of October through December and should not significantly affect the operations of the boatyard. While we note that the pipeline would not actually be located adjacent to the railroad tracks on the east side of the river, the railroad corridor is essentially undeveloped, and the proposed route of the variation would not disrupt any existing or planned uses. In addition, the variation would traverse fewer streams, wetlands, and forested areas.

Considering the advantages offered by the Housatonic Valley Variation, we recommend that it be adopted. We also recommend that Iroquois conduct the necessary studies to identify and avoid plant species of concern, and also conduct any studies necessary to characterize and mitigate potential problems associated with the alignment near the two identified landfills.

6.2.66 Cranberry Pond Variation

The Cranberry Pond Variation, suggested by the Town of Stratford and the HVA, would deviate from the proposed route to the west from MP 327.6, cross under the existing electric transmission lines, and continue to the south rejoining the proposed route at MP 328.3. The objective of this route variation is to avoid Cranberry Pond by traversing upland areas to the north and west of the pond (see figure A-1, sheet 53 of 57). This route variation is similar to an alignment originally identified and evaluated by Iroquois in 1986.

This route variation would be approximately the same length as the proposed route, would generally traverse the same land use type areas (i.e., forested, with scattered residences), but would require two additional road crossings. According to the town, the area to the west of Cranberry Pond is owned by a utility company.

We examined possible alignments to the west of Cranberry Pond and noted the potential for disruption of wetlands associated with Cemetery Pond Brook (see section 6.3.37.4). We feel the proposed route and the route to the west of Cranberry Pond are similar in terms of disruption to wetlands and residences; however, we note that the route suggested by the Town of Stratford would avoid residences in that town (along Warner Hill Road), but would place the route closer to residences in the Town of Shelton (along James Farm Road).

Considering the similarity of the two routes, we choose not to transfer impact from one town to the other. Therefore, we continue to recommend the proposed route in this area, and based on a site visit in March 1990, remain confident that the proposed route as currently aligned will have minimal impact on the Cranberry Pond ecosystem. We note, however, that should the Commission certify the Housatonic Valley Variation, the Cranberry Pond area will be avoided entirely and neither the proposed route nor the variation in this area would be necessary.

6.2.67 United Illuminating Right-of-Way

The Town of Stratford and the HVA recommended greater use of the electric transmission line south of Cranberry Pond in the Town of Stratford. We examined this corridor on numerous occasions and feel that the proposed route as currently recommended responds to their comments to the maximum extent possible. The existing electric transmission line right-of-way is currently recommended to be used between MPs 328.3 and 329 (see table 5.1.9-2). Along this segment, the pipeline must be located on the west side of the transmission line because of the steep slopes and planned development along James Farm Road to the east. The pipeline could not use the electric transmission line right-of-way between MPs 329 and 330 because of the proximity of several homes to the existing right-of-way in this area. We confirmed this during site visits in May 1989 and again in March 1990. Finally, between MPs 330.0 and 330.8 we have again recommended use of the existing powerline right-of-way.

6.2.68 Carroll Variation

The Carroll Variation was originally evaluated in the DEIS as a means of increasing the distance between the pipeline and several residences.

This route variation would extend between MPs 330.4 and 330.8. It would be approximately 250 feet longer than the proposed route and would have similar impact in most resource areas, with the exception of vegetation and land use. The variation would require the clearing of approximately 1.3 acres of forest, whereas the proposed route along the north side of the powerline right-of-way would require slightly less clearing (approximately 0.9 acre). The route variation would be located within 50 feet of two residences, whereas the proposed route would be within 50 feet of four residences (one of these residences would be affected by both the route variation and the proposed route). The route variation would require two crossovers of the existing transmission right-of-way; the proposed route would be adjacent to the existing right-of-way but would not cross over it. Both alignments would traverse a small unnamed drainage.

Based on the fact that we had recommended that Iroquois construct the proposed pipeline within the existing powerline right-of-way, which we felt would address Mr. Carroll's concerns, we rejected the variation.

In response to numerous comments from landowners and local officials on the DEIS, we conducted another site visit in this area in March 1990. Because of overwhelming local support from adjacent landowners, we found the variation to be preferable. We note, however, that should the Commission certify the Housatonic Valley Variation, neither the proposed route nor the variations in this area would be necessary.

6.2.69 Milford Landfall Variation

The marine route of the proposed Iroquois pipeline would traverse an officially designated transient anchorage to the north of Charles Island. The Milford Harbor Management Commission (MHMC) expressed concern with this alignment and suggested an alternative alignment to the west of the Charles Island tombolo (sand bar). The suggested alternative alignment is similar to an alternative identified and evaluated by Iroquois in 1986 and included in their Resource Report No. 10-Alternatives (IGTS, 1988). The original alternative evaluated by Iroquois was developed to provide alternative alignments through Silver Sands State Park; the transient anchorage was not designated at the time and, therefore, was not considered in Iroquois' original evaluation.

Iroquois' original analysis of these alternative landfall routes indicated that Alternative C (which corresponds closely to the route suggested by the MHMC) would traverse fewer shellfish lease areas than the proposed route (4,500 feet versus 9,000 feet). The proposed route, however, is aligned through shellfish closure areas (i.e., areas where harvesting for direct human consumption is prohibited) and would traverse lease areas owned by large commercial shellfish operators rather than a lease area owned by individual shell fishermen. The Connecticut Aquaculture Division of the Department of Agriculture has indicated that the proposed route would be preferable from the standpoint of minimizing impact on shellfish. Additional discussion of offshore shell fish resources is presented in Volume 3/Response 3.9-4 and 3.9-8.

We have also evaluated the potential impact of the proposed route on the transient anchorage area. In their response to comments to the ACOE, Iroquois indicated that the depth of burial through the anchorage would be increased to 5 feet, and that the type of craft expected to use this anchorage would not be limited or precluded by the presence of the pipeline. Their analysis and conclusion are supported by another recent study prepared in conjunction with a new underwater electric transmission line across eastern Long Island Sound. The Shipping, Anchoring, and Fishing Practices Report prepared by the New York Power Authority indicates that for yachts and small craft where anchor handling is normally by manual means, high efficiency anchors weighing less than 75 pounds are usually used. Large pleasure craft and small service craft generally use lightweight, high efficiency anchors normally not exceeding 250 points, while small tugs and barges can reasonably be expected to be fitted with anchors of not more than 1,500 pounds. An anchor penetration analysis indicated that typical high efficiency small craft anchors weighing 250 pounds can be expected to penetrate sandy substrates to a depth of approximately 3 feet, while the penetration of anchors weighing 1,500 pounds is predicted to be 4 feet (NYPA, 1986).

Our review of the facts indicates that the proposed route as planned (i.e., burial depths of 5 feet) would not affect the use of the transient anchorage area; however, the alternative alignment suggested by MHMC would have greater impact on the area shellfish resources. Therefore, we continue to recommend Iroquois' proposed landfall location and marine route in the Milford offshore area.

6.2.70 South Commack Terminus Variation

A representative of the Commack Civics Group suggested an alternative alignment at the terminus of the Iroquois pipeline to provide greater distance between the pipeline and the residences near the existing Pilgrim Substation as originally proposed by Iroquois in 1986. The alternative alignment would place the pipeline to the east and south of the substation; the proposed route terminates on the north side of substation (see figure A-1, sheet 57 of 57).

We find the impact of these two alignments to be similar. Both alignments would require additional clearing around the substation; however, the alternative alignment would require slightly more clearing. Iroquois has indicated that they have consulted with LILCO, and both parties are in agreement that the alternative could be built. Since all parties appear to agree that the alternative alignment is acceptable, we recommend that this alignment, including terminal facilities on the south side of the substation, be incorporated into the proposed route.

7.0 STAFF'S CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations presented herein are those of the staff of the Federal Energy Regulatory Commission (FERC or Commission).

Information provided by the applicants and further developed from field investigations, literature research, alternatives analysis, and contacts with Federal, state, and local agencies, public interest groups, and individual members of the public indicates that construction of the proposed Iroquois/Tennessee Project would result in a limited, adverse environmental impact. Most of the impact would occur during the construction period. However, if constructed and operated in accordance with our recommendations, it would be an environmentally acceptable action.

Several important factors were considered closely in our determination. A major consideration was the extent to which we were able to recommend re-routes to the proposed pipeline alignments to avoid wetlands, residential areas, proposed developments, landfills, sensitive stream crossings, and other areas of concern. Another key recommendation was to restrict Iroquois' proposed construction and permanent right-of-way in many areas and recommend an increased utilization of existing electric utility rights-of-way to reduce impact and further encumbrances on non-utility lands. Finally, we have developed, in conjunction with other Federal cooperating agencies, a clearly defined, standardized set of construction procedures for stream and wetland crossings that would significantly reduce the impact of pipeline construction on these valuable resources. Specific erosion control, revegetation, and right-of-way maintenance procedures have also been developed and recommended.

The Commission staff's responsibility in this proceeding is to identify significant environmental effects so that these can be considered in the decision process. We have developed and recommended additional mitigating measures that we believe to be appropriate and reasonable for the construction and operation of the natural gas pipeline facilities. We believe that these measures would significantly reduce the environmental impact that would result from construction of the project as proposed. We are recommending that these measures be attached as conditions to any certificate issued by the Commission.

7.1 ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION

The following discussion describes resource impacts of particular concern that would be associated with the proposed action.

Construction of the Iroquois/Tennessee Project would have minimal impact on geologic resources. Direct impact would be limited to reduction in available sand and gravel resources where the proposed route crosses or lies adjacent to exploitable deposits of sand and gravel. Where exploitable mineral resources are crossed, the applicant would compensate lease owners or make arrangement for future access. Of greater concern is the impact associated with construction, namely effects of rock blasting on nearby structures and the removal and disposal of excess excavated material. Effects of blasting can be mitigated through careful adherence to the recommendations described herein.

Geologic hazards would not significantly impact pipeline construction or operation. No fault-induced surface ground rupture has been experienced in the project area, and a welded steel pipeline should not be affected by the moderate levels of ground shaking which are expected in the Northeastern United States. Liquefaction, slope stability, karst features, and ground subsidence do not pose particularly significant widespread hazards along the proposed routes.

Iroquois would cross 65 miles and Tennessee would cross approximately 17 miles of soils with moderate to steep slopes where significant erosion is likely. Iroquois would cross 87 miles and Tennessee would cross 13 miles of soils that are wet due to seasonally high water tables which have the potential to result in reduced soil productivity due to compaction and soil structure damage during construction. Wet, organic soils compose 1.3 miles of the proposed Iroquois and 0.5 mile of the Tennessee route and have low bearing capacities, so that construction would potentially result in ground subsidence and drainage problems.

The proposed aboveground facilities would affect 2.2 acres of soil with prime or statewide importance status for Iroquois and a maximum of 3.9 acres for Tennessee. Most of this prime or statewide important soil is presently wooded at the proposed aboveground facility sites and withdrawal of this land from potential agricultural use would represent a minimal impact. By following the mitigation measures described in the applicants' proposed erosion and sedimentation control plans, as well as our additional recommendations, impact such as water and wind erosion, soil structure damage, compaction, and drainage alterations would not be significant.

The proposed Iroquois project would pass within 0.1 mile of four community or municipal water-supply wells. The proposed Tennessee route would pass within 0.1 mile of three community or municipal wells. Potential impact on groundwater supplies includes local contamination from spills of hazardous substances such as fuel and lubricants used during construction or operation, and change in well yield or water quality as a result of construction. The mitigation measures we recommend would avoid or minimize this potential impact. In the unlikely event that private or public groundwater supply systems are determined to be adversely affected by construction, the applicants would be required to provide compensation.

The proposed Iroquois pipeline would cross 322 perennial water bodies in five major drainage basins. Of these 322 water bodies, 49.1 percent are good quality (classified C or better). The proposed Tennessee segments would cross 58 perennial water bodies, of which 63.8 percent are good quality. The potential impact on these water bodies includes increased turbidity, sedimentation, decreased dissolved oxygen concentrations, releases of chemical and nutrient pollutants from sediments, and introduction of chemical contaminants, such as fuels and lubricants.

By following all permit requirements, the "Erosion Control, Revegetation, and Maintenance Plan" outlined in appendix C, as well as the "Stream and Wetland Construction and Mitigation Procedures" contained in appendix D, the above-listed impact would be reduced or eliminated. In addition, we have made several recommendations to ensure that impact would be temporary and minimal. These recommendations deal primarily with revegetation to minimize erosion into streams, restrictions on the refueling of equipment, and fluming of sensitive streams. If all recommendations are properly implemented, impact on surface waters would be minimal and temporary.

However, to ensure that all certificate conditions are compiled with and the pipeline contractors strictly conform with the mitigation measures and procedures, we have recommended that at least one environmental inspector per construction spread be provided. This inspector would have authority equal to welding or trenching inspectors and would ensure compliance with environmental specifications.

The proposed Iroquois pipeline would cross 108 perennial water bodies that support important fishery resources. Of these, 86.1 percent support either naturally reproducing or stocked trout populations. The proposed Tennessee segments combined would cross 58 perennial water bodies. Of these, 46.5 percent support either naturally reproducing or stocked trout populations. The potential impact from construction activities on fisheries includes sedimentation and turbidity, acoustic shock, destruction of stream cover, introduction of water pollutants, or entrainment of fish during hydrostatic test water intake.

By following all permit requirements and the "Stream and Wetland Construction and Mitigation Procedures," the above-listed impact would be reduced to acceptable levels. In addition, we have made several specific recommendations to further reduce impact. These deal primarily with using particular blasting techniques to minimize acoustic shock, scheduling crossings to avoid migration of anadromous species and spawning of resident fish, using specific methods to eliminate entrainment of fish during hydrostatic test water intake, and route variations. If all recommendations are followed, impact on fisheries would be temporary and minimal.

The proposed Iroquois pipeline would affect approximately 40.9 acres of significant wildlife habitat, all consisting of state-mapped deer wintering areas (DWAs). The proposed Tennessee facilities would impact 3.2 acres of significant wildlife habitats. One state wildlife management area (Upper and Lower Lakes) would be crossed by the proposed Iroquois facilities. No national wildlife refuges or management areas would be affected. The Tennessee facilities would not cross any national or state wildlife refuges or wildlife management areas, although many landowners along both applicants' routes maintain their properties in accordance with specific wildlife or timber management plans.

The primary impact on DWAs would be loss of forested cover, which could reduce the carrying capacity of the habitat. To minimize this impact, we have recommended that Iroquois consult with state wildlife biologists to determine plantings to revegetate the right-of-way in these areas. These measures would ensure that impact on DWAs would have minimal effects on populations using these habitats. We have recommended that Tennessee conduct surveys and develop appropriate mitigation measures, in consultation with state biologists, to minimize impact to acceptable levels.

We have made several recommendations regarding construction windows to ensure the proposed Iroquois pipeline would not affect any federally listed or proposed endangered or threatened species. It could, however, affect one state listed endangered species, the Bog turtle. The Iroquois pipeline could potentially affect an additional 15 state-listed plant species, and 2 state-listed animal species that are not currently known to exist on the proposed route but are suspected to occur there. The proposed Tennessee facilities would not affect any federally listed endangered or threatened species; it could, however, affect two state-listed rare plants and possibly one state-listed rare turtle. The Tennessee pipeline would potentially affect an additional two state-listed plant species and one state-listed animal species that are not known to exist on the proposed route but are suspected to occur there.

Construction activities could result in the loss of some individuals and in the loss of some habitat for certain state-listed plant species. We have recommended that Iroquois and Tennessee, in consultation with appropriate state agencies, conduct field surveys of the known and suspected sites of the state-listed species to determine the existence and extent of the populations and appropriate mitigative procedures. These site-specific mitigation plans would be filed with the Secretary of the Commission for review and approval by the Director of Office of Pipeline and Producer Regulation (OPPR), prior to any construction activity.

Approximately 1,665 acres of forest vegetation would be cleared for construction of the proposed Iroquois facilities, of which approximately 727 would be maintained permanently cleared of woody vegetation. Construction of the proposed Tennessee facilities would result in clearing approximately 287 acres of forest vegetation, of which approximately 111 acres would be maintained permanently cleared of woody vegetation.

The clearing of forest vegetation would be the primary impact on vegetation resulting from pipeline construction. We have recommended that prior to construction, the applicants identify and mark stands of old growth timber, individual large specimen trees, and active maple sugar operations, and protect these trees during construction. Impact on the most sensitive vegetation types would therefore be minimized.

The proposed Iroquois route would cross 344 wetlands while the proposed Tennessee route would cross 55 wetlands. The proposed construction right-of-way would temporarily alter 267 acres of wetland habitat along the Iroquois facilities and 14 acres along the proposed Tennessee facilities. Herbaceous vegetation would recover within a year, while most forested wetlands would require 20-30 years to return to a forested condition. Iroquois facilities would clear 211 acres of forested wetland habitat while Tennessee would clear 11 acres.

Thirty-four route variations were considered and recommended to completely avoid or reduce impact on wetland resources. In addition, we have recommended construction procedures to mitigate impact on those wetlands that could not be avoided (see appendix D). These procedures include segregation of topsoil during trenching for redistribution after pipe placement, restriction of construction access, and the use of wooden mats as working platforms for construction equipment in wetland areas. We have also recommended that rights-of-way through forested wetlands be allowed to permanently revegetate with native herbaceous and woody plant species to a height of 15 feet within 15 feet of the pipeline. These procedures, in addition to numerous variations recommended to either completely avoid wetlands or to reduce the amount of clearing, would significantly reduce the disturbance of these areas as well as the duration of impact.

Construction of the proposed Iroquois/Tennessee Project would temporarily affect approximately 4,154 acres and 523 acres for the proposed Iroquois and Tennessee facilities, respectively. Operation of the proposed project would permanently affect 2,492 acres for Iroquois and 195 acres for Tennessee.

Approximately 1,665 acres of woodland would be cleared for the proposed Iroquois pipeline, of which 999 acres would be retained for the permanent right-of-way; Tennessee would clear approximately 287 acres of woodland and would retain 111 acres for their permanent right-of-way. A total of 2,303 acres of agricultural land would be temporarily affected by construction, 2,128 acres for Iroquois facilities and 175 acres for Tennessee facilities. A total of 325 acres of residential land would be disturbed during construction; the permanent right-of-way would encumber 182.5 acres, 166 acres for Iroquois and 16 acres for Tennessee. Approximately 181 residences located within 50 feet could be potentially affected by the proposed construction, 81 for Iroquois and 100 for Tennessee. We have made recommendations to reduce clearing in forested areas, protect vegetation screening and increase distances between the pipelines and residences.

Approximately 11.7 acres of land would be permanently cleared for the construction and operation of one compressor station and 21 aboveground facilities; 8.2 acres for Iroquois' proposed mainline valves, interconnection points, pig launcher/receivers and metering stations and 3.5 acres for Tennessee's proposed Mendon compressor station and six new metering facilities.

The proposed Iroquois pipeline would cross the Seaway Trail, North Country Trail, Berne Town Park, Mount Merino, Taconic State Parkway, and West Mountain in New York. In Connecticut, Iroquois would cross the Appalachian Trail, Wimisink Wildlife Sanctuary, Morrissey Brook Preserve, Housatonic Range Trail, Hill and Plain School, Still River Nature Preserve, Pomperaug Trail, Means Brook Valley, Shelton Conservation Land Trust, Roosevelt Forest, City of Milford Open Space, and Silver Sands State Park.

The proposed Tennessee pipeline would cross the Upton State Forest in Massachusetts, Pembroke Memorial Park in New Hampshire, Cheshire Land Trust and Willow Brook Trail in Connecticut, and the Hanton City Hiking Trail in Rhode Island.

A total of 18 recreational and/or scenic water bodies used for fishing and boating would be crossed by the proposed project; 15 by the Iroquois pipeline and 3 by the Tennessee pipeline. Two golf courses would be crossed; the Candlewood Valley Country Club by the Iroquois pipeline and the Plausawa Country Club by the Tennessee pipeline. Where Iroquois/Tennessee facilities would affect sensitive visual resources we have made mitigation recommendations. Five solid and/or hazardous waste sites would be in proximity to the proposed Iroquois route. We have recommended avoidance or studies where contamination could be a potential issue.

7.2 ALTERNATIVES

7.2.1 No Action, Energy, System, and Major Alternatives

Alternatives we considered that would avoid the need to construct the Iroquois/ Tennessee Project include no action and energy alternatives. The no action alternative would avoid all of the environmental effects of the proposed project. The Northeast would forego the environmental benefits associated with the use of natural gas. Potential users of the project's natural gas would be required to use other energy sources, most of which when combusted would involve more impact than natural gas.

Our review of the environmental consequences associated with not building the Iroquois/Tennessee Pipeline Project does not extend in this EIS to the customer's need for service and the need for the related interstate pipeline facilities. These issues will be addressed by the Commission at such time as it considers the entirety of each proposal, including such areas as markets, transportation rates, adequacy of gas supply, urgency of the project, the need for competition, and environmental effects.

If no project were constructed, the Northeast customers would be required to utilize other means to meet future energy needs. Possible options would include the modification of existing natural gas transmission systems serving the Northeast, expansion or construction of new facilities that use fuel oils or coal, construction of new electrical generating facilities and energy conservation and energy-load management. The only potentially feasible option to provide the proposed volumes of natural gas would be to modify the existing natural gas transmission system network entering the Northeast. We studied such existing system expansion. This option would involve existing pipeline companies, as well as Canada, resulting in institutional, political, and economic issues that are beyond the scope of this analysis. Ultimately, as stated in section 3.2.1, the constraints would remain, especially in peak demand periods and the potential for curtailment would still exist. Use of alternative fuels could result in significant increases in SO_2 emissions, and to a lesser extent, NO_2 and PM emissions, in several northeast states.

Four single-pipeline systems were identified that we believe are feasible alternatives to the Iroquois/Tennessee and Champlain Projects. Two were studied in detail and the results are described in the Draft Environmental Impact Statements (DEIS), Volume II and incorporated herein by reference. However, the single pipeline alternatives were presented as alternatives to the construction of <u>both</u> the Iroquois/Tennessee and the Champlain Pipeline Projects. Subsequent to the publication of the DEIS, the Champlain Project was indefinitely deferred. As such, the single pipeline alternatives are not directly comparable to the Iroquois/Tennessee Project alone. In fact, the Iroquois/Tennessee Project, as now proposed, closely resembles the Iroquois Mainline Single Pipeline Alternative, since former Champlain Pipeline Project customers have now contracted with Iroquois for transportation services.

Alternatives that utilize a natural gas source or delivery system different from that of the Iroquois/Tennessee Pipeline Project are possible. Of these, we studied two alternatives that would receive natural gas at existing import points in Niagara, New York, or Highgate, Vermont, and involve substantial expansion of existing natural gas pipeline systems or new pipeline systems. We found that they would be reasonable alternatives but not preferable to the proposed project.

Several alternatives that would replace major segments of the Iroquois/Tennessee Project by following alternate routes were considered. Five were studied to try to make greater use of existing corridors. Electric transmission line corridors included portions of the Massena-Marcy 765 kV line, and all of the Marcy-South 345 kV line. Highway corridors studied included the New York State Thruway, Taconic State Parkway, I-684, I-287 and several non-access-controlled highways. Following Central Hudson existing natural gasline on the west side of the Hudson River was also considered. None of these existing corridors was found to offer environmentally superior routes. Some of them were not feasible. Other major alternatives considered but rejected as less environmentally desirable included the Greater Northeast (GNE) alternative through eastern New York and western Massachusetts, and the original Iroquois route through Litchfield, Connecticut.

7.2.2 Alternative Sites and Route Variations

Alternative sites for aboveground facilities were considered in this project evaluation. We concluded that the proposed site locations for aboveground facilities with our recommended mitigation measures would be acceptable and would result in minimal impact on the surrounding area.

Route variations were identified and assessed to avoid or reduce impact associated with pipeline construction and operation on various resources, including residential areas, proposed developments, sensitive or significant habitats or water crossings, recreational areas, and wetlands. A total of 133 variations were considered for the proposed Iroquois route. Of those considered, 94 have been recommended for adoption for the proposed Iroquois facilities. Suggestions for route variations have been received throughout the DEIS comment period. All reasonable route variations or modifications submitted to the Commission have been considered and assessed. All studies are listed in table 7.2-1 with a designation of whether they have been recommended.

7.3 FERC STAFF RECOMMENDED MEASURES

To further mitigate the environmental impact associated with the construction and/or operation of the proposed facilities, we recommend that the following mitigation measures be included as specific conditions to any certificate issued by FERC. Recommendations 1 through 31 pertain to both Iroquois and Tennessee; 32 through 48 pertain solely to Iroquois; and 49 through 57 pertain solely to Tennessee. The referenced recommendation number found at the end of each recommendation is a reference back to the Draft Environmental Impact Statement (DEIS) so the reader can compare between the draft and the final easily.

1. Both applicants shall adhere to the construction procedures and mitigation measures described in their respective applications and in their responses to our data requests, except as otherwise modified by these certificate conditions. (DEIS recommendation 1)

2. The applicants shall submit detailed alignment maps and aerial photographs at a scale not smaller than 1:6,000. All staging areas, access roads, and other areas that would be used or disturbed shall be identified. Any alterations to the mapped route or aboveground facility locations shown on the 1:6,000-scale aerial photographs filed with the Commission on January 17, 1989, for Iroquois and on July 18, 1989, for Tennessee, other than the staff's recommended variations and minor field realignments per landowner needs and requirements, shall be clearly identified and must be filed with the Secretary of the Commission and approved by the Director OPPR prior to implementation.

   Such alterations shall include, but not be limited to, all route changes resulting from implementation of the cultural resource mitigation measures; endangered, threatened, or special concern species mitigation measures; areas of ground subsidence; further route modifications that may be recommended by state regulatory authorities; and those agreed to for individual landowners that also affect adjacent parcels of property. (DEIS recommendation 2, modified)

TABLE 7.2-1

Summary of Route Variations

Variation Name	Mileposts	County/Town	Status
St. Lawrence Wetland	MP 0.7 to 1.5	St. Lawrence/Waddington	Not Recommended
Lisbon Wetland Modification	MP 7.0 to 9.6	St. Lawrence/Lisbon	Recommended
Lisbon Wetland	MP 8.1 to 9.5	St. Lawrence/Lisbon	Not Recommended
Morey Ridge	MP 10.0 to 11.0	St. Lawrence/Lisbon	Recommended
Fulton Road	MP 11.6 to 12.5	St. Lawrence/Lisbon	Not Recommended
Dandy Road Wetland Modification	MP 12.6 to 14.1	St. Lawrence/Lisbon	Recommended
Dandy Road Wetland	MP 12.7 to 13.4	St. Lawrence/Lisbon	Not Recommended
Line Creek	MP 13.9 to 15.5	St. Lawrence/Lisbon, Canton	Recommended
Canton Wetland	MP 16.1 to 17.2	St. Lawrence/Canton	Not Recommended
Canton Wetland Modification	MP 16.1 to 17.2	St. Lawrence/Canton	Recommended
Grass River	MP 17.8 to 19.3	St. Lawrence/Canton	Recommended
Route 11	MP 21.3 to 23.7	St. Lawrence/Canton	Recommended
Eddy Pyrites	MP 23.7 to 24.2	St. Lawrence/Canton	Recommended
Justintown Road	MP 25.3 to 25.7	St. Lawrence/Canton	Not Recommended
Justintown Road Modification	MP 25.3 to 25.7	St. Lawrence/Canton	Recommended
Dekalb Wetland	MP 27.4 to 29.0	St. Lawrence/Dekalb	Recommended
Marshville Wetland	MP 30.2 to 31.0	St. Lawrence/Hermon	Not Recommended
Hermon Wetland	MP 32.2 to 35.2	St. Lawrence/Hermon	Recommended
Pond Road Wetland	MP 35.9 to 36.3	St. Lawrence/Hermon	Recommended
Firefall Wetland	MP 38.3 to 39.2	St. Lawrence/Hermon, Edwards	Recommended
Wolf Lake Wetland	MP 39.5 to 40.0	St. Lawrence/Edwards	Recommended
Edwards	MP 41.1 to 43.5	St. Lawrence/Edwards	Not Recommended
Route 58 Wetland	MP 43.2 to 43.7	St. Lawrence/Edwards	Not Recommended
Route 58 Wetland Modification	MP 43.2 to 43.7	St. Lawrence/Edwards	Recommended
Mott Creek	MP 47.9 to 48.1	St. Lawrence/Edwards	Recommended
Route 812 Wetland	MP 52.5 to 52.8	St. Lawrence/Pitcairn	Recommended
Harrisville	MP 53.2 to 54.7	Lewis/Diana	Recommended
Route 3 Wetland	MP 54.9 to 56.5	Lewis/Diana	Recommended
Jadwin Memorial Forest	MP 57.3 to 76.3	Lewis/Diana, Croghan	Recommended
Diana Sugar Bush a/	MP 57.7 to 59.1	Lewis/Diana	Recommended
Hogsback Creek a/	MP 60.0 to 61.9	Lewis/Diana	Recommended
Blanchard Creek a/	MP 63.3 to 63.5	Lewis/Diana	Recommended
Indian River a/	MP 64.0 to 64.5	Lewis/Diana	Recommended
Punky Swamp a/	MP 66.5 to 69.0	Lewis/Diana, Croghan	Recommended
Croghan Sugarbush a/	MP 73.6 to 74.0	Lewis/Croghan	Recommended
New Bremen Sugarbush	MP 74.3 to 83.5	Lewis/Croghan, New Bremen	Not Recommended
New Bremen Sugarbush Modification	MP 76.5 to 78.6	Lewis/Croghan	Recommended
Indian Pipe State Forest a/	MP 83.5 to 85.7	Lewis/New Bremen	Recommended
Anne's Independence River Alternate	MP 84.6 to 92.9	Lewis/New Bremen, Watson, Greig	Recommended
Greig Wetland	MP 93.2 to 93.8	Lewis/Greig	Recommended
Lyons Falls	MP 98.1 to 101.3	Lewis/Turin, W. Turin	Recommended
Wingate Swamp Modification	MP 109.6 to 111.8	Oneida/Booneville	Recommended
Wingate Swamp	MP 110.6 to 111.7	Oneida/Booneville	Not Recommended
Kent Creek	MP 113.0 to 113.7	Oneida/Booneville	Recommended
Route 28	MP 115.1 to 116.6	Oneida/Booneville	Recommended
Kayuta Lake Wetland	MP 117.2 to 118.4	Oneida/Remsen	Not Recommended
Kayuta Lake Wetland Modification	MP 117.2 to 118.7	Oneida/Remsen	Recommended
South Kayuta Lake	MP 119.4 to 120.1	Oneida/Remsen	Recommended
Remsen Wetland	MP 120.3 to 121.8	Oneida/Remsen	Not Recommended
Remsen Wetland Modification	MP 120.3 to 122.2	Oneida/Remsen	Recommended
Cady Brook	MP 123.2 to 123.5	Oneida/Remsen	Recommended
Trenton Wetland Modification	MP 124.0 to 125.0	Oneida/Remsen, Trenton	Recommended
Trenton Wetland	MP 124.5 to 125.2	Oneida/Remsen, Trenton	Not Recommended
King Quarry	MP 131.9 to 132.5	Herkimer/Russia	Recommended
Rose Valley Landfill	MP 132.5 to 135.5	Herkimer/Russia, Newport	Not Recommended
Rose Valley Landfill Modification	MP 132.5 to 135.5	Herkimer/Russia, Newport	Recommended
Big Bill Brook	MP 138.6 to 139.7	Herkimer/Norway	Recommended
Fairfield	MP 141.0 to 142.5	Herkimer/Fairfield	Recommended
Little Falls Watershed	MP 142.9 to 144.3	Herkimer/Fairfield	Recommended

TABLE 7.2-1 (cont'd)

Variation Name	Mileposts	County/Town	Status
Manheim	MP 148.1 to 150.8	Herkimer/Manheim	Recommended
Route 5	MP 151.2 to 153.2	Herkimer/Manheim	Recommended
Mohawk River	MP 154.0 to 154.5	Herkimer/Danube	Recommended
Minden	MP 160.6 to 164.3	Montgomery/Minden	Recommended
Canajoharie Wetland	MP 164.9 to 165.5	Montgomery/Minden	Recommended
Deflection #10	MP 167.5 to 171.4	Montgomery/Canajoharie	Recommended
Flat Creek	MP 174.2 to 175.6	Montgomery/Root	Recommended
Route 162 Wetland	MP 182.0 to 183.2	Montgomery/Charlestown	Recommended
Route 146	MP 192.0 to 194.8	Schoharie/Wright	Recommended
Wright Wetland	MP 195.6 to 196.3	Schoharie/Wright	Not Recommended
Woodlawn Cemetery	MP 199.0 to 200.1	Albany/Berne	Recommended
Eight Mile	MP 208.3 to 209.0	Albany/Westerlo	Recommended
Westerlo	MP 210.9 to 211.7	Albany/Westerlo	Recommended
Basic Creek Wetland	MP 213.1 to 213.9	Albany/Westerlo	Not Recommended
Greenville	MP 217.3 to 218.0	Greene/Greenville	Recommended
Route 81	MP 221.6 to 222.0	Greene/Coxsackie	Recommended
Athens	MP 225.1 to 225.9	Greene/Athens	Recommended
Athens Airport Wetland Modification	MP 228.8 to 230.0	Greene/Athens	Recommended
Athens Airport Wetland	MP 228.9 to 229.3	Greene/Athens	Not Recommended
Leeds Road	MP 231.0 to 231.5	Greene/Athens	Recommended
Mt. Merino I	MP 232.4 to 232.7	Columbia/Greenport	Not Recommended
Mt. Merino II	MP 232.4 to 232.9	Columbia/Greenport	Not Recommended
Greenport Ravine	MP 233.2 to 234.5	Columbia/Greenport	Recommended
Greenport Orchard	MP 234.5 to 235.0	Columbia/Greenport	Not Recommended
Greenport Quarry Modification	MP 236.3 to 237.0	Columbia/Greenport	Recommended
Greenport Quarry	MP 236.3 to 237.0	Columbia/Greenport	Not Recommended
Livingston	MP 241.2 to 241.6	Columbia/Livingston	Recommended
Milan	MP 252.3 to 253.6	Dutchess/Milan	Recommended
ROW Alignment	MP 255.3 to 255.8	Dutchess/Milan	Not Recommended
Silver Lake Wetland Modification	MP 255.6 to 256.1	Dutchess/Milan	Recommended
Silver Lake Wetland	MP 255.8 to 256.2	Dutchess/Milan	Not Recommended
Little Wappinger Creek Modification	MP 257.7 to 258.4	Dutchess/Clinton	Recommended
Little Wappinger Creek	MP 257.8 to 258.2	Dutchess/Clinton	Not Recommended
Maple Lane	MP 259.1 to 259.5	Dutchess/Clinton	Recommended
Anne's Alternate #3	MP 260.2 to 265.9	Dutchess/Clinton, Pleasant Valley	Recommended
Simon Alternative	MP 267.3 to 271.7	Dutchess/Pleasant Valley	Recommended
Gidley Road	MP 272.1 to 272.4	Dutchess/LaGrange	Not Recommended
Dover Variation	MP 281.7 to 282.5	Dutchess/Dover	Recommended
Dover/Sherman	MP 282.4	Dutchess/Dover	Not Recommended
State Route 55	MP 282.9 to 286.6	Dutchess/Dover	Recommended
Route 55/Route 39	MP 286.6 to 287.9	Fairfield/Sherman	Not Recommended
Wimisink	MP 287.3 to 288.1	Fairfield/Sherman	Recommended
Wimisink Brook	MP 287.7 to 287.9	Fairfield/Sherman	Not Recommended
Stilson Hill	MP 289.0 to 290.5	Litchfield/New Milford Fairfield/Sherman	Recommended
East Stilson Hill	MP 288.9 to 292.9	Litchfield/New Milford	Not Recommended
Kimberly-Clark	MP 291.1 to 292.5	Litchfield/New Milford	Recommended
Route 7	MP 293.0 to 301.0	Litchfield/New Milford, Bridgewater, Brookfield	Not Recommended
New Milford	MP 294.5 to 297.7	Litchfield/New Milford	Not Recommended
Still River Variation	MP 297.5 to 298.0	Litchfield/New Milford	Recommended
Brookfield Variation #1	MP 300.4 to 300.9	Fairfield/Brookfield	Recommended
Brookfield Wetland	MP 301.8 to 302.0	Fairfield/Brookfield	Not Recommended
Brookfield Variation #2	MP 301.8 to 302.8	Fairfield/Brookfield	Recommended
Route 133 Wetland	MP 302.9 to 303.1	Fairfield/Brookfield	Recommended
Brookfield Variation #3	MP 303.6 to 303.8	Fairfield/Brookfield	Recommended
Bound Swamp Wetland	MP 305.1 to 305.6	Fairfield/Brookfield	Recommended
Newtown Conrail	MP 305.4 to 308.9	Fairfield/Brookfield	Not Recommended
Lands End Wetland	MP 305.6 to 306.4	Fairfield/Newtown	Recommended
Algonquin	MP 307.0 to 308.1	Fairfield/Newton	Recommended
Old Farm Hill Subdivision	MP 308.3 to 310.1	Fairfield/Newton	Recommended
Pootatuck River	MP 311.0 to 311.4	Fairfield/Newton	Recommended
Newtown Subdivision	MP 312.2 to 315.2	Fairfield/Newton	Recommended
Paugussett State Forest	MP 315.2 to 315.9	Fairfield/Newton	Recommended
Forest View Subdivision a/	MP 315.8 to 316.3	Fairfield/Newton	Recommended
Monroe Subdivision	MP 316.7 to 318.2	Fairfield/Monroe	Recommended
Conrail	MP 316.8 to 323.7	Fairfield/Monroe	Not Recommended
Blakeman	MP 323.1 to 323.8	Fairfield/Shelton	Recommended

TABLE 7.2-1 (cont'd)

Variation Name	Mileposts	County/Town	Status
Housatonic Valley	MP 326.8 to 331.5	Fairfield/Shelton New Haven/Milford	Recommended
Shelton Pipeline	MP 327.2 to 331.5	Fairfield/Shelton	Not Recommended
Cranberry Pond	MP 327.6 to 328.3	Fairfield/Shelton	Not Recommended
United Illuminating ROW	MP 328.3 to 330.8	Fairfield/Shelton	Not Recommended
Carroll a/	MP 330.4 to 330.8	Fairfield/Stratford	Recommended
Milford	MP 331.1 to 332.8	New Haven/Milford	Recommended
Milford Landfall	MP 333.9 to 336.6	New Haven/Milford	Not Recommended
South Commack Terminus	MP 369.0 to 369.4	Suffolk/Smithtown	Recommended

a/ Recommended for adoption, subject to adoption of another variation. See text.

3. The authorized pipeline routes and aboveground facility locations shall include all of the staff's recommended route variations, alternative sites, and construction procedures as discussed in section 6.0 and as identified in tables 5.1.9-2, 5.1.9-4, and 7.2-1 of this Environmental Impact Statement (EIS). Where type "C" construction is specified in table 5.1.9-4, the applicants shall file with the Secretary of the Commission, detailed construction and right-of-way restoration plans for these areas for review and approval by the Director of OPPR prior to construction. (DEIS recommendation 3, modified)

4. For the areas identified in table 5.1.9-2 where the applicants proposed pipeline facilities would parallel existing powerline rights-of-way, the entire 50-foot-wide permanent right-of-way shall be placed within those electric transmission rights-of-way. Additionally, the proposed pipeline construction right-of-way shall extend no more than 25 feet outboard from the existing electric utility right-of-way except where specified by recommended route variations in table 7.2-1. However, where, for safety or environmental issues, it is not possible to place the entire 50-foot-wide permanent right-of-way within those electric transmission rights-of-way, Iroquois will file with the Secretary of the Commission for review and approval by the Director of OPPR the specific reasons for proposed variance to this recommendation. However, in no circumstance will it be acceptable for the pipe to be placed less than 5 feet within the edge of the electric transmission right-of-way and no permanent right-of-way outside of the existing right-of-way will be granted. (DEIS recommendation 4, modified)

5. Both applicants shall implement the "Stream and Wetland Construction and Mitigation Procedures" contained in appendix D when constructing across flowing streams, rivers, and wetlands; and shall implement the "Erosion Control, Revegetation, and Maintenance Plan" contained in appendix C for all other disturbed areas. Any deviation from these procedures must be reported to and approved by the Commission environmental staff at least 2 weeks prior to implementation. Any deviation that the staff determines to be significant cannot be implemented without the prior written approval of the Director of OPPR. (DEIS recommendation 5)

6. Both applicants shall employ at least one environmental inspector per construction spread to monitor compliance with all mitigation measures. The environmental inspector's duties and responsibilities shall include those described in section 5.1.2.1.2 of this EIS and the Erosion Control, Revegetation, and Maintenance Plan (see appendix C). (DEIS recommendation 6)

7. For each owner or manager of woodland, the applicants shall offer to install and maintain at all access points one or more of the off-road vehicle (ORV) and pedestrian control measures described in section 5.1.9.2.1 at the completion of cleanup and reseeding. Iroquois shall install barriers at access points to Long Island Lighting Company (LILCO) right-of-way. (DEIS recommendation 8, modified)

8. During negotiations with landowners, Iroquois and Tennessee shall avoid routing the pipeline close to wells or septic systems and will take into consideration any potential plans for the expansion or relocation of these systems. (DEIS recommendation 9)

9. Prior to construction, Iroquois/Tennessee shall identify, and file with the Secretary of the Commission for review and approval by the Director of OPPR, the preferred method of disposal of any excess rock from trench excavation. Use of excavated rock as a backfill shall be in accordance with the requirements of appendix C. (DEIS recommendation 10, modified)

10. Prior to construction, Iroquois and Tennessee shall identify, and file with the Secretary of the Commission for review and approval by the Director of OPPR, the preferred method for disposal of construction-related bulk waste and provide an identification of landfills to be used. (New recommendation)

11. Iroquois and Tennessee shall conduct a comprehensive preconstruction survey to locate soil drainage systems. This survey should include input from landowners, state agencies, and the U.S. Department of Agriculture Soil Conservation Service (SCS). Further, both shall repair traversed soil drainage systems and demonstrate the effectiveness of such repairs. Qualified specialists shall be used to insure proper repairs and adequate probing/testing of the repaired drainage systems. In addition, the applicants shall, as part of their normal maintenance, monitor and correct any future drainage problems that have resulted from pipeline construction. (DEIS recommendation 11, modified)

12. Prior to commencing pipeline construction, both applicants shall prepare, and file with the Secretary of the Commission for review and approval by the Director of OPPR, a proposed groundwater monitoring plan designed to provide a program for site-specific identification of community and private water supply wells and springs located near the proposed routes. The plan shall also provide for documentation of pre- and post-construction well- and spring-water quality and yields and should be of adequate detail to determine with relative certainty whether the pipeline construction was responsible for any adverse impact on the groundwater user. In the event that private wells or springs identified as a result of the groundwater monitoring program are damaged by pipeline construction activities, the applicants shall provide an emergency source of potable water and shall restore the system to its original capacity. (DEIS recommendation 12)

13. Iroquois and Tennessee shall prepare and file with the Secretary of the Commission a Spill Prevention, Containment, and Control Plan which describes the preventive and mitigative measures to be employed to minimize the impact associated with such occurrences. These measures should include but not be limited to: requiring all fueling and lubrication to be done in areas designated for such purposes, with such areas to be located away from all water bodies; requiring each construction crew to have on-hand sufficient supplies of absorbent and barrier materials to allow the rapid recovery of any spills; and development of standing procedures regarding excavation and off-site disposal of any soil materials contaminated by spillage. (DEIS recommendation 13, modified)

14. Iroquois and Tennessee shall not conduct refueling activities or store hazardous material within any designated well protection area(s) or within 200 feet of any private, municipal or community water supply well. (DEIS recommendation 14, modified)

15. Iroquois and Tennessee shall conduct streambed blasting in such a manner (e.g., delayed detonation, air bubble curtains) as to reduce the total acoustic shock wave intensity to the greatest extent possible, based on site-specific conditions. Additionally, prior to each detonation in rivers (greater than 100-feet wide), a disturbance such as a scare charge or other methods shall be used in the water to scare fish out of the area prior to trench blasting. (DEIS recommendation 15, modified)

16. To protect wildlife nesting along the right-of-way, Iroquois and Tennessee shall perform vegetation maintenance on the right-of-way no more frequently than once every 3 years and shall not undertake maintenance clearing on the right-of-way prior to August 1 of any year. (DEIS recommendation 16, modified)

17. The applicants shall apply the total score method used by Freeman (1982) to identify all trees within or adjacent to the proposed construction right-of-way that have a score of 80 percent or greater than that recorded for that particular species in either the "National Register of Big Trees" (Prado, 1978), the New York State Register of Big Trees, or a similar methodology for other states. To avoid damage to all trees falling within this category (i.e., specimen trees), the applicants shall adjust the final route alignment so that specimen trees are avoided by allowing no trenching within 15 feet of the outer edge of the tree's drip line. Further, Iroquois and Tennessee shall identify, clearly mark, and protect any trees immediately adjacent to the cleared right-of-way that are of significant value to the landowner. (DEIS recommendaiton 17, modified)

18. Iroquois and Tennessee shall complete all Phase I and Phase II cultural resource reports required under the Commission's July 27, 1988, Order, and forward copies to the Director of OPPR and the appropriate State Historic Preservation Officers (SHPOs). This requirement shall apply to the proposed action and the related nonjurisdictional projects identified in this EIS.

    a. In all cases where cultural resources in or eligible for the listing in National Register of Historic Places (NRHP) are found within the project area, applicants shall attempt to avoid these resources. Any modifications, including route realignments, shall be filed with the Secretary of the Commission for review and approval by the Director of OPPR in accordance with condition no. 1.

    b. Where cultural resources such as archeological sites, historic districts, and significant standing structures that are in or meet the criteria for NRHP eligibility are located in the proposed project area and cannot be avoided or would be visually affected by the project, applicants shall prepare Phase 3 mitigation or data recovery plans and submit the plans to the SHPO for comment and to the Secretary of the Commission for review and approval by the Director of OPPR.

    c. No construction shall begin in those portions of the proposed project area or any other areas that would be disturbed (e.g., staging areas, storage and maintenance areas, access roads) that contain significant cultural resources until the Director of OPPR has reviewed and approved all cultural resource surveys and mitigation plans, and has considered any comments by the appropriate SHPOs and the Advisory Council on Historic Preservation and has provided written approval. (DEIS recommendation 18)

19. The applicants shall ensure that Indian tribes and identified interested groups and individuals will be consulted and provided the necessary information in order for those parties to respond to areas of historic value, including sacred areas, archeological sites and their excavation, burials, and other ethnographic-use areas, with particular reference to traditional plants, animals, and ritual areas. The applicants shall provide copies of all correspondence with the above parties and all documentation on traditional Native American concerns resulting from the consultation in the cultural resources technical report. Due to the sensitive nature of this information, it shall be provided to the appropriate SHPOs marked "Sensitive" and filed with the Secretary of the Commission marked "Privileged - Do Not Release." (DEIS recommendation 19, modified)

20. Iroquois and Tennessee, in coordination with the appropriate state agencies, shall conduct surveys of specific sites along the route that are suspected of containing vernal pool habitat or suitable habitat for state-listed species. Iroquois and Tennessee, in consultation with these state agencies, shall develop and file site-specific construction and mitigation plans with the Secretary of the Commission for review and approval by the Director of OPPR, prior to construction. (DEIS recommendation 20)

21. Iroquois and Tennessee shall construct dry-ditch crossings of all streams that are utilized as public water sources within 3 miles of downstream potable water supplies, regardless of their size. In addition, all Class AA streams will be constructed using the dry-ditch method in order to protect their exceptional quality. (DEIS recommendation 21, modified)

22. Iroquois and Tennessee, in consultation with the appropriate state agencies, shall conduct preconstruction winter surveys of the deer wintering areas (DWAs) crossed to determine intensity of use and location of concern. Mitigation plans for all DWAs crossed shall be developed and filed with the Secretary of the Commission for review and approval by the Director of OPPR prior to construction. (DEIS recommendation 22)

23. To reduce uncontrolled use of new right-of-way through forested areas, Iroquois and Tennessee, with the concurrence of the landowners, shall plant dense vegetation at least 3 feet high with an ultimate height of at least 7 feet at each road crossing of the right-of-way in all unbroken forested areas that exceed 1 mile in length. A vegetated berm at least 2 feet high shall be placed parallel to the intersected roads in these forested areas to further reduce uncontrolled access. (DEIS recommendation 23, modified)

24. Iroquois and Tennessee shall not construct within 1 mile of any active bald eagle roost site between the period of November 1 and March 31. (DEIS recommendation 24, modified)

25. If hazardous wastes are encountered during construction, Iroquois and Tennessee shall stop construction and notify state and local agencies to determine the appropriate course of action. (DEIS recommendation 25)

26. Iroquois and Tennessee shall coordinate closely with the owner or manager of golf courses that would be crossed to develop a construction schedule to minimize disruption and to limit the amount of time construction occurs on the property. (DEIS recommendation 26, modified)

27. Iroquois and Tennessee shall file with the Secretary of the Commission, for review and approval by the Director of OPPR, specific construction mitigation plans for each trail crossing including the Seaway Trail, North Country Trail, Housatonic Range Trail, Pomperaug Trail, AT, Willow Brook Trail, and Hanton City Hiking Trail. Mitigation measures shall include plantings and limitations of clearing to 50 feet. (DEIS recommendation 27, modified)

28. Iroquois and Tennessee shall comply with all required mitigation recommended in the visual mitigation table (see table 5.1.9-6). (DEIS recommendation 28)

29. Prior to initiating service to the nonjurisdictional customers identified in this EIS, Iroquois or Tennessee (whichever makes the delivery) shall certify that all necessary permits to construct and operate the nonjurisdictional facilities have been obtained. Copies of all applicable permits, including any conditions and stipulations, shall be filed with the Secretary of the Commission. No gas service shall be rendered until the Director of OPPR has reviewed this material and approved the commencement of the service. (DEIS recommendation 29)

30. Within 30 days of the issuance of a certificate for this project, Iroquois and Tennessee shall each file with the Secretary of the Commission, for review and approval by the Director of OPPR, a plan describing how the mitigating measures identified in section 7.3 of this EIS will be implemented. The plan must identify dates for 1) the completion of cultural resource requirements and other required surveys, 2) the start of construction, and 3) the start and completion of restoration. (DEIS recommendation 30)

31. Where blasting is necessary, the applicants shall employ the following measures to minimize possible impact:

    a. Seismographic surveys shall be conducted to monitor ground vibrations adjacent to homes and other structures and care shall be taken to ensure that vibrations due to blasting are limited.

    b. A full-time blasting consultant shall be employed; types of explosives, loading quantities and procedures, drill patterns, and timing of delays shall be approved, as shall the method, use, and type of matting to minimize vibrations and fly-rock.

c. Blasting shall not be permitted within 10 feet of existing structures. Precautions shall be taken where the proposed route parallels or crosses existing electrical transmission corridors. In such areas, the use of electrical detonation caps shall be restricted.

d. All blasting shall occur during daylight hours.

e. At property requests, pre- and post-blast foundation inspections shall be conducted to insure structures, including wells and septic systems, are not damaged within 100 feet of the blasting zone. The applicants shall consult with the property owners on a one-to-one basis to determine whether pre- and post-blast surveys are requested or declined. Documented damages resulting from blasting shall be reimbursed by the applicant to an extent equivalent to or greater than the pre-blasting condition. (DEIS recommendation 46, modified)

32. Iroquois shall construct the pipeline route across New York State Forests by following the route variations described in sections 3.6.9 (Harrisville), 3.6.11 (Jadwin Memorial State Forest), and 3.6.12 (Indian Pipe State Forest, if Anne's Independence River Variation is not adopted). (DEIS recommendation 31)

33. In the event that construction of the Long Island Sound crossing and associated landfalls occurs after March 15, Iroquois shall survey on a daily basis the landfall areas for piping plover nesting activity, and if nesting piping plovers are present within 0.5 mile of pipeline centerline, Iroquois shall not construct at the landfall areas between March 15 and October 1. (DEIS recommendation 32, modified)

34. Before commencing construction in Albany County, New York, Iroquois shall consult with the U.S. Fish and Wildlife Service (FWS) and the New York Department of Environmental Conservation (NYDEC) to determine if the proposed route is in the vicinity of an active bald eagle nest site. In the event that an active nest site has been established, Iroquois shall develop, in consultation with the FWS and the NYDEC, a final route alignment and construction schedule that would avoid any impact on bald eagles nesting in Albany County, New York. The final route alignment and construction schedule shall be filed with the Secretary of the Commission for review and approval by the Director of OPPR prior to construction in Albany County, New York. (DEIS recommendation 33)

35. At landfill sites near the towns of Russia and Dover, New York, and New Milford and Milford, Connecticut, Iroquois shall determine if they were used exclusively as Class III fill (rock, concrete, and soil) sites. If they were used as other than Class III fill sites, or if the records are incomplete or inconclusive, Iroquois shall route the pipeline around the site to avoid the possibility of encountering toxic materials. If the landfill route cannot be avoided and toxic materials are suspected, Iroquois shall perform sufficient testing to ensure that contaminated materials will not be excavated or otherwise disturbed. (DEIS recommendation 34)

36. Iroquois shall not conduct any construction activities within 0.5 mile of the great blue heron rookery (Albany County, New York) between April 1 and July 31. In addition, Iroquois shall survey its right-of-way within 0.5 mile of the rookery to determine the location of suitable nest trees, and shall make final centerline adjustments to avoid clearing suitable nest trees. (DEIS recommendation 35)

37. Iroquois shall undertake a plant and wildlife survey at the Boys Halfway River caves to determine if any species of concern are present, and develop a mitigation plan as necessary, including, but not limited to, centerline realignment. Copies of the survey shall be filed with the Secretary of the Commission for review and approval by the Director of OPPR prior to construction. (New recommendation)

38. Following completion of Iroquois' survey of the proposed pipeline route, route realignments to avoid known maple sugarbushes shall be filed with the Secretary of the Commission for the Director of OPPR's review and approval. Where avoidance is not possible, Iroquois shall identify their economic value to establish the level of compensation for tree removal and lost production. The economic value shall also be determined for orchard and nursery plants permanently removed and the landowners so compensated. (DEIS recommendation 36, modified)

39. Where the pipeline would cross residential developments identified in table 5.1.9-5, Iroquois shall coordinate with the developer and realign the centerline as necessary to minimize disruption to site plans. This should be done in a manner that would encumber as few residential properties as possible with the pipeline easement and would make use of the development's access roads wherever possible without adversely affecting other resources. (DEIS recommendation 37)

40. Iroquois shall restore the vegetative buffer to not less than 5-feet wide between dwellings in Brookfield, Connecticut, and the Conrail railroad where Iroquois would parallel the railroad right-of-way. (New recommendation)

41. Iroquois shall limit the construction right-of-way in nonagricultural areas to 75 feet. In agricultural areas where topsoil must be segregated, 100-foot construction right-of-way is acceptable. In all areas, the permanent, cleared right-of-way shall be limited to 50 feet. (DEIS recommendation 38, modified)

42. Iroquois shall develop final alignment and mitigation plans for land trust crossings and file them with the Secretary of the Commission for the Director of OPPR's review and approval prior to construction. (DEIS recommendation 39)

43. Iroquois shall implement its proposed Land Preservation and Enhancement Program (LPEP) to offset impact on public interest areas located on or near the right-of-way. In addition, Iroquois shall conduct its proposed ecological impact studies to assess the long-term effects of construction and operation of the Iroquois pipeline on streams, wetlands, DWAs, and upland forest habitats. However, in order to ensure that Iroquois-proposed ecological studies are properly designed and implemented to answer long-standing questions pertaining to the ecological impact of constructing natural gas pipeline facilities in the northeastern U.S., Iroquois shall file a detailed design and implementation plan for each phase of its proposed ecological impact

study with the Secretary of the Commission for review and final approval by the Director of OPPR prior to implementation. (DEIS recommendation 40)

44. Iroquois shall utilize the following schedule when constructing across the specified water bodies: the Hudson River shall be crossed between August 1 and November 30; the Housatonic River shall be crossed between October 1 and December 31; the Long Island Sound shall be crossed between October 1 and May 31; and the St. Lawrence River shall be crossed between July 1 and August 31. In addition, Iroquois shall adopt the timing constraints contained in table 5.1.4-1 when constructing across coldwater and warmwater streams in New York. (DEIS recommendation 41)

45. Iroquois shall prepare a site-specific wetland restoration plan for wetlands disturbed at the Hudson River staging area, Means Brook, and Still River. This plan shall be filed with the Secretary of the Commission for review and approval by the Director of OPPR, prior to construction. (DEIS recommendation 43, modified)

46. Iroquois shall conduct chemical testing of subsurface and surficial sediments at the proposed St. Lawrence River crossing. Test parameters shall include priority pollutant metals and organics. Surficial sediments downstream of the proposed Mohawk, Hudson, and Housatonic River crossings shall be retested prior to construction. The results of such testing shall be filed with the Secretary of the Commission for review by the Director of OPPR, with the U.S. Army Corps of Engineers (COE), and with the appropriate state water quality management agency. (New recommendation)

47. Iroquois shall provide a minimum of 10 feet of cover over the pipeline as it traverses the Athens airport runway and for 50 feet on each side of the runway, or reroute the pipe at least 50-feet away at its closest point. (New recommendation)

48. Iroquois shall not construct within Connecticut's or New York's coastal management zone until it has filed proof with the Commission that the responsible state agencies concur that the proposed facilities are consistent with each states' coastal zone management program. Determination from each state shall be filed with the Secretary of the Commission for review prior to construction. (DEIS recommendation 60)

49. Consistent with the minimum federal safety standards, Tennessee will insure that pipeline loops shall be constructed at the same depth as any existing line(s) on the same right-of-way. (DEIS recommendation 44, modified)

50. Tennessee shall develop and file site-specific construction and restoration plans for its proposed crossing of Larrywaug Brook (Stockbridge Bowl) with the Secretary of the Commission for review and approval by the Director of OPPR prior to construction. In addition, Tennessee shall consult with the Stockbridge Bowl Association to ensure that the proposed crossing of Larrywaug Brook does not adversely affect the drawdown capability of Stockbridge Bowl. (DEIS recommendation 45, modified)

51. Tennessee shall realign the Columbia/Berkshire Loop to the north side of the existing right-of-way to avoid the Kampoosa Bog located between milepost (MP) 256+6.0 and MP 256+8.0. (DEIS recommendation 51)

52. Tennessee shall relocate the proposed meter station M7 on the Lincoln Extension to an upland area and submit the revised location, including a plot plan detailing the area required for construction and operation of this station, to the Director of OPPR for review and approval prior to construction. (New recommendation)

53. Tennessee shall retain a landscape design professional to develop a plan to vegetate the banks of the Mill River, which is within the Cheshire Land Trust, to minimize views from the trail of the residential area located to the west. (DEIS recommendation 53)

54. Tennessee shall file revised noise analyses with the Secretary of the Commission for the compressors proposed at Compressor Station 245, 254, and 261, and the proposed Mendon Compressor Station, based on far-field sound level data (from either the manufacturer or a similar unit in service elsewhere) for the actual engine/compressor unit proposed for each site, for review and approval by the Director of OPPR, prior to construction of the compression facilities. The design of the installation of the new compressor units shall limit the noise level attributable to the new units to a day-night sound level (Ldn) of 55 decibels of A-weighted scale (dBA) at the nearest noise-sensitive receptor. (DEIS recommendation 55)

55. Tennessee shall file a report with the Secretary of the Commission documenting its current plans and schedules for further reductions of noise from existing cooling fans and the compressor building at Compressor Station 254, for review and approval by the Director of OPPR, prior to commencing construction of the additional compressor. (DEIS recommendation 56, modified)

56. Tennessee shall locate the proposed compressor at Compressor Station 254 in a separate acoustically treated building, and shall prepare an analysis of the feasibility of alternative compressor building locations, including those identified in figure 5.1.8-1. The analysis shall also examine the feasibility of excavating the hillside at alternative site B to form a berm that blocks the line of site to nearby residences. Tennessee shall file the analysis with the Secretary of the Commission for review and approval by the Director of OPPR prior to construction of the compressor addition. (DEIS recommendation 57, modified)

57. Tennessee shall not abandon or replace any facilities until it has received an Alternative Disposal Permit (Permit) pursuant to 40 CFR § 761.60(e), from the U.S. Environmental Protection Agency, and has submitted a copy of the Permit to the Secretary of the Commission for review and approval by the Director of OPPR. (DEIS recommendation 58)

APPENDIX A

PIPELINE ROUTE/NONJURISDICTIONAL FACILITIES LOCATION MAPS

APPENDIX A

MAP INDEX

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A-1	New Meter Station and Interconnection Point Locations - Sheets 2, 27, 32, 45, 49, 53, 54, 57
A-2	Key Map - Tennessee Pipeline Facilities - Sheets 1 and 2
A-2-1	Schoharie/Albany Loop Maps - Sheets 1 to 4
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NOTE: Refer to Volume III for the pipeline route/nonjurisdictional facilities location maps.

APPENDIX B

ALTERNATIVE FUEL CONSUMPTION AND EMISSION DATA

APPENDIX B-1

APPENDIX B-1

ASSUMPTIONS AND FACTORS USED IN DETERMINING EMISSION CHANGES

This appendix lists the various factors and assumptions used in determining emission changes if the Northeast Settlement Projects are not approved. One replacement fuel for natural gas in residential, commercial, and industrial sectors is electricity. Consequently, if gas is not available, then electricity consumption would be distributed among generating equipment using various fuels. Exhibit B-2 discusses the split between resistance heating and electric heat pumps in new homes that are assumed to switch to electric heating in the event gas is not available.

Tables 3 through 6 show the details of estimated alternative fuel substitution. Column A shows the projected split among alternative fuels for each sector. Column B apportions the split among different fuel uses. The sums of all values in column B for all type uses equals 1.00. Column C is the efficiency adjustment factor. Column D (the alternate fuel substitution factor) is the multiple of columns B & C. Note that in all cases this adds up to less than 1.00. This is because of the assumption that a portion of the electricity substitution would be supplied by a heat pump, which would yield more energy in the form of heat than the energy it consumes in electricity. Later in the conversion it is necessary to convert the additional amounts of electricity consumed into the primary fuels used to generate the electricity. Close to three Btus of primary fuel will be required for each Btu of electricity generated. When this correction is made, the total Btus of alternate fuels would be greater than the total Btus of the gas they replace. However, that correction does not show in these tables. Note that in the tables in Appendix B-3, the total Btus of alternate fuels always exceed the total Btus of gas replaced.

Tables 7 through 9 list the conversion factors to convert MMBtus of various fuels to emission pollutants. In general, the factors are based upon the Federal New Source Performance Standards for new fuel-burning equipment or the maximum allowed limits for each state, whichever is more stringent. To the extent any user installs equipment or uses fuels that emit less pollutants than legally allowed, the computed emissions are over estimated.

EXHIBIT 1

SOURCE OF INCREASED ELECTRICITY IF NORTHEAST PROJECTIONS NOT APPROVED

BASIC ASSUMPTIONS

1. **Nuclear:** Utilities normally run plants with the lowest fuel cost as base load plants. Due to its low fuel cost, any nuclear capacity available in the region would likely be fully utilized whether or not the Northeast pipeline projects are completed. Consequently, the amount of electricity generated by nuclear capacity should not change if the Northeast projects are not approved.

2. **Hydro:** Same as Nuclear. All hydro power available will be utilized in either scenario.

3. **1992:** NERC and EIA both project that the Northeast will still have remaining spare generating capacity in 1992. Consequently, we assumed that the increased generation required to meet demand in the residential, commercial, and industrial sectors that normally would be supplied by gas would be divided among coal, oil, and gas in roughly the same proportion as their relative generation in 1987.

   For the normal projected demand increases in the electric utility sector we assumed that to the extent gas isn't available it would be distributed among other fuels in proportion to their historic relative use. We made an exception in Rhode Island, where planned new generating capacity significantly exceeds existing generating capacity, and where gas is slated to replace #6 fuel oil in an existing facility. In Rhode Island, we assumed that to the extent gas isn't available, #6 fuel oil would continue to be used in that facility as at present and that #2 fuel oil would replace gas for the rest of the increased load. We made the same assumptions in the electric utility sector for 1997 as for 1992.

4. **1997:** Electricity growth in both New England and the Middle Atlantic states will require new generating capacity by 1997. Because short lead times will not allow construction of traditional coal-fired generation, the majority of new units in 1997 will be oil- or gas-fired combined-cycle units. If restrictions on pipeline capacity prevent firm gas sales, necessity will likely require constructing dual-fired plants that can burn gas off-peak and substitute #2 fuel oil during periods that gas isn't available. By 1997 some coal-fired, combined-cycle plants possibly will be competitive. Consequently, we assumed that coal would replace a small portion of the load that can't be met by gas.

   We made an arbitrary assumption concerning cogen fuels, assuming to the extent gas isn't available in 1992 it would be replaced 100% by #2 fuel oil, and in 1997 by 90% #2 fuel oil and 10% coal.

EXHIBIT 2

DISPLACEMENT OF NATURAL GAS FOR SPACE HEATING IN THE NORTHEAST

The Gas Research Institute (GRI) projects the housing stock by system type for the northeast as follows:

	New England		Middle Atlantic	
	1987	Incr. 1995	1987	Incr. 1995
Electric	510	+40	1058	153
Heat Pump	77	+77	191	+259
Resistance	433	-37	867	-106
Gas	1476	+482	6927	+741
Oil	2409	-82	5369	-481
Other	297	+28	590	+47

They also project the efficiency of new electric heat pumps increasing in New England from a COP of 1.66 in 1987 to 2.10 in 1995. If their projections of the increased efficiency of heat pumps is reasonable, then their projection of the growth of heat pumps in the New England region likely is also reasonable.

Energy Information Agency (EIA) data clearly shows that oil has been losing market in the northeast at the expense of the growth of gas heating and electric heating. Gas has not increased annual volumes, but has increased its number of customers. Demand from the new customers has offset the decline in demand from old customers due to conservation and the increased efficiency of new gas furnaces. Electricity has both increased sales and market share.

If gas is unable to supply new customers due to capacity limitations, how will new homes and markets be heated? Also, to the extent that new homes rely on electric heat, to what extent will electric resistance heating be used, and to what extent will heat pumps be used?

For this study it was assumed that if gas isn't available for new connections, that the principal fuels used in place of gas would be #2 fuel oil and electricity. It was assumed they would increase market share in the absence of gas in proportion to their relative growth projected by GRI. It was assumed that 30% of the new electric homes in 1992 would be heating using resistance heaters, and 70% using heat pumps. In 1997 we assumed that only 20% of new homes heated by electricity would use resistance heating and that 80% would use heat pumps.

TABLE 3

ALTERNATE FUEL SUBSTITUTION -- NEW ENGLAND 1992

RESIDENTIAL SECTOR

	Space Heat				Water Heat				Cooking				Drying				Total	
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	B	D
U. S.		0.757				0.17				0.056				0.013			0.996	
Northeast		0.73				0.16				0.1				0.01			1	
Electricity	0.24	0.18	0.58	0.10	0.65	0.10	0.76	0.08	0.95	0.10	0.63	0.06	0.95	0.01	0.833	0.01	0.38	0.248
#2 Fuel Oil	0.60	0.44	1.01	0.44	0.33	0.05	1.07	0.06		0.00		0.00		0.00		0.00	0.49	0.498
LPG	0.02	0.01	1	0.01	0.02	0.00	1	0.00	0.05	0.01	1	0.01	0.05	0.00	1	0.00	0.02	0.023
Coal	0.04	0.03	1.37	0.04		0.00		0.00		0.00		0.00		0.00		0.00	0.03	0.040
Wood	0.10	0.07	1.37	0.10		0.00		0.00		0.00		0.00		0.00		0.00	0.07	0.100
Total	1.00	0.73		0.70	1.00	0.16		0.14	1.00	0.10		0.06	1.00	0.01		0.01	1.00	0.910

COMMERCIAL SECTOR

	Space Heat				Water Heat				Other*				Cooling				Total	
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	B	D
U. S.		0.70				0.04				0.25				0.01			1.00	
Northeast		0.71				0.04				0.25				0.00			1.00	
Electricity	0.24	0.17	0.54	0.09	0.75	0.03	0.76	0.02	0.95	0.24	0.73	0.17		0.00		0.00	0.44	0.288
#2 Fuel Oil	0.60	0.43	1.01	0.43	0.25	0.01	1.07	0.01		0.00		0.00		0.00		0.00	0.44	0.440
#6 Fuel Oil	0.08	0.06	1.01	0.06		0.00		0.00		0.00		0.00		0.00		0.00	0.06	0.057
LPG	0.02	0.01	1	0.01		0.00		0.00	0.05	0.01	1	0.01		0.00		0.00	0.03	0.026
Coal	0.04	0.03	1.11	0.03		0.00		0.00		0.00		0.00		0.00		0.00	0.03	0.031
Wood	0.02	0.01	1.11	0.02		0.00		0.00		0.00		0.00		0.00		0.00	0.01	0.015
Total	1.00	0.71		0.64	1.00	0.04		0.03	1.00	0.25		0.19	0.00	0.00		0.00	1.00	0.860

* Includes cooking (resturants) & drying (laundries).

INDUSTRIAL SECTOR

	Space Heat				Process Steam				Direct Heat				Plant Fuel				Total	
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	B	D
U. S.		0.28				0.41				0.14				0.17			1.00	
Northeast		0.28				0.41				0.14				0.17			1.00	
Electricity	0.20	0.06	0.54	0.03		0.00		0.00	0.20	0.03	0.83	0.02	0.40	0.07	0.36	0.02	0.15	0.077
#2 Fuel Oil	0.45	0.13	1.01	0.13	0.20	0.08	1.03	0.08	0.50	0.07	1.03	0.07	0.50	0.09	1.03	0.09	0.36	0.37[illegible]
#6 Fuel Oil	0.20	0.06	1.01	0.06	0.40	0.16	1.03	0.17	0.20	0.03	1.11	0.03		0.00		0.00	0.25	0.25[illegible]
LPG	0.05	0.01	1	0.01		0.00		0.00	0.10	0.01	1	0.01	0.10	0.02	1	0.02	0.05	0.04[illegible]
Coal	0.05	0.01	1.11	0.02	0.40	0.16	1.11	0.18		0.00		0.00		0.00		0.00	0.18	0.197
Wood	0.05	0.01	1.11	0.02		0.00		0.00		0.00		0.00		0.00		0.00	0.01	0.015
Total	1.00	0.28		0.26	1.00	0.41		0.44	1.00	0.14		0.14	1.00	0.17		0.13	1.00	0.96[illegible]

KEYS:
A -- Allocation Fraction
B -- Use Fraction
C -- Alternate Fuel Adjustment Factor
D -- Alternate Fuel Substitution Fraction

TABLE 4

ALTERNATE FUEL SUBSTITUTION -- NEW ENGLAND 1997

RESIDENTIAL SECTOR

	Space Heat				Water Heat				Cooking				Drying				Total	
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	B	D
U. S.		0.757				0.17				0.056				0.013			0.996	
Northeast		0.73				0.16				0.1				0.01			1	
Electricity	0.24	0.18	0.53	0.09	0.65	0.10	0.76	0.08	0.95	0.10	0.63	0.06	0.95	0.01	0.833	0.01	0.38	0.239
#2 Fuel Oil	0.60	0.44	1.05	0.46	0.33	0.05	1.07	0.06		0.00		0.00		0.00		0.00	0.49	0.516
LPG	0.02	0.01	1	0.01	0.02	0.00	1	0.00	0.05	0.01	1	0.01	0.05	0.00	1	0.00	0.02	0.023
Coal	0.04	0.03	1.42	0.04		0.00		0.00		0.00		0.00		0.00		0.00	0.03	0.041
Wood	0.10	0.07	1.42	0.10		0.00		0.00		0.00		0.00		0.00		0.00	0.07	0.103
Total	1.00	0.73		0.71	1.00	0.16		0.14	1.00	0.10		0.06	1.00	0.01		0.01	1.00	0.924

COMMERCIAL SECTOR

	Space Heat				Water Heat				Other*				Cooling				Total	
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	B	D
U. S.		0.70				0.04				0.25				0.01			1.00	
Northeast		0.71				0.04				0.25				0.00			1.00	
Electricity	0.24	0.17	0.48	0.08	0.75	0.03	0.76	0.02	0.95	0.24	0.73	0.17		0.00		0.00	0.44	0.277
#2 Fuel Oil	0.60	0.43	1.01	0.43	0.25	0.01	1.07	0.01		0.00		0.00		0.00		0.00	0.44	0.440
#6 Fuel Oil	0.08	0.06	1.01	0.06		0.00		0.00		0.00		0.00		0.00		0.00	0.06	0.057
LPG	0.02	0.01	1	0.01		0.00		0.00	0.05	0.01	1	0.01		0.00		0.00	0.03	0.026
Coal	0.04	0.03	1.14	0.03		0.00		0.00		0.00		0.00		0.00		0.00	0.03	0.032
Wood	0.02	0.01	1.14	0.02		0.00		0.00		0.00		0.00		0.00		0.00	0.01	0.016
Total	1.00	0.71		0.63	1.00	0.04		0.03	1.00	0.25		0.19	0.00	0.00		0.00	1.00	0.851

* Includes cooking (resturants) & drying (laundries).

INDUSTRIAL SECTOR

	Space Heat				Process Steam				Direct Heat				Plant Fuel				Total	
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	B	D
U. S.		0.28				0.41				0.14				0.17			1.00	
Northeast		0.28				0.41				0.14				0.17			1.00	
Electricity	0.20	0.06	0.48	0.03		0.00		0.00	0.20	0.03	0.83	0.02	0.40	0.07	0.36	0.02	0.15	0.074
#2 Fuel Oil	0.45	0.13	1.01	0.13	0.20	0.08	1.03	0.08	0.50	0.07	1.03	0.07	0.50	0.09	1.03	0.09	0.36	0.371
#6 Fuel Oil	0.20	0.06	1.01	0.06	0.40	0.16	1.03	0.17	0.20	0.03	1.11	0.03		0.00		0.00	0.25	0.256
LPG	0.05	0.01	1	0.01		0.00		0.00	0.10	0.01	1	0.01	0.10	0.02	1	0.02	0.05	0.045
Coal	0.05	0.01	1.14	0.02	0.40	0.16	1.11	0.18		0.00		0.00		0.00		0.00	0.18	0.198
Wood	0.05	0.01	1.14	0.02		0.00		0.00		0.00		0.00		0.00		0.00	0.01	0.015
Total	1.00	0.28		0.26	1.00	0.41		0.44	1.00	0.14		0.14	1.00	0.17		0.13	1.00	0.961

KEYS:
A -- Allocation Fraction
B -- Use Fraction
C -- Alternate Fuel Adjustment Factor
D -- Alternate Fuel Substitution Fraction

TABLE 5

ALTERNATE FUEL SUBSTITUTION -- MIDDLE ATLANTIC STATES 1992

RESIDENTIAL SECTOR

	Space Heat				Water Heat				Cooking				Drying				Total	
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	B	D
U. S.		0.757				0.17				0.056				0.013			0.996	
Northeast		0.73				0.16				0.1				0.01			1	
Electricity	0.24	0.18	0.5	0.09	0.65	0.10	0.76	0.08	0.95	0.10	0.63	0.06	0.95	0.01	0.833	0.01	0.38	0.234
#2 Fuel Oil	0.60	0.44	1	0.44	0.33	0.05	1.07	0.06		0.00		0.00		0.00		0.00	0.49	0.494
LPG	0.02	0.01	1	0.01	0.02	0.00	1	0.00	0.05	0.01	1	0.01	0.05	0.00	1	0.00	0.02	0.023
Coal	0.04	0.03	1.33	0.04		0.00		0.00		0.00		0.00		0.00		0.00	0.03	0.038
Wood	0.10	0.07	1.33	0.10		0.00		0.00		0.00		0.00		0.00		0.00	0.07	0.097
Total	1.00	0.73		0.68	1.00	0.16		0.14	1.00	0.10		0.06	1.00	0.01		0.01	1.00	0.888

COMMERCIAL SECTOR

	Space Heat				Water Heat				Other*				Cooling				Total	
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	B	D
U. S.		0.70				0.04				0.25				0.01			1.00	
Northeast		0.71				0.04				0.25				0.00			1.00	
Electricity	0.24	0.17	0.51	0.09	0.75	0.03	0.76	0.02	0.95	0.24	0.73	0.17		0.00		0.00	0.44	0.283
#2 Fuel Oil	0.60	0.43	1.01	0.43	0.25	0.01	1.07	0.01		0.00		0.00		0.00		0.00	0.44	0.440
#6 Fuel Oil	0.08	0.06	1.01	0.06		0.00		0.00		0.00		0.00		0.00		0.00	0.06	0.057
LPG	0.02	0.01	1	0.01		0.00		0.00	0.05	0.01	1	0.01		0.00		0.00	0.03	0.026
Coal	0.04	0.03	1.11	0.03		0.00		0.00		0.00		0.00		0.00		0.00	0.03	0.031
Wood	0.02	0.01	1.11	0.02		0.00		0.00		0.00		0.00		0.00		0.00	0.01	0.015
Total	1.00	0.71		0.64	1.00	0.04		0.03	1.00	0.25		0.19	0.00	0.00		0.00	1.00	0.855

* Includes cooking (resturants) & drying (laundries).

INDUSTRIAL SECTOR

	Space Heat				Process Steam				Direct Heat				Plant Fuel				Total	
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	B	D
U. S.		0.28				0.41				0.14				0.17			1.00	
Northeast		0.28				0.41				0.14				0.17			1.00	
Electricity	0.20	0.06	0.51	0.03		0.00		0.00	0.20	0.03	0.83	0.02	0.40	0.07	0.36	0.02	0.15	0.076
#2 Fuel Oil	0.45	0.13	1.01	0.13	0.20	0.08	1.03	0.08	0.50	0.07	1.03	0.07	0.50	0.09	1.03	0.09	0.36	0.371
#6 Fuel Oil	0.20	0.06	1.01	0.06	0.40	0.16	1.03	0.17	0.20	0.03	1.11	0.03		0.00		0.00	0.25	0.256
LPG	0.05	0.01	1	0.01		0.00		0.00	0.10	0.01	1	0.01	0.10	0.02	1	0.02	0.05	0.045
Coal	0.05	0.01	1.11	0.02	0.40	0.16	1.11	0.18		0.00		0.00		0.00		0.00	0.18	0.197
Wood	0.05	0.01	1.11	0.02		0.00		0.00		0.00		0.00		0.00		0.00	0.01	0.015
Total	1.00	0.28		0.26	1.00	0.41		0.44	1.00	0.14		0.14	1.00	0.17		0.13	1.00	0.962

KEYS:
A -- Allocation Fraction
B -- Use Fraction
C -- Alternate Fuel Adjustment Factor
D -- Alternate Fuel Substitution Fraction

TABLE 6

ALTERNATE FUEL SUBSTITUTION -- MIDDLE ATLANTIC STATES 1997

RESIDENTIAL SECTOR

	Space Heat				Water Heat				Cooking				Drying				Total	
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	B	D
U. S.		0.757				0.17				0.056				0.013			0.996	
Northeast		0.73				0.16				0.1				0.01			1	
Electricity	0.24	0.18	0.45	0.08	0.65	0.10	0.76	0.08	0.95	0.10	0.63	0.06	0.95	0.01	0.833	0.01	0.38	0.225
#2 Fuel Oil	0.60	0.44	1.03	0.45	0.33	0.05	1.07	0.06		0.00		0.00		0.00		0.00	0.49	0.507
LPG	0.02	0.01	1	0.01	0.02	0.00	1	0.00	0.05	0.01	1	0.01	0.05	0.00	1	0.00	0.02	0.023
Coal	0.04	0.03	1.37	0.04		0.00		0.00		0.00		0.00		0.00		0.00	0.03	0.040
Wood	0.10	0.07	1.37	0.10		0.00		0.00		0.00		0.00		0.00		0.00	0.07	0.100
Total	1.00	0.73		0.68	1.00	0.16		0.14	1.00	0.10		0.06	1.00	0.01		0.01	1.00	0.896

COMMERCIAL SECTOR

	Space Heat				Water Heat				Other*				Cooling				Total	
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	B	D
U. S.		0.70				0.04				0.25				0.01			1.00	
Northeast		0.71				0.04				0.25				0.00			1.00	
Electricity	0.24	0.17	0.48	0.08	0.75	0.03	0.76	0.02	0.95	0.24	0.73	0.17		0.00		0.00	0.44	0.277
#2 Fuel Oil	0.60	0.43	1.01	0.43	0.25	0.01	1.07	0.01		0.00		0.00		0.00		0.00	0.44	0.440
#6 Fuel Oil	0.08	0.06	1.01	0.06		0.00		0.00		0.00		0.00		0.00		0.00	0.06	0.057
LPG	0.02	0.01	1	0.01		0.00		0.00	0.05	0.01	1	0.01		0.00		0.00	0.03	0.026
Coal	0.04	0.03	1.14	0.03		0.00		0.00		0.00		0.00		0.00		0.00	0.03	0.032
Wood	0.02	0.01	1.14	0.02		0.00		0.00		0.00		0.00		0.00		0.00	0.01	0.016
Total	1.00	0.71		0.63	1.00	0.04		0.03	1.00	0.25		0.19	0.00	0.00		0.00	1.00	0.851

* Includes cooking (resturants) & drying (laundries).

INDUSTRIAL SECTOR

	Space Heat				Process Steam				Direct Heat				Plant Fuel				Total	
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	B	D
U. S.		0.28				0.41				0.14				0.17			1.00	
Northeast		0.28				0.41				0.14				0.17			1.00	
Electricity	0.20	0.06	0.48	0.03		0.00		0.00	0.20	0.03	0.83	0.02	0.40	0.07	0.36	0.02	0.15	0.074
#2 Fuel Oil	0.45	0.13	1.01	0.13	0.20	0.08	1.03	0.08	0.50	0.07	1.03	0.07	0.50	0.09	1.03	0.09	0.36	0.371
#6 Fuel Oil	0.20	0.06	1.01	0.06	0.40	0.16	1.03	0.17	0.20	0.03	1.11	0.03		0.00		0.00	0.25	0.256
LPG	0.05	0.01	1	0.01		0.00		0.00	0.10	0.01	1	0.01	0.10	0.02	1	0.02	0.05	0.045
Coal	0.05	0.01	1.14	0.02	0.40	0.16	1.11	0.18		0.00		0.00		0.00		0.00	0.18	0.198
Wood	0.05	0.01	1.14	0.02		0.00		0.00		0.00		0.00		0.00		0.00	0.01	0.015
Total	1.00	0.28		0.26	1.00	0.41		0.44	1.00	0.14		0.14	1.00	0.17		0.13	1.00	0.961

KEYS:
A -- Allocation Fraction
B -- Use Fraction
C -- Alternate Fuel Adjustment Factor
D -- Alternate Fuel Substitution Fraction

TABLE 7

NORTHEAST ALTERNATE ENERGY STUDY
STATE NOX EMISSION FACTORS (LB/MMBTU)

MARKET SECTOR & Type Fuel	CN	MA	NH	NJ	NY	PA	RI	VT
RESIDENTIAL								
Natural Gas	0.102	0.102	0.102	0.102	0.102	0.102	0.102	0.102
Electricity	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
#2 Fuel Oil	0.128	0.128	0.128	0.128	0.128	0.128	0.128	0.128
Coal	0.353	0.353	0.353	0.353	0.353	0.353	0.353	0.353
Wood	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
LPG	0.102	0.102	0.102	0.102	0.102	0.102	0.102	0.102
COMMERCIAL								
Natural Gas	0.092	0.092	0.092	0.092	0.092	0.092	0.092	0.092
Electricity	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
#2 Fuel Oil	0.136	0.136	0.136	0.136	0.136	0.136	0.136	0.136
#6 Fuel Oil	0.300	0.407	0.407	0.407	0.407	0.407	0.407	0.407
Coal	0.256	0.256	0.256	0.256	0.256	0.256	0.256	0.256
Wood	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038
LPG	0.092	0.092	0.092	0.092	0.092	0.092	0.092	0.092
INDUSTRIAL								
Natural Gas	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150
Electricity	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
#2 Fuel Oil	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150
#6 Fuel Oil	0.300	0.400	0.400	0.400	0.400	0.400	0.400	0.400
Coal	0.580	0.580	0.580	0.580	0.580	0.580	0.580	0.580
Wood	0.156	0.156	0.156	0.156	0.156	0.156	0.156	0.156
LPG	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150
ELECTRIC UTILITY								
Additional Generating Load from Electricity Replacing Gas								
Natural Gas	0.200	0.200	0.200	0.200	0.200	0.200	0.164	0.200
#2 Fuel Oil	0.300	0.300	0.300	0.300	0.300	0.300	0.180	0.300
#6 Fuel Oil	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
Coal	0.600	0.600	0.600	0.600	0.600	0.600	0.600	0.600
Electrical Imports	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Normal Load								
Natural Gas	0.200	0.200	0.200	0.200	0.200	0.200	0.164	0.200
#2 Fuel Oil	0.300	0.300	0.300	0.300	0.300	0.300	0.180	0.300
#6 Fuel Oil	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
Coal	0.600	0.600	0.600	0.600	0.600	0.600	0.600	0.600
Nuclear	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hydro	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
COGENERATION								
Natural Gas	0.280	0.280	0.280	0.280	0.280	0.280	0.280	0.280
#2 Fuel Oil	0.410	0.410	0.410	0.410	0.410	0.410	0.410	0.410
Residual Fuel Oil	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
Coal	0.600	0.600	0.600	0.600	0.600	0.600	0.600	0.600

TABLE 8

NORTHEAST ALTERNATE ENERGY STUDY
STATE SO2 EMISSION FACTORS (LB/MMBTU)

MARKET SECTOR & Type Fuel	CN	MA	NH	NJ	NY	PA	RI	VT
RESIDENTIAL								
Natural Gas	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
Electricity	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
#2 Fuel Oil	0.5200	0.3400	0.4100	0.2060	0.3800	0.3090	0.5200	0.5200
Coal	1.1900	1.1000	1.5000	0.2380	0.2380	3.0000	0.5500	2.3800
Wood	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070
LPG	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
COMMERCIAL								
Natural Gas	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
Electricity	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
#2 Fuel Oil	0.5200	0.3400	0.4100	0.2060	0.3800	0.3090	0.5200	0.5200
#6 Fuel Oil	1.0600	1.1000	2.1200	0.3180	0.3900	2.1200	1.0600	2.1200
Coal	1.5000	1.1000	1.5000	0.3000	0.3000	3.0000	0.5500	3.0000
Wood	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080
LPG	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
INDUSTRIAL								
Natural Gas	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
Electricity	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
#2 Fuel Oil	0.5200	0.3400	0.4100	0.2060	0.3800	0.5200	0.5200	0.5200
#6 Fuel Oil	0.8000	0.8000	0.8000	0.3180	0.3900	0.8000	0.8000	0.8000
Coal	1.1000	1.1000	1.2000	0.3000	0.3000	1.2000	0.5500	1.2000
Wood	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080
LPG	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
ELECTRIC UTILITY								
Additional Generating Load from Electricity Replacing Gas								
Natural Gas	0.0006	0.0006	0.0006	0.0006	0.0006	0.2000	0.0006	0.0006
#2 Fuel Oil	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000
#6 Fuel Oil	0.8000	1.1000	0.8000	0.3180	0.3900	0.8000	1.0600	0.8000
Coal	1.1000	1.1000	1.2000	0.3000	0.3000	1.2000	1.2000	1.2000
Electrical Imports	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Normal Load								
Natural Gas	0.0006	0.0006	0.0006	0.0006	0.0006	0.2000	0.0006	0.0006
#2 Fuel Oil	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000
#6 Fuel Oil	0.8000	1.1000	0.8000	0.3180	0.3900	0.8000	1.0600	0.8000
Coal	1.1000	1.1000	1.2000	0.3000	0.3000	1.2000	1.2000	1.2000
Nuclear	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hydro	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
COGENERATION								
Natural Gas	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
#2 Fuel Oil	0.5000	0.3400	0.4000	0.2000	0.3700	0.3000	0.5000	0.5000
Residual Fuel Oil	0.8000	0.8000	0.8000	0.3180	0.3900	0.8000	0.8000	0.8000
Coal	1.1000	1.1000	1.2000	0.3000	0.3000	1.2000	1.2000	1.2000

TABLE 9

NORTHEAST ALTERNATE ENERGY STUDY
STATE TSP EMISSION FACTORS (LB/MMBTU)

MARKET SECTOR & Type Fuel	CN	MA	NH	NJ	NY	PA	RI	VT
RESIDENTIAL								
Natural Gas	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
Electricity	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
#2 Fuel Oil	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018
Coal	0.200	0.580	0.300	0.580	0.580	0.580	0.580	0.500
Wood	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130
LPG	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
COMMERCIAL								
Natural Gas	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
Electricity	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
#2 Fuel Oil	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
#6 Fuel Oil	0.087	0.087	0.154	0.040	0.045	0.154	0.087	0.154
Coal	0.200	0.100	0.300	0.380	0.380	0.380	0.380	0.380
Wood	0.200	0.100	0.300	0.600	0.600	0.400	0.780	0.270
LPG	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
INDUSTRIAL								
Natural Gas	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
Electricity	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
#2 Fuel Oil	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
#6 Fuel Oil	0.087	0.087	0.100	0.040	0.045	0.100	0.087	0.100
Coal	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
Wood	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
LPG	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019
ELECTRIC UTILITY								
Additional Generating Load from Electricity Replacing Gas								
Natural Gas	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
#2 Fuel Oil	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
#6 Fuel Oil	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Coal	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Electrical Imports	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Normal Load								
Natural Gas	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
#2 Fuel Oil	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
#6 Fuel Oil	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Coal	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Nuclear	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hydro	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
COGENERATION								
Natural Gas	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
#2 Fuel Oil	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036
Residual Fuel Oil	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030
Coal	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030

APPENDIX B-2

APPENDIX B-2

Determination of Northeast Gas Demand

The calculation of gas demand in the Northeast states follows several steps, described in the following discussion. A flowchart outlining the calculations used to determine demand projections is included in Figure I-1 for reference.

Step 1

In response to the Commission's March 1988 data request, various operators filed projections of anticipated increased demand contingent upon new pipeline capacity to the Northeast. Both peak-day and annual volumes were projected through the year 1997 for each state in the region for pipeline sales to electric utilities, cogenerators, and local distribution companies (LDCs). LDC demand was projected for the residential, commercial, industrial, electric utility, and cogeneration sectors.

The available data for settlements and for authorized discrete projects included only peak-day increases, with no allocation of LDC sales by market sector or projected annual volumes. The settlement data also differed materially from the filed data in how it was distributed among sales to electric utilities, cogenerators, and LDCs.

Table 10 shows the March 1988 data for the 1997 forecast year along with the settlement data, broken out by market sector (as defined by each set of data) and by state. For each settlement market sector (LDC, cogeneration and electric generation) for each state, a ratio is determined between the settlement volumes (including previously authorized projects) and the March 1988 forecasted volumes.

Step 2

The ratios from Step 1 are multiplied by the March 1988 forecasts for annual flow increases for each market sector (including the LDC breakdown), for each state and for each forecast year to obtain "adjusted growth projections," the results of which are shown in Table 11.

The results in Table 11 are not used further in the calculations, but represent projected annual demand (not peak day demand) as defined by the overall settlement volumes only.

All remaining calculations in this Appendix are performed for each market sector, for each state and for each forecast year as shown on Table 11.

Step 3

The ratios from Step 1 are multiplied by the March 1988 forecasts for peak flow increases, to obtain a forecast for adjusted peak day increases. The results of this calculation are not shown on a table.

Step 4

The volumes for previously approved projects are subtracted from the adjusted peak day increases from Step 3. The amounts to subtract for each LDC category are determined by prorating the volumes according the breakdown within the March 1988 data for each state and forecast year, since these amounts are not explicitly available in the data for approved projects. The result of this calculation is the forecast for net peak day growth, and is not shown in a table.

Step 5

Growth load factors are determined for each market sector, forecast year and state and multiplied by their respective results from Step 4. The growth load factor for a given category is the ratio of the increase in annual volume to the increase in annualized peak day volume for that category. The result of this calculation is the forecast for settlement growth, and is not shown on a table.

Step 6

The company use and unaccounted-for amounts are removed from the results of Step 5 to obtain the 100% replacement projection, which is shown in Table 12.

This result represents gas that would need to be replaced if the settlement projects are not completed and there is 100% replacement of the projected gas volumes.

Step 7

Each amount from Step 6 (Table 12) is multiplied by its appropriate AGA partial replacement factor to obtain the "Partial Replacement Projection," shown in Table 13.

This result represents projected volumes of gas that would need to be replaced by alternate fuels if some of the anticipated increased demand can be met with gas flowing through existing pipelines off-peak when there is spare capacity. It represents demand that would most likely have to be replaced if the settlement projects are not approved.

TABLE 10

FILED PEAK DAY INCREASES -- MARCH 1988 DATA

	CN	MA	NH	NJ	NY	PA	RI	VT	NoEAST		MAtl.	NE
RESIDENTIAL	119	43	41	505	390	49	25	12	1184		944	240
COMMERCIAL	55	75	12	171	119	36	16	8	492		326	166
INDUSTRIAL	22	12	1	27	21	0	0	20	103		48	55
ELECTRIC UTIL	56	0	0	2	0	0	0	0	58		2	56
COGENERATION	17	12	0	2	0	10	0	12	53		12	41
COMPANY USE	1	2	0	-1	11	1	2	1	17		11	6
TOTAL LDC	270	144	54	706	541	96	43	53	1907		1343	564
DIRECT EU	0	240	0	0	0	0	50	0	290		0	290
DIRECT COGEN	26	217	0	82	73	22	15	0	435		177	258
NON-LDC	26	457	0	82	73	22	65	0	725		177	548
TOTAL	296	601	54	788	614	118	108	53	2632		1520	1112

SETTLEMENT PEAK DAY INCREASES (11/21/88 AND 1/17/89 FILINGS)

	CN	MA	NH	NJ	NY	PA	RI	VT	NoEAST		MAtl.	NE
SETTLEMENT												
LDC	144	91	4	206	280	28	1		754		514	240
EU		95					145		240		0	240
COGEN		145		102	218		13		478		320	158
SUB-TOTAL	144	331	4	308	498	28	159	0	1471		833	638
UNDESIGNATED					30				30	[1]	30	0
SYSTEM SUPPLY					39				39	[2]	39	0
TOTAL	144	331	4	308	566	28	159	0	1540		902	638
AUTHORIZED OTHER NORTHEAST PROJECTS												
LDC	8	122	11	233	329	29	85		817		592	226
EU		22					50		72		0	72
COGEN				3		15			18		18	0
SUB-TOTAL	8	144	11	236	329	44	135	0	907		610	298
UNDESIGNATED	70	30	40				10		150	[3]	0	150
SYSTEM SUPPLY		3		180	44	2	1		230	[4]	226	4
CAP. RESTORATION					60				60	[4]	60	0
TOTAL	78	177	51	416	433	46	146	0	1347		896	452
TOTAL SETT & AUTH	222	508	55	724	999	74	305	0	2887		1797	1090
ALLOCATION												
LDC	222	246	55	620	782	59	97	0	2080		1460	620
EU	0	117	0	0	0	0	195	0	312		0	312
COGEN	0	145	0	105	218	15	13	0	496		338	158
RELATIVE TO FILING												
LDC	0.822	1.710	1.015	0.877	1.445	0.610	2.253	0.000	1.091		1.087	1.099
EU	0.000	0.486	0.000	0.000	0.000	0.000	3.900	0.000	1.075		1.000	1.075
COGEN	0.000	0.668	0.000	1.279	2.985	0.682	0.853	0.000	1.139		1.908	0.612

ADJUSTED PEAK DAY INCREASES

	CN	MA	NH	NJ	NY	PA	RI	VT	NoEAST	MAtl.	NE
RESIDENTIAL	98	74	42	443	563	30	56	0	1306	1036	269
COMMERCIAL	45	128	12	150	172	22	36	0	566	344	222
INDUSTRIAL	18	21	1	24	30	0	0	0	94	54	40
ELECTRIC UTIL	46	0	0	2	0	0	0	0	48	2	46
COGENERATION	14	21	0	2	0	6	0	0	42	8	35
COMPANY USE	1	3	0	-1	16	1	5	0	24	16	9
TOTAL LDC	222	246	55	620	782	59	97	0	2080	1460	620
DIRECT EU	0	117	0	0	0	0	195	0	312	0	312
DIRECT COGEN	0	145	0	105	218	15	13	0	496	338	158
NON-LDC	0	262	0	105	218	15	208	0	807	338	470
TOTAL	222	508	55	724	999	74	305	0	2887	1797	1089

NOTES:
[1] 30 MMcfd settlement undesignated allocated to New York.
[2] 39 MMcfd settlement system supply allocated to New York.
[3] 150 MMcfd authorized undesignated allocated to New England states as shown.
[4] 290 MMCF/d authorized system supply and capacity restoration allocated in accordance with Table 1, FERC APEC Project Environmental Assessment (excluding APEC I Capacity Restoration Project).

TABLE 11

ADJUSTED GROWTH PROJECTIONS

	CN	MA	NH	NJ	NY	PA	RI	VT	NoEAST	MAtl.	NE
RESIDENTIAL											
88-89	632	6937	160	5031	5728	225	890	0	19604	10984	8620
89-90	1634	7406	334	10647	12139	563	1641	0	34364	23349	11014
90-91	2410	7326	647	16197	21381	921	2391	0	51273	38499	12774
91-92	3568	7993	908	21592	28616	1298	3144	0	67119	51506	15613
96-97	8559	9929	2373	45191	58978	3109	6855	0	134995	107278	27716
COMMERCIAL											
88-89	-483	4615	200	2073	3279	162	480	0	10326	5514	4812
89-90	-801	6734	455	3928	6639	438	960	0	18353	11005	7348
90-91	4924	7993	707	5900	10103	715	1440	0	31783	16719	15064
91-92	5972	9500	976	7892	14539	993	1920	0	41792	23425	18368
96-97	8422	16572	2579	18420	33869	2172	4293	0	86327	54461	31866
INDUSTRIAL											
88-89	-544	901	2	793	747	564	0	0	2463	2104	359
89-90	298	1115	6	1228	1296	564	0	0	4506	3087	1419
90-91	3096	1242	11	1638	2831	564	0	0	9383	5034	4349
91-92	3640	1392	15	2254	3357	564	0	0	11223	6175	5047
96-97	3582	1919	45	2260	5384	564	0	0	13754	8208	5545
ELECTRIC UTILITIES											
88-89	572	-18526	0	142	-2210	0	0	0	-20021	-2068	-17953
89-90	265	-18527	0	4287	146	0	4836	0	-8993	4433	-13426
90-91	19609	-18526	0	4494	11116	0	5656	0	22349	15609	6740
91-92	19304	-18526	0	4705	11267	0	5974	0	22725	15973	6753
96-97	14585	-18526	0	5843	28869	0	5974	0	36746	34712	2034
COGENERATION											
88-89	33	765	0	19386	39	191	0	0	20414	19616	797
89-90	2782	2738	0	38074	413	401	2682	0	47090	38888	8202
90-91	5504	3221	0	47347	2339	2560	10231	0	71201	52246	18956
91-92	5815	5285	0	51280	2901	2560	14839	0	82680	56741	25939
96-97	6716	10859	0	61561	3792	2560	50911	0	136399	67913	68486
COMPANY USED AND UNACCOUNTED FOR											
88-89	153	7522	-100	132	1047	-352	419	0	8821	827	7994
89-90	179	7536	-70	1283	1619	-345	7	0	10209	2557	7652
90-91	1273	7563	-51	1318	2379	-323	72	0	12232	3374	8858
91-92	839	7582	-63	1594	2827	-317	142	0	12604	4103	8501
96-97	-40	7818	80	2863	4082	-294	552	0	15062	6652	8410
TOTAL LDCs											
88-89	363	2215	262	27557	8630	790	1789	0	41607	36977	4630
89-90	4356	7002	725	59447	22252	1621	10125	0	105528	83320	22208
90-91	36817	8819	1315	76894	50149	4438	19790	0	198222	131481	66741
91-92	39139	13227	1837	89317	63508	5098	26019	0	238143	157922	80221
96-97	41824	28573	5076	136139	134974	8112	68585	0	423283	279225	144058
DIRECT ELECTRIC UTILITIES											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	71175	0	71175	0	71175
90-91	0	0	0	0	0	0	71175	0	71175	0	71175
91-92	0	16851	0	0	0	0	71175	0	88026	0	88026
96-97	0	33703	0	0	0	0	71175	0	104878	0	104878
DIRECT COGENERATION											
88-89	0	973	0	0	0	5475	90	0	6538	5475	1063
89-90	0	8244	0	12469	22563	5475	550	0	49300	40507	8793
90-91	0	36888	0	38163	28384	5475	3580	0	112490	72022	40468
91-92	0	39276	0	38163	45953	5475	4188	0	133056	89591	43464
96-97	0	39276	0	38163	55956	5475	4188	0	143058	99594	43464
TOTAL - ALL CATEGORIES											
88-89	363	3188	262	27557	8630	6265	1879	0	48144	42452	5692
89-90	4356	15246	725	71916	44815	7096	81849	0	226003	123827	102176
90-91	36817	45707	1315	115057	78533	9913	94545	0	381887	203503	178384
91-92	39139	69354	1837	127480	109461	10573	101382	0	459225	247514	211712
96-97	41824	101552	5076	174302	190930	13587	143948	0	671219	378819	292400

TABLE 12

100% REPLACEMENT PROJECTION

	CN	MA	NH	NJ	NY	PA	RI	VT	NoEAST	MAtl.	NE
RESIDENTIAL											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	896	0	0	0	0	0	0	0	896	0	896
91-92	1589	0	0	0	0	0	0	0	1589	0	1589
96-97	5552	3672	173	15049	26278	1465	71	0	52260	42791	9468
COMMERCIAL											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	1831	0	0	0	0	0	0	0	1831	0	1831
91-92	2659	0	0	0	0	4	0	0	2663	4	2659
96-97	5463	6130	188	6134	15090	1023	44	0	34072	22247	11825
INDUSTRIAL											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	1151	0	0	0	0	0	0	0	1151	0	1151
91-92	1621	0	0	0	0	0	0	0	1621	0	1621
96-97	2323	710	3	753	2399	0	0	0	6188	3152	3036
ELECTRIC UTILITIES											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	7290	0	0	0	0	0	0	0	7290	0	7290
91-92	8595	0	0	0	0	0	0	0	8595	0	8595
96-97	9461	0	0	1946	0	0	0	0	11407	1946	9461
COGENERATION											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	2046	0	0	0	0	0	0	0	2046	0	2046
91-92	2589	0	0	0	0	11	0	0	2600	11	2589
96-97	4356	4017	0	20501	0	1206	0	0	30079	21706	8373
COMPANY USED AND UNACCOUNTED FOR											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	0	0	0	0	0	0	0	0	0	0	0
91-92	0	0	0	0	0	0	0	0	0	0	0
96-97	0	0	0	0	0	0	0	0	0	0	0
TOTAL LDCs											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	13214	0	0	0	0	0	0	0	13214	0	13214
91-92	17052	0	0	0	0	15	0	0	17067	15	17052
96-97	27155	14529	365	44382	43767	3693	115	0	134006	91842	42163
DIRECT ELECTRIC UTILITIES											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	52925	0	52925	0	52925
90-91	0	0	0	0	0	0	52925	0	52925	0	52925
91-92	0	10585	0	0	0	0	52925	0	63510	0	63510
96-97	0	27436	0	0	0	0	52925	0	80361	0	80361
DIRECT COGENERATION											
88-89	0	973	0	0	0	0	90	0	1063	0	1063
89-90	0	8244	0	11461	22563	0	550	0	42817	34024	8793
90-91	0	36888	0	37072	28384	0	3580	0	105923	65455	40468
91-92	0	39276	0	37072	45953	0	4188	0	126489	83025	43464
96-97	0	39276	0	37072	55956	0	4188	0	136492	93027	43464
TOTAL - ALL CATEGORIES											
88-89	0	973	0	0	0	0	90	0	1063	0	1063
89-90	0	8244	0	11461	22563	0	53475	0	95742	34024	61718
90-91	13214	36888	0	37072	28384	0	56505	0	172062	65455	106606
91-92	17052	49861	0	37072	45953	15	57113	0	207066	83040	124026
96-97	27155	81241	365	81454	99723	3693	57228	0	350859	184870	165989

TABLE 13

PARTIAL REPLACEMENT PROJECTION

	CN	MA	NH	NJ	NY	PA	RI	VT	NoEAST	MAtl.	NE
RESIDENTIAL											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	806	0	0	0	0	0	0	0	806	0	806
91-92	1430	0	0	0	0	0	0	0	1430	0	1430
96-97	4997	3305	156	13544	23650	1318	64	0	47034	38512	8522
COMMERCIAL											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	1648	0	0	0	0	0	0	0	1648	0	1648
91-92	2393	0	0	0	0	4	0	0	2397	4	2393
96-97	4917	5517	169	5521	13581	921	40	0	30665	20023	10643
INDUSTRIAL											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	576	0	0	0	0	0	0	0	576	0	576
91-92	810	0	0	0	0	0	0	0	810	0	810
96-97	1162	355	2	376	1199	0	0	0	3094	1576	1518
ELECTRIC UTILITIES											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	1822	0	0	0	0	0	0	0	1822	0	1822
91-92	2149	0	0	0	0	0	0	0	2149	0	2149
96-97	2365	0	0	486	0	0	0	0	2852	486	2365
COGENERATION											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	512	0	0	0	0	0	0	0	512	0	512
91-92	647	0	0	0	0	3	0	0	650	3	647
96-97	1089	1004	0	5125	0	301	0	0	7520	5427	2093
COMPANY USED AND UNACCOUNTED FOR											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	0	0	0	0	0	0	0	0	0	0	0
91-92	0	0	0	0	0	0	0	0	0	0	0
96-97	0	0	0	0	0	0	0	0	0	0	0
TOTAL LDCs											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	0	0	0	0	0
90-91	5363	0	0	0	0	0	0	0	5363	0	5363
91-92	7429	0	0	0	0	6	0	0	7436	6	7429
96-97	14529	10181	327	25053	38431	2540	104	0	91164	66024	25141
DIRECT ELECTRIC UTILITIES											
88-89	0	0	0	0	0	0	0	0	0	0	0
89-90	0	0	0	0	0	0	13231	0	13231	0	13231
90-91	0	0	0	0	0	0	13231	0	13231	0	13231
91-92	0	2646	0	0	0	0	13231	0	15877	0	15877
96-97	0	6859	0	0	0	0	13231	0	20090	0	20090
DIRECT COGENERATION											
88-89	0	243	0	0	0	0	22	0	266	0	266
89-90	0	2061	0	2865	5641	0	137	0	10704	8506	2198
90-91	0	9222	0	9268	7096	0	895	0	26481	16364	10117
91-92	0	9819	0	9268	11488	0	1047	0	31622	20756	10866
96-97	0	9819	0	9268	13989	0	1047	0	34123	23257	10866
TOTAL - ALL CATEGORIES											
88-89	0	243	0	0	0	0	22	0	266	0	266
89-90	0	2061	0	2865	5641	0	13369	0	23935	8506	15430
90-91	5363	9222	0	9268	7096	0	14126	0	45076	16364	28712
91-92	7429	12465	0	9268	11488	6	14278	0	54935	20763	34173
96-97	14529	26859	327	34321	52420	2540	14382	0	145378	89281	56097

APPENDIX B-3

TABLE 14

NORTHEAST U.S. 100% REPLACEMENT CASE APPENDIX B

MARKET SECTOR & Type Fuel	1986 ENERGY DEMAND (MDth)	1992 DEMAND INCR. (MDth) W NEP	1992 DEMAND INCR. (MDth) W/O NEP	1992 EMISSION INCR. (Ton/yr) NOx	1992 EMISSION INCR. (Ton/yr) SO2	1992 EMISSION INCR. (Ton/yr) PM	1997 DEMAND INCR. (MDth) W NEP	1997 DEMAND INCR. (MDth) W/O NEP	1997 EMISSION INCR. (Ton/yr) NOx	1997 EMISSION INCR. (Ton/yr) SO2	1997 EMISSION INCR. (Ton/yr) PM
RESIDENTIAL											
Natural Gas	936800	1589	0	-81	-0	-12	52260	0	-2665	-16	-392
Electricity	394700	0	395 ▒	0	0	0	0	11925 ▒	0	0	0
#2 Fuel Oil	652900	0	793	51	206	7	0	26612	1703	4532	240
Coal	25500	0	64	11	38	6	0	2104	371	512	566
Wood	182700	0	159	1	1	10	0	5261	21	18	342
LPG	37400	0	37	2	0	0	0	1218	62	0	12
Subtotal	2230000	1589	1447	-17	244	12	52260	47120	-508	5047	767
COMMERCIAL											
Natural Gas	462200	2663	0	-122	-1	-20	34072	0	-1567	-10	-256
Electricity	443700	0	767 ▒	0	0	0	0	9471 ▒	0	0	0
#2 Fuel Oil	258500	0	1174	80	305	8	0	15025	1022	2721	105
#6 Fuel Oil	121000	0	153	23	81	7	0	1955	381	659	61
Coal	26100	0	84	11	63	8	0	1103	141	400	166
Wood	3300	0	42	1	0	4	0	552	10	2	121
LPG	6700	0	71	3	0	1	0	910	42	0	9
Subtotal	1321500	2663	2292	-5	449	8	34072	29015	29	3772	206
INDUSTRIAL											
Natural Gas	430700	1621	0	-122	-0	-12	6188	0	-464	-2	-46
Electricity	367700	0	126 ▒	0	0	0	0	462 ▒	0	0	0
#2 Fuel Oil	103400	0	602	45	156	4	0	2298	172	467	16
#6 Fuel Oil	142500	0	416	62	166	18	0	1588	288	462	52
Coal	381400	0	320	93	176	8	0	1225	355	424	31
Wood	161200	0	25	2	0	1	0	99	8	0	5
LPG	46500	0	73	5	0	1	0	278	21	0	3
Subtotal	1633400	1621	1562	86	499	20	6188	5950	380	1353	59
ELECTRIC UTILITY											
Additional Generating Load from Electricity Replacing Gas											
Natural Gas	0	0	0	0	0	0	0	0	0	0	0
#2 Fuel Oil	0	0	20	3	2	0	0	29901	4483	2990	209
#6 Fuel Oil	0	0	3272	491	1309	49	0	0	0	0	0
Coal	0	0	574	172	316	9	0	10819	3246	2908	162
Electrical Imports	0	0	0	0	0	0	0	4590	0	0	0
Normal Load											
Natural Gas	193400	72104	0	-6258	-22	-541	91768	0	0	0	0
#2 Fuel Oil	27800	0	49269	4451	4927	345	0	49727	4519	4973	348
#6 Fuel Oil	817200	0	21183	3178	10403	318	0	35263	5289	17565	529
Coal	1364000	0	5326	1598	2930	80	0	13382	4015	6681	201
Nuclear	1078700	0	0	0	0	0	0	0	0	0	0
Hydro	572200	0	0	0	0	0	0	0	0	0	0
Subtotal	4053300	72104	79645	3634	19864	260	91768	143683	21552	35117	1449
COGENERATION											
Natural Gas	Included	129089	0	-18072	-39	-904	166571	0	-23320	-50	-1166
#2 Fuel Oil	in Ind.	0	132445	27151	21116	2384	0	153812	31531	23811	2769
Residual Fuel Oil	& EU	0	0	0	0	0	0	0	0	0	0
Coal	sectors	0	0	0	0	0	0	18556	5567	5177	278
Subtotal		129089	132445	9079	21078	1480	166571	172368	13778	28938	1881
TOTAL MARKET											
Natural Gas	2023100	207066	0	-24655	-62	-1488	350859	0	-28017	-78	-1860
#2 Fuel Oil	1042600	0	184303	31781	26713	2749	0	277374	43431	39493	3687
Residual Fuel Oil	1080700	0	25023	3754	11959	392	0	38805	5958	18687	641
Nuclear	1078700	0	0	0	0	0	0	0	0	0	0
Hydro	572200	0	0	0	0	0	0	0	0	0	0
Coal	1797000	0	6368	1885	3522	111	0	47190	13695	16101	1403
Wood	347200	0	226	3	1	16	0	5911	39	21	468
LPG	90600	0	181	11	0	2	0	2406	125	1	24
Electrical Imports	0	0	0	0	0	0	0	4590	0	0	0
Subtotal	8032100	207066	216102	12778	42133	1781	350859	376277	35231	74225	4363

▒ Replacement of gas by electricity will increase the primary fuel consumption used to generate electricity. Cells marked with ▒ not included in primary fuel total. 900424

TABLE 15

NORTHEAST U.S. PARTIAL REPLACEMENT CASE APPENDIX B

MARKET SECTOR & Type Fuel	1986 ENERGY DEMAND (MDth)	1992 DEMAND INCR. (MDth) W NEP	1992 DEMAND INCR. (MDth) W/O NEP	1992 EMISSION INCR. (Ton/yr) NOx	1992 EMISSION INCR. (Ton/yr) SO2	1992 EMISSION INCR. (Ton/yr) PM	1997 DEMAND INCR. (MDth) W NEP	1997 DEMAND INCR. (MDth) W/O NEP	1997 EMISSION INCR. (Ton/yr) NOx	1997 EMISSION INCR. (Ton/yr) SO2	1997 EMISSION INCR. (Ton/yr) PM
RESIDENTIAL											
Natural Gas	936800	1589	159	-73	-0	-11	52260	5226	-2399	-14	-353
Electricity	394700	0	355 ‡	0	0	0	0	10732 ‡	0	0	0
#2 Fuel Oil	652900	0	713	46	185	6	0	23951	1533	4079	216
Coal	25500	0	57	10	34	6	0	1894	334	460	509
Wood	182700	0	143	1	1	9	0	4735	19	17	308
LPG	37400	0	33	2	0	0	0	1096	56	0	11
Subtotal	2230000	1589	1461	-15	220	11	52260	47634	-457	4542	691
COMMERCIAL											
Natural Gas	462200	2663	266	-110	-1	-18	34072	3407	-1411	-9	-230
Electricity	443700	0	691 ‡	0	0	0	0	8524 ‡	0	0	0
#2 Fuel Oil	258500	0	1057	72	275	7	0	13522	920	2448	95
#6 Fuel Oil	121000	0	137	21	73	6	0	1759	343	593	55
Coal	26100	0	76	10	57	8	0	993	127	360	149
Wood	3300	0	38	1	0	4	0	496	9	2	109
LPG	6700	0	64	3	0	1	0	819	38	0	8
Subtotal	1321500	2663	2329	-4	404	7	34072	29520	26	3394	186
INDUSTRIAL											
Natural Gas	430700	1621	810	-61	-0	-6	6188	3094	-232	-1	-23
Electricity	367700	0	63 ‡	0	0	0	0	231 ‡	0	0	0
#2 Fuel Oil	103400	0	301	23	78	2	0	1149	86	234	8
#6 Fuel Oil	142500	0	208	31	83	9	0	794	144	231	26
Coal	381400	0	160	46	88	4	0	613	178	212	15
Wood	161200	0	13	1	0	1	0	49	4	0	2
LPG	46500	0	36	3	0	0	0	139	10	0	1
Subtotal	1633400	1621	1591	43	249	10	6188	6069	190	676	30
ELECTRIC UTILITY											
Additional Generating Load from Electricity Replacing Gas											
Natural Gas	0	0	15	1	0	0	0	19485	1948	61	146
#2 Fuel Oil	0	0	22	3	2	0	0	6665	999	666	47
#6 Fuel Oil	0	0	2799	420	1120	42	0	0	0	0	0
Coal	0	0	491	147	270	7	0	9646	2894	2585	145
Electrical Imports	0	0	0	0	0	0	0	4092	0	0	0
Normal Load											
Natural Gas	193400	72104	54078	-1564	-5	-135	91768	68826	0	0	0
#2 Fuel Oil	27800	0	7774	704	777	54	0	7877	719	788	55
#6 Fuel Oil	817200	0	9728	1459	4949	146	0	13004	1951	6641	195
Coal	1364000	0	1280	384	704	19	0	3088	926	1579	46
Nuclear	1078700	0	0	0	0	0	0	0	0	0	0
Hydro	572200	0	0	0	0	0	0	0	0	0	0
Subtotal	4053300	72104	76188	1554	7818	134	91768	132683	9437	12321	634
COGENERATION											
Natural Gas	Included	129089	96817	-4518	-10	-226	166571	124928	-5830	-12	-291
#2 Fuel Oil	in Ind.	0	33111	6788	5279	596	0	38453	7883	5953	692
Residual Fuel Oil	& EU	0	0	0	0	0	0	0	0	0	0
Coal	sectors	0	0	0	0	0	0	4639	1392	1294	70
Subtotal		129089	129928	2270	5269	370	166571	168020	3445	7234	470
TOTAL MARKET											
Natural Gas	2023100	207066	152145	-6325	-16	-396	350859	224966	-7923	24	-751
#2 Fuel Oil	1042600	0	42979	7635	6597	667	0	91616	12140	14168	1112
Residual Fuel Oil	1080700	0	12873	1931	6225	203	0	15557	2437	7465	276
Nuclear	1078700	0	0	0	0	0	0	0	0	0	0
Hydro	572200	0	0	0	0	0	0	0	0	0	0
Coal	1797000	0	2064	598	1153	44	0	20872	5851	6491	934
Wood	347200	0	193	2	1	14	0	5281	32	19	419
LPG	90600	0	134	7	0	1	0	2054	104	1	20
Electrical Imports	0	0	0	0	0	0	0	4092	0	0	0
Subtotal	8032100	207066	210388	3848	13960	533	350859	364439	12641	28168	2010

‡ Replacement of gas by electricity will increase the primary fuel consumption used to generate electricity. Cells marked with ‡ not included in primary fuel total.

900424

TABLE 16

Iroquois Phase I — NORTHEAST U.S. — 100% REPLACEMENT CASE — APPENDIX B

MARKET SECTOR & Type Fuel	1986 ENERGY DEMAND (MDth)	1992 DEMAND INCR. (MDth) W NEP	1992 DEMAND INCR. (MDth) W/O NEP	1992 EMISSION INCR. (Ton/yr) NOx	1992 EMISSION INCR. (Ton/yr) SO2	1992 EMISSION INCR. (Ton/yr) PM	1997 DEMAND INCR. (MDth) W NEP	1997 DEMAND INCR. (MDth) W/O NEP	1997 EMISSION INCR. (Ton/yr) NOx	1997 EMISSION INCR. (Ton/yr) SO2	1997 EMISSION INCR. (Ton/yr) PM
RESIDENTIAL											
Natural Gas	936800	1299	0	-66	-0	-10	21492	0	-1096	-6	-161
Electricity	394700	0	323 ▓	0	0	0	0	4940 ▓	0	0	0
#2 Fuel Oil	652900	0	648	41	169	6	0	10966	702	2201	99
Coal	25500	0	52	9	31	5	0	869	153	228	213
Wood	182700	0	130	1	0	8	0	2173	9	8	141
LPG	37400	0	30	2	0	0	0	501	26	0	5
Subtotal	2230000	1299	1183	-14	200	10	21492	19449	-207	2430	297
COMMERCIAL											
Natural Gas	462200	2175	0	-100	-1	-16	15703	0	-722	-5	-118
Electricity	443700	0	627 ▓	0	0	0	0	4365 ▓	0	0	0
#2 Fuel Oil	258500	0	959	65	249	7	0	6925	471	1429	48
#6 Fuel Oil	121000	0	125	19	66	5	0	901	169	322	29
Coal	26100	0	69	9	51	7	0	508	65	202	72
Wood	3300	0	34	1	0	3	0	254	5	1	51
LPG	6700	0	58	3	0	1	0	419	19	0	4
Subtotal	1321500	2175	1871	-4	366	7	15703	13372	6	1949	88
INDUSTRIAL											
Natural Gas	430700	1326	0	-99	-0	-10	3623	0	-272	-1	-27
Electricity	367700	0	103 ▓	0	0	0	0	270 ▓	0	0	0
#2 Fuel Oil	103400	0	492	37	128	3	0	1346	101	305	9
#6 Fuel Oil	142500	0	340	51	136	15	0	930	160	301	33
Coal	381400	0	262	76	144	7	0	717	208	289	18
Wood	161200	0	21	2	0	1	0	58	5	0	3
LPG	46500	0	60	4	0	1	0	163	12	0	2
Subtotal	1633400	1326	1278	71	408	16	3623	3484	214	895	38
ELECTRIC UTILITY											
Additional Generating Load from Electricity Replacing Gas											
Natural Gas	0	0	0	0	0	0	0	0	0	0	0
#2 Fuel Oil	0	0	16	2	2	0	0	13099	1962	1310	92
#6 Fuel Oil	0	0	2676	401	1070	40	0	0	0	0	0
Coal	0	0	467	140	257	7	0	4740	1422	1452	71
Electrical Imports	0	0	0	0	0	0	0	2011	0	0	0
Normal Load											
Natural Gas	193400	7030	0	-703	-2	-53	8420	0	0	0	0
#2 Fuel Oil	27800	0	49034	4415	4903	343	0	49048	4417	4905	343
#6 Fuel Oil	817200	0	12199	1830	5666	183	0	13377	2007	6117	201
Coal	1364000	0	1164	349	640	17	0	1494	448	773	22
Nuclear	1078700	0	0	0	0	0	0	0	0	0	0
Hydro	572200	0	0	0	0	0	0	0	0	0	0
Subtotal	4053300	7030	65556	6435	12537	538	8420	83768	10257	14556	729
COGENERATION											
Natural Gas	Included	17506	0	-2451	-5	-123	23114	0	-3236	-7	-162
#2 Fuel Oil	in Ind.	0	17961	3682	3639	323	0	21344	4375	4198	384
Residual Fuel Oil	& EU	0	0	0	0	0	0	0	0	0	0
Coal	sectors	0	0	0	0	0	0	2575	772	1133	39
Subtotal		17506	17961	1231	3634	201	23114	23919	1912	5324	261
TOTAL MARKET											
Natural Gas	2023100	29335	0	-3420	-9	-211	72352	0	-5326	-19	-468
#2 Fuel Oil	1042600	0	69111	8243	9090	683	0	102727	12029	14347	976
Residual Fuel Oil	1080700	0	15339	2301	6939	243	0	15207	2335	6740	263
Nuclear	1078700	0	0	0	0	0	0	0	0	0	0
Hydro	572200	0	0	0	0	0	0	0	0	0	0
Coal	1797000	0	2013	583	1123	43	0	10904	3069	4076	435
Wood	347200	0	185	3	1	13	0	2485	18	9	196
LPG	90600	0	148	9	0	1	0	1083	57	0	11
Electrical Imports	0	0	0	0	0	0	0	2011	0	0	0
Subtotal	8032100	29335	86796	7719	17144	772	72352	134417	12182	25154	1412

▓ Replacement of gas by electricity will increase the primary fuel consumption used to generate electricity.
Cells marked with ▓ not included in primary fuel total.

900424

TABLE 17

Iroquois Phase I — NORTHEAST U.S. — PARTIAL REPLACEMENT CASE — APPENDIX B

MARKET SECTOR & Type Fuel	1986 ENERGY DEMAND (MDth)	1992 DEMAND INCR. (MDth) W NEP	1992 DEMAND INCR. (MDth) W/O NEP	1992 EMISSION INCR. (Ton/yr) NOx	1992 EMISSION INCR. (Ton/yr) SO2	1992 EMISSION INCR. (Ton/yr) PM	1997 DEMAND INCR. (MDth) W NEP	1997 DEMAND INCR. (MDth) W/O NEP	1997 EMISSION INCR. (Ton/yr) NOx	1997 EMISSION INCR. (Ton/yr) SO2	1997 EMISSION INCR. (Ton/yr) PM
RESIDENTIAL											
Natural Gas	936800	1299	130	-60	-0	-9	21492	2149	-986	-6	-145
Electricity	394700	0	291 ▓	0	0	0	0	4446 ▓	0	0	0
#2 Fuel Oil	652900	0	583	37	152	5	0	9870	632	1981	89
Coal	25500	0	47	8	28	5	0	782	138	205	192
Wood	182700	0	117	0	0	8	0	1956	8	7	127
LPG	37400	0	27	1	0	0	0	451	23	0	5
Subtotal	2230000	1299	1195	-12	180	9	21492	19653	-186	2187	267
COMMERCIAL											
Natural Gas	462200	2175	217	-90	-1	-15	15703	1570	-650	-4	-106
Electricity	443700	0	564 ▓	0	0	0	0	3928 ▓	0	0	0
#2 Fuel Oil	258500	0	863	59	224	6	0	6232	424	1286	44
#6 Fuel Oil	121000	0	112	17	60	5	0	811	152	290	26
Coal	26100	0	62	8	46	6	0	458	59	182	65
Wood	3300	0	31	1	0	3	0	229	4	1	46
LPG	6700	0	52	2	0	1	0	377	17	0	4
Subtotal	1321500	2175	1902	-4	330	6	15703	13605	6	1755	79
INDUSTRIAL											
Natural Gas	430700	1326	663	-50	-0	-5	3623	1812	-136	-1	-14
Electricity	367700	0	52 ▓	0	0	0	0	135 ▓	0	0	0
#2 Fuel Oil	103400	0	246	18	64	2	0	673	50	152	5
#6 Fuel Oil	142500	0	170	26	68	7	0	465	80	151	17
Coal	381400	0	131	38	72	3	0	359	104	145	9
Wood	161200	0	10	1	0	1	0	29	2	0	1
LPG	46500	0	30	2	0	0	0	82	6	0	1
Subtotal	1633400	1326	1302	35	204	8	3623	3553	107	447	19
ELECTRIC UTILITY											
Additional Generating Load from Electricity Replacing Gas											
Natural Gas	0	0	12	1	0	0	0	8509	850	3	64
#2 Fuel Oil	0	0	18	3	2	0	0	2910	436	291	20
#6 Fuel Oil	0	0	2289	343	916	34	0	0	0	0	0
Coal	0	0	399	120	220	6	0	4212	1264	1285	63
Electrical Imports	0	0	0	0	0	0	0	1787	0	0	0
Normal Load											
Natural Gas	193400	7030	5272	-176	-1	-13	8420	6315	0	0	0
#2 Fuel Oil	27800	0	7718	695	772	54	0	7721	696	772	54
#6 Fuel Oil	817200	0	7580	1137	3819	114	0	7867	1180	3930	118
Coal	1364000	0	289	87	159	4	0	362	109	191	5
Nuclear	1078700	0	0	0	0	0	0	0	0	0	0
Hydro	572200	0	0	0	0	0	0	0	0	0	0
Subtotal	4053300	7030	23579	2210	5887	199	8420	39683	4534	6471	325
COGENERATION											
Natural Gas	Included	17506	13130	-613	-1	-31	23114	17336	-809	-2	-40
#2 Fuel Oil	in Ind.	0	4490	921	910	81	0	5336	1094	1049	96
Residual Fuel Oil	& EU	0	0	0	0	0	0	0	0	0	0
Coal	sectors	0	0	0	0	0	0	644	193	283	10
Subtotal		17506	17620	308	908	50	23114	23315	478	1331	65
TOTAL MARKET											
Natural Gas	2023100	29335	19424	-987	-3	-72	72352	37690	-1731	-10	-241
#2 Fuel Oil	1042600	0	13919	1733	2123	148	0	32742	3331	5532	308
Residual Fuel Oil	1080700	0	10152	1523	4862	160	0	9142	1412	4371	161
Nuclear	1078700	0	0	0	0	0	0	0	0	0	0
Hydro	572200	0	0	0	0	0	0	0	0	0	0
Coal	1797000	0	928	261	525	24	0	6817	1866	2290	344
Wood	347200	0	158	2	1	11	0	2213	14	8	175
LPG	90600	0	109	6	0	1	0	910	46	0	9
Electrical Imports	0	0	0	0	0	0	0	1787	0	0	0
Subtotal	8032100	29335	44691	2538	7508	273	72352	91301	4939	12192	755

▓ Replacement of gas by electricity will increase the primary fuel consumption used to generate electricity.
Cells marked with ▓ not included in primary fuel total.

900424

TABLE 18

Iroquois Phases I & II — NORTHEAST U.S. — 100% REPLACEMENT CASE — APPENDIX B

MARKET SECTOR & Type Fuel	1986 ENERGY DEMAND (MDth)	1992 DEMAND INCR. (MDth) W NEP	1992 DEMAND INCR. (MDth) W/O NEP	1992 EMISSION INCR. (Ton/yr) NOx	1992 EMISSION INCR. (Ton/yr) SO2	1992 EMISSION INCR. (Ton/yr) PM	1997 DEMAND INCR. (MDth) W NEP	1997 DEMAND INCR. (MDth) W/O NEP	1997 EMISSION INCR. (Ton/yr) NOx	1997 EMISSION INCR. (Ton/yr) SO2	1997 EMISSION INCR. (Ton/yr) PM
RESIDENTIAL											
Natural Gas	936800	1589	0	-81	-0	-12	25807	0	-1316	-8	-194
Electricity	394700	0	395 ▒	0	0	0	0	5956 ▒	0	0	0
#2 Fuel Oil	652900	0	793	51	206	7	0	13184	844	2623	119
Coal	25500	0	64	11	38	6	0	1046	185	305	259
Wood	182700	0	159	1	1	10	0	2616	10	9	170
LPG	37400	0	37	2	0	0	0	601	31	0	6
Subtotal	2230000	1589	1447	-17	244	12	25807	23402	-247	2930	360
COMMERCIAL											
Natural Gas	462200	2659	0	-122	-1	-20	21025	0	-967	-6	-158
Electricity	443700	0	766 ▒	0	0	0	0	5844 ▒	0	0	0
#2 Fuel Oil	258500	0	1172	80	305	8	0	9271	630	1862	65
#6 Fuel Oil	121000	0	153	23	81	7	0	1206	229	474	42
Coal	26100	0	84	11	63	8	0	681	87	291	85
Wood	3300	0	42	1	0	4	0	340	6	1	59
LPG	6700	0	71	3	0	1	0	561	26	0	6
Subtotal	1321500	2659	2288	-5	448	8	21025	17904	11	2623	99
INDUSTRIAL											
Natural Gas	430700	1621	0	-122	-0	-12	4483	0	-336	-1	-34
Electricity	367700	0	126 ▒	0	0	0	0	334 ▒	0	0	0
#2 Fuel Oil	103400	0	602	45	156	4	0	1665	125	370	12
#6 Fuel Oil	142500	0	416	62	166	18	0	1150	200	383	42
Coal	381400	0	320	93	176	8	0	888	257	374	22
Wood	161200	0	25	2	0	1	0	72	6	0	4
LPG	46500	0	73	5	0	1	0	202	15	0	2
Subtotal	1633400	1621	1562	86	499	20	4483	4310	267	1126	48
ELECTRIC UTILITY											
Additional Generating Load from Electricity Replacing Gas											
Natural Gas	0	0	0	0	0	0	0	0	0	0	0
#2 Fuel Oil	0	0	20	3	2	0	0	16600	2488	1660	116
#6 Fuel Oil	0	0	3271	491	1308	49	0	0	0	0	0
Coal	0	0	571	171	314	9	0	6007	1802	2049	90
Electrical Imports	0	0	0	0	0	0	0	2548	0	0	0
Normal Load											
Natural Gas	193400	39675	0	-3508	-12	-298	52480	0	0	0	0
#2 Fuel Oil	27800	0	49161	4434	4916	344	0	49425	4474	4943	346
#6 Fuel Oil	817200	0	17547	2632	8402	263	0	26880	4032	13388	403
Coal	1364000	0	3463	1039	1905	52	0	8080	2424	4395	121
Nuclear	1078700	0	0	0	0	0	0	0	0	0	0
Hydro	572200	0	0	0	0	0	0	0	0	0	0
Subtotal	4053300	39675	74032	5262	16836	419	52480	109540	15220	26434	1077
COGENERATION											
Natural Gas	Included	17978	0	-2517	-5	-126	26216	0	-3670	-8	-184
#2 Fuel Oil	in Ind.	0	18445	3781	3760	332	0	24208	4963	4725	436
Residual Fuel Oil	& EU	0	0	0	0	0	0	0	0	0	0
Coal	sectors	0	0	0	0	0	0	2920	876	1323	44
Subtotal		17978	18445	1264	3755	206	26216	27128	2169	6040	296
TOTAL MARKET											
Natural Gas	2023100	63521	0	-6349	-19	-467	130011	0	-6290	-23	-568
#2 Fuel Oil	1042600	0	70193	8394	9346	696	0	114353	13523	16182	1093
Residual Fuel Oil	1080700	0	21386	3208	9958	337	0	29236	4461	14246	487
Nuclear	1078700	0	0	0	0	0	0	0	0	0	0
Hydro	572200	0	0	0	0	0	0	0	0	0	0
Coal	1797000	0	4501	1325	2495	83	0	19622	5631	8736	621
Wood	347200	0	226	3	1	16	0	3027	23	11	233
LPG	90600	0	181	11	0	2	0	1364	72	0	14
Electrical Imports	0	0	0	0	0	0	0	2548	0	0	0
Subtotal	8032100	63521	96487	6592	21781	666	130011	170151	17420	39152	1880

▒ Replacement of gas by electricity will increase the primary fuel consumption used to generate electricity.
Cells marked with ▒ not included in primary fuel total.

900424

TABLE 19

Iroquois Phases I & II — NORTHEAST U.S. — PARTIAL REPLACEMENT CASE — APPENDIX B

MARKET SECTOR & Type Fuel	1986 ENERGY DEMAND (MDth)	1992 DEMAND INCR. (MDth) W NEP	1992 DEMAND INCR. (MDth) W/O NEP	1992 EMISSION INCR. (Ton/yr) NOx	1992 EMISSION INCR. (Ton/yr) SO2	1992 EMISSION INCR. (Ton/yr) PM	1997 DEMAND INCR. (MDth) W NEP	1997 DEMAND INCR. (MDth) W/O NEP	1997 EMISSION INCR. (Ton/yr) NOx	1997 EMISSION INCR. (Ton/yr) SO2	1997 EMISSION INCR. (Ton/yr) PM
RESIDENTIAL											
Natural Gas	936800	1589	159	-73	-0	-11	25807	2581	-1185	-7	-174
Electricity	394700	0	355 *	0	0	0	0	5360 *	0	0	0
#2 Fuel Oil	652900	0	713	46	185	6	0	11865	759	2361	107
Coal	25500	0	57	10	34	6	0	942	166	274	233
Wood	182700	0	143	1	1	9	0	2354	9	8	153
LPG	37400	0	33	2	0	0	0	541	28	0	5
Subtotal	2230000	1589	1461	-15	220	11	25807	23643	-222	2637	324
COMMERCIAL											
Natural Gas	462200	2659	266	-110	-1	-18	21025	2103	-870	-6	-142
Electricity	443700	0	690 *	0	0	0	0	5260 *	0	0	0
#2 Fuel Oil	258500	0	1055	72	274	7	0	8344	567	1675	58
#6 Fuel Oil	121000	0	137	21	73	6	0	1086	206	427	38
Coal	26100	0	75	10	57	8	0	613	78	262	77
Wood	3300	0	38	1	0	4	0	306	6	1	53
LPG	6700	0	64	3	0	1	0	505	23	0	5
Subtotal	1321500	2659	2325	-4	403	7	21025	18216	10	2360	89
INDUSTRIAL											
Natural Gas	430700	1621	810	-61	-0	-6	4483	2241	-168	-1	-17
Electricity	367700	0	63 *	0	0	0	0	167 *	0	0	0
#2 Fuel Oil	103400	0	301	23	78	2	0	832	62	185	6
#6 Fuel Oil	142500	0	208	31	83	9	0	575	100	192	21
Coal	381400	0	160	46	88	4	0	444	129	187	11
Wood	161200	0	13	1	0	1	0	36	3	0	2
LPG	46500	0	36	3	0	0	0	101	8	0	1
Subtotal	1633400	1621	1591	43	249	10	4483	4396	133	563	24
ELECTRIC UTILITY											
Additional Generating Load from Electricity Replacing Gas											
Natural Gas	0	0	15	1	0	0	0	10786	1078	3	81
#2 Fuel Oil	0	0	22	3	2	0	0	3689	553	369	26
#6 Fuel Oil	0	0	2799	420	1120	42	0	0	0	0	0
Coal	0	0	488	147	269	7	0	5340	1602	1816	80
Electrical Imports	0	0	0	0	0	0	0	2265	0	0	0
Normal Load											
Natural Gas	193400	39675	29757	-877	-3	-74	52480	39360	0	0	0
#2 Fuel Oil	27800	0	7748	700	775	54	0	7811	709	781	55
#6 Fuel Oil	817200	0	8865	1330	4475	133	0	11083	1663	5661	166
Coal	1364000	0	838	251	461	13	0	1928	578	1052	29
Nuclear	1078700	0	0	0	0	0	0	0	0	0	0
Hydro	572200	0	0	0	0	0	0	0	0	0	0
Subtotal	4053300	39675	50532	1975	7098	175	52480	82263	6183	9682	437
COGENERATION											
Natural Gas	Included	17978	13483	-629	-1	-31	26216	19662	-918	-2	-46
#2 Fuel Oil	in Ind.	0	4611	945	940	83	0	6052	1241	1181	109
Residual Fuel Oil	& EU	0	0	0	0	0	0	0	0	0	0
Coal	sectors	0	0	0	0	0	0	730	219	331	11
Subtotal		17978	18094	316	939	52	26216	26444	542	1510	74
TOTAL MARKET											
Natural Gas	2023100	63521	44489	-1748	-6	-140	130011	76733	-2062	-12	-298
#2 Fuel Oil	1042600	0	14451	1788	2255	153	0	38594	3892	6552	360
Residual Fuel Oil	1080700	0	12009	1801	5750	190	0	12744	1968	6279	225
Nuclear	1078700	0	0	0	0	0	0	0	0	0	0
Hydro	572200	0	0	0	0	0	0	0	0	0	0
Coal	1797000	0	1619	464	908	37	0	9996	2773	3922	441
Wood	347200	0	193	2	1	14	0	2696	18	10	208
LPG	90600	0	134	7	0	1	0	1147	58	0	11
Electrical Imports	0	0	0	0	0	0	0	2265	0	0	0
Subtotal	8032100	63521	72896	2315	8908	255	130011	144175	6647	16751	948

* Replacement of gas by electricity will increase the primary fuel consumption used to generate electricity. Cells marked with * not included in primary fuel total.

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APPENDIX C

EROSION CONTROL, REVEGETATION, AND MAINTENANCE PLAN

APPENDIX C

EROSION CONTROL, REVEGETATION, AND MAINTENANCE PLAN

I. SUPERVISION AND INSPECTION

The following plan requires that some judgment be applied in the field and shall thus be implemented under the supervision of the Environmental Inspector or other qualified professional with knowledge of soil conditions and conservation plantings in the project area. Problems with contractor compliance shall be reported to the Environmental Inspector for remedial action. All uncultivated and non-wetland areas and residential turfs disturbed by construction shall be treated in accordance with this plan except for areas where landowners specify other seeding requirements. Deviations from this plan that involve less protective measures will only be permitted with the written approval of the Director, Office of Pipeline and Producer Regulation.

Inspectors shall have the direct responsibility to represent the applicant and to enforce these requirements. They shall have peer status with all other activity inspectors. A chief inspector shall be responsible for enforcing stop-work authority.

Duties of the environmental inspectors shall include monitoring and/or supervision of the following:

A. compliance with requirements of erosion and sedimentation control plans; Stream and Wetland Construction and Mitigation Procedures (appendix D); conditions of the FERC certificate; and other environmental permits and approvals;

B. marking of surface and subsurface drainage system locations identified by landowners and/or soil conservation authorities;

C. identification of stabilization needs in all areas;

D. performance of appropriate tests of subsoil and topsoil to determine the extent of compaction across the project right-of-way;

E. restoration of soil profile as requested or required;

F. approval of imported soils used as fill and/or additional cover material;

G. documentation of the temporary and permanent revegetation programs;

H. monitoring of crop productivity for not less than 2 years for purposes of additional restoration, in case of inadequate restorative practices, and preparation of weekly activity reports documenting problems and solutions;

I. documentation of all public and private roadway crossings/access points to insure safe and accessible conditions exist relative to pre-construction conditions.

Within 30 days of the in-service date for the facilities, a summary shall be filed with the Commission detailing the quantity and type of fertilizer for each pipeline segment; lime, seed, mulch, and equipment used to implement this plan; the acreage treated, and the dates of backfilling and seeding. The number of landowners specifying other seeding requirements and a description of the requirements shall be reported. In the event that the in-service date precedes the seeding season, the materials, equipment, and dates for future seeding shall be stated as well as the temporary stabilization measures utilized.

II. PRECONSTRUCTION PLANNING

A. Locate all drainage tiles prior to construction by contacting landowners and local soil conservation authorities.

B. Undertake an assessment of vegetation requirements for screening and landscaping of new compression and metering facilities. A report shall be submitted to FERC for review and approval prior to construction.

C. Locate all roadway crossings/access points to document and insure that safe and accessible conditions exist throughout the construction phase. Use of 50-foot-long crushed stone access pads, sweeping, culvert installation, matting and other forms of rutting protection shall be utilized depending on local permit conditions. If crushed stone access pads are used, place stone on a synthetic fabric in active agricultural areas.

III. CLEARING AND INSTALLATION

A. Prevent the mixing of topsoil with subsoil by using topsoil segregation construction methods in annually cultivated or rotated crop lands and in residential areas. In all actively cultivated agricultural lands, which includes permanent or rotated cropland and hayfields, full right-of-way topsoil stripping will be used with the construction right-of-way not to exceed 100 feet. The ditch and spoil side method of topsoil segregation shall be applied in all other improved and residential areas, and in other areas at the landowners request. The construction right-of-way for the ditch plus spoilside method shall be limited to 75-feet. For deep soils (such as floodplains and stream terraces), 12 inches of topsoil shall be segregated. Where soils are shallow to bedrock or have a stony subsoil, 8 inches of topsoil segregation is recommended. Remove stones greater than 4 inches in any shape or dimension from the segregated topsoils.

B. Probe all drainage systems with a sewer rod or pipe snake to determine if damage has occurred. All tiles damaged during construction shall be flagged by the trench inspector, then repaired to their original or better condition. Filter-covered drain tiles should only be used after consultation with the local soil conservation authorities. Qualified specialists shall be used to insure proper repairs and adequate probing/testing of the repaired drainage systems.

Detailed records of drainage system repairs should be kept and given to the landowner for future reference.

C. Contact landowners and local soil conservation authorities to determine future drain tile locations. Increase depth of cover over the pipeline to 4 feet or more, if needed, so the pipeline is below the anticipated depth of drain tile installations.

D. Construct and maintain temporary slope breakers at the following spacing:

Slope (%)	Spacing (ft)
5 - 15	300
16 - 30	200

Temporary slope breakers shall be repaired at the end of each working day.

E. Use temporary silt fences at the base of slopes adjacent to road crossings where vegetation has been disturbed within the following distances from the road:

Slope (%)	Vegetation Strip Required (ft)
< 5	25
5 - 15	50
15 - 30	75
> - 30	100

F. Use silt fences at the base of slopes at all stream crossings, as recommended in the Stream and Wetland Construction and Mitigation Procedures (appendix D).

G. Construct trench breakers so that the bottom of one breaker is at the same elevation as the top of the next breaker down slope. The use of topsoil in trench breakers shall be prohibited.

IV. CLEANUP

A. Final clean-up and permanent erosion control measures, as appropriate, shall be completed within 10 days after the trench is backfilled, weather and soil conditions permitting.

B. Blast rock shall not be used as backfill in rotated or permanent cropland. It may be used to backfill the trench to the top of the existing bedrock profile in hayfields and pastures. Excess loose rock generated by blasting shall be removed from at least the top 12 inches of topsoil in all rotated and permanent cropland and hayfields as well as residential areas, pastures, and other areas at the landowners' request.

C. Test for soil compaction across the project right-of-way in agricultural areas. Tests shall be done on the same soil type under the same moisture conditions and should include the following areas: soil from undisturbed areas, soil stockpile areas, the trenched zone, the work area, and any traffic areas related to the project. Devices such as COE-style cone penetrometers or other appropriate devices may be utilized to test for compaction.

D. Plow severely rutted areas with a paraplow (or similar "winged" plow) or arrange with the landowner to plant and plow under a "green manure" crop, such as alfalfa, to decrease soil bulk density and to improve soil structure. If plowing is employed, the stripped construction right-of-way will be plowed first followed by replacement of the segregated topsoil. Where necessary, additional plowing of the topsoil will be undertaken to prevent subsurface compaction. If subsequent construction and cleanup activities result in further compaction, additional tilling will be undertaken.

E. Remove construction debris from the right-of-way and grade it to leave the soil in the proper condition for planting, taking care to remove all construction debris and woody material. On slopes, divert concentrations of surface flow to a stabilized outlet using runoff diversions with a 2 percent outslope directed toward appropriate energy-dissipating devices.

F. Permanent slope breakers shall be constructed and maintained at the following spacing:

Slope (%)	Spacing (ft)
5 - 10	150
11 - 20	100
21 - 30	75
> 30	50

G. Restore all turf, ornamental shrubs, and other landscaping in accordance with the landowner's requests or compensate the landowner the amount equal to replacement of said landscaping. Such restoration work shall be performed by a landscaping contractor familiar with local horticultural and turf establishment practices.

H. Insure public and private roadway crossings/access points are restored to safe and acceptable conditions relative to pre-construction status.

V. REVEGETATION

A. GENERAL REQUIREMENTS

1. Apply finely ground agricultural or dolomitic limestone at a rate of 2 tons/acre. Lime temporarily seeded sites to a pH of 6.0 to insure optimum growing conditions with regard to pH.

2. Fertilize permanent grass and/or legume plantings with 300 lbs/acre of 10-20-20 fertilizer mix. If manure is also applied, reduce the addition of nitrogen by half for each 10 tons of manure applied. Where possible, incorporate lime and fertilizer into the top 2 inches of soil.

3. Prepare the seedbed to depth of 3 to 4 inches using appropriate equipment to provide a firm, smooth seedbed, free of debris. If hydroseeding is to be done, scarify the seedbed to ensure sites for seeds to lodge and germinate.

4. The project area should be seeded no earlier than May 1 and no later than October 15. Any soil disturbance that occurs between October 15 and May 1, or any bare soil left unstabilized by vegetation, should be treated as a winter construction problem and mulched. See section V (B) and (D) of this Plan. Except in lawns, all seeding of permanent cover shall be done between the aforementioned dates. If seeding cannot be done within the seeding dates, temporary erosion control shall be used and seeding of permanent cover shall be done at the beginning of the next seeding season.

5. Seed slopes steeper than 3:1 immediately after final grading, weather permitting, subject to the limitations addressed in section V (A.4).

6. Seed rights-of-way within 6 working days of final grading, weather permitting, subject to the limitations addressed in section V (A.4).

B. TEMPORARY EROSION CONTROL

1. In the event that construction is completed more than 30 days before the seeding season for perennial vegetation, all areas adjacent to perennial and intermittent streams shall be mulched with 3 tons/acre of hay or straw, or its equivalent, for a minimum of 100 feet on either side of the waterway. The mulch shall be anchored with a mulch anchoring tool, as discussed in section D.

2. Fertilize temporary plantings with 400 lbs/acre of 10-10-10 fertilizer mix. Where possible, incorporate lime and fertilizer into the top 2 inches of soil.

C. SEED SPECIFICATIONS

1. Purchase seed in accordance with the Pure Live Seed (PLS) specifications for seed mixes.

2. Use seed within 12 months of testing.

3. Treat legume seed with an inoculant specific to the species. For conventional seeding, use four times the manufacturer's recommended rate of inoculant, and 10 times the recommended rate if hydroseeding methods are being used.

4. Uniformly apply the seed over the area and cover it 0.5- to 1-inch deep, depending on seed size. A seed drill equipped with a cultipacker is preferred, but broadcast or hydroseeding can be used at double the seeding rates listed in the table below. Where broadcasted, firm the seedbed with a cultipacker or roller. Other alternative seed mixes specifically requested by the landowner or land-managing agency may be used.

Seeding Specifications and Adaptation

Species Mix	Pounds PLS Per Acre	Use and Adaptation
Northeast		
Tall Fescue	20	Well to Poorly Drained
Birdsfoot Trefoil	8	
Redtop	2	
Flat Pea	30	Excessively Drained
Tall Fescue	20	
Redtop	2	

D. MULCH SPECIFICATIONS

1. Mulch all dry sandy sites and all slopes greater than 8 percent with 2 tons/acre of straw or hay or its equivalent. Spread mulch uniformly over the area so that 75 percent of the ground surface is covered. If a mulch blower is used, the strands shall not be shredded less than 8 inches in length to allow anchoring.

2. Anchor mulch immediately after placing to minimize loss by wind and water. Use a mulch anchoring tool, which is a series of straight notched disks specifically designed for the purpose, to crimp the mulch to a depth of 2 to 3 inches. To maintain proper seed depth, a regular farm disc should not be used.

3. Mulch may be anchored using a liquid mulch binder. Cutback asphalt (rapid or medium curing), or emulsified asphalt applied at 200 gallons/acre may be used. A variety of synthetic binders are also available, which should be used at rates recommended by the manufacturer for mulch anchoring. Use caution in residential areas or areas of pedestrian traffic, because asphaltic and some synthetic binders can damage shoes, clothing, automobile paint, etc.

4. Use jute thatching or bonded fiber blankets (instead of straw or hay) on streambanks to stabilize seeded areas. Anchor the thatching with pegs or staples.

5. Up to 1 ton/acre of wood chips may be added as mulch if areas so mulched are top-dressed with 11 lbs/acre available nitrogen or a similar quantity of 50 percent slow-release fertilizer.

VI. OFF-ROAD VEHICLE CONTROL

For each owner and manager of forest lands, offer to install and maintain, based on state and local regulations, the following off-road vehicle control measures and install one or more of them, as requested, at the completion of clean-up and reseeding:

A. Install a locking, heavy steel gate with fencing extending a reasonable distance to prevent bypassing the gate, and post appropriate signs.

B. Plant conifers across the right-of-way. The spacing of trees and length of right-of-way planted should be sufficient to limit access and to screen the right-of-way from view.

C. Install a slash and timber barrier, a pipe barrier, or a line of boulders across the right-of-way to restrict vehicle access.

D. Post signs at all points of access and along the right-of-way at intervals not to exceed 2,000 feet, saying "This Area Seeded for Wildlife Benefits and Erosion Control."

VII. MAINTENANCE

A. Follow-up inspections shall occur after the first and second growing season, normally 3 to 6 months and 12 to 15 months after planting, respectively, to determine the success of revegetation. Revegetation shall be considered successful if perennial vegetation contacts 70 percent or more of each square yard of the right-of-way, based on representative random sampling in the field. If vegetative cover is less, the judgment of a professional agronomist shall be used to determine the need for fertilizing or reseeding based on site conditions, and those actions shall be undertaken at the beginning of the next growing season.

B. Right-of-way vegetation maintenance clearing shall not be done more frequently than every 3 years, and not before August 1 of any year.

C. Efforts to control off-road vehicle use, in cooperation with the landowner, shall continue throughout the life of the project. Signs, gates, and vehicle trails shall be maintained as necessary.

D. Monitor and correct drainage problems in active agricultural areas that have resulted from pipeline construction.

APPENDIX D

STREAM AND WETLAND
CONSTRUCTION AND MITIGATION PROCEDURES

APPENDIX D

STREAM AND WETLAND CONSTRUCTION AND MITIGATION PROCEDURES

I. PERENNIAL STREAM CROSSINGS

A. STAGING AREAS/ADDITIONAL RIGHT-OF-WAY (ROW)

1. Locate at least 50 feet away from streambank, where topographic conditions permit.

2. Limit size to minimum needed for prefabrication of pipe segment for stream crossing.

3. Do not store hazardous materials, chemicals, fuels, and lubricating oils; refuel construction equipment; or perform concrete coating activities, within 100 feet of streambanks or within any municipal watershed area.

B. SPOIL PILE PLACEMENT/CONTROL

1. Trench spoil shall be placed at least 10 feet away from streambanks at all minor and major stream crossings.

2. Spoil piles located above streambanks shall be protected with silt fence and/or haybales.

3. Prevent flow of spoil off of ROW.

C. TIME WINDOW FOR CONSTRUCTION

1. June 1 through September 30 unless expressly permitted or further restricted by appropriate state agency on a site-specific basis.

2. Notify authorities responsible for potable water supplies located within 3 miles downstream prior to FERC certification and at least 72 hours prior to commencement of instream work.

D. CROSSING PROCEDURES

1. Provide notification to the U.S. Army Corps of Engineers (COE) concerning the proposed construction activities, and submit to FERC staff a copy of the COE's determination regarding the need for individual Section 404 and/or Section 10 permits.

2. Comply with nationwide Section 404 permit Nos. 12 and 14 conditions (33 CFR §330) at a minimum.

3. Apply for state-issued stream crossing permits and obtain Section 401 water quality certification or waiver.

4. Crossings shall be constructed as perpendicular to axis of stream channel as engineering and routing conditions permit.

5. Utilize clean gravel for upper 1 foot of fill over backfilled trench in all minor and major streams, which contain coldwater fisheries.

6. Maintain downstream flow rates at all times.

7. Minor Streams ($\leq$ 10 feet wide and $\leq$ 2 feet average depth)

   a. For crossings of all coldwater and warmwater fisheries, construction equipment will cross the stream on a bridge consisting of one of the following:

      - equipment pads and culvert(s)
      - clean rockfill and culvert(s)
      - flexi-float or portable bridge

   b. For crossings of all coldwater fisheries, and warmwater fisheries considered significant by the state fish management agency, route stream across trench using flume pipe, and install pipeline using "dry-ditch" techniques as follows:

      - install flume after blasting, but prior to trenching
      - use sand bag/plastic dam structure
      - properly align flume pipe
      - do not remove flume during trenching or pipe-laying activities
      - dewater trench, as required, to prevent discharge of silt laden water into stream during construction and backfilling operations
      - remove all flumes and dams upon completion of construction

   c. For all other minor perennial stream crossings, complete instream construction within 24 hours.

8. Major Streams (> 10 feet wide or > 2 feet average depth, but $\leq$ 100 feet wide)

   a. Construction equipment crosses on bridge consisting of one of the following:

      - equipment pads and culvert(s)
      - clean rockfill and culvert(s)
      - flexi-float or portable bridge

b. In-stream equipment limited to that needed to construct crossing.

c. Notify state authorities at least 48 hours prior to commencement of in-stream trenching or blasting.

d. Attempt to complete in-stream trenching and backfill work (not including blasting) within 48 hours; maximum of 72 hours allowed.

9. Rivers (> 100 feet wide)

a. Submit site-specific construction procedures to FERC staff for review and approval prior to construction.

E. TEMPORARY EROSION AND SEDIMENT CONTROL

1. Perform daily inspection, and repair as needed.

2. Install and maintain sediment filter devices at all streambanks.

3. Use trench plugs at major stream and river crossings to prevent diversion of streamflow into upland portions of pipeline trench during construction.

F. BANK STABILIZATION AND REVEGETATION

1. All riprap activities must comply with nationwide Section 404 permit No. 13 conditions at a minimum.

2. Limit use of riprap to areas where flow conditions preempt vegetative stabilization, unless otherwise specifically required by state permit.

3. Restore topsoil to original horizon and revegetate with conservation grasses and legumes.

4. Allow 10-foot-wide riparian strip above streambank to permanently revegetate with native woody plant species across the entire ROW.

5. Maintain sediment filter devices at base of all slopes located adjacent to streams until ROW revegetation is complete.

6. Install permanent slope breakers at base of all slopes adjacent to streams.

G. TRENCH DEWATERING

1. Dewater into upland area in such a manner that no silt laden water flows into any perennial stream or river.

II. FEDERALLY DELINEATED WETLAND CROSSINGS a/

A. STAGING AREAS

1. Locate at least 50 feet away from wetland edge, where topographic conditions permit.

2. Limit size to minimum needed for prefabrication of pipe segment for wetland crossing.

3. Do not store hazardous materials, chemicals, fuels, and lubricating oils; refuel construction equipment; or perform concrete coating activities, within 100 feet of wetland boundary.

4. Do not construct aboveground facilities in any federally delineated wetland.

B. SPOIL PILE PLACEMENT/CONTROL

1. Utilize sediment filter devices to prevent flow of spoil off of ROW.

C. CROSSING PROCEDURES

1. Provide notification to the COE concerning the proposed construction activities, and submit to FERC staff a copy of the COE's determination regarding the need for individual Section 404 permits prior to construction.

2. Comply with nationwide Section 404 permit conditions (33 CFR §330) at a minimum.

3. Apply for state-issued wetland crossing permit and obtain Section 401 water quality certification or waiver.

4. Pipeline should be routed to avoid wetland areas to the maximum extent practicable. If wetland cannot be avoided, or crossed by following an existing ROW, route new pipeline in a manner that

a/ These procedures apply to any wetland which satisfies delineation requirements contained in the Federal Manual for Identifying and Delineating Wetlands Using the Unified Federal Method (Method). Applicant must delineate all wetlands using this Method prior to construction.

minimizes disturbance to wetland. Where looping an existing pipeline, locate loop line no more than 25 feet away from existing pipeline.

5. Minimize width of construction right-of-way to $\leq$ 75 feet.

6. Cut vegetation off only at ground level, leaving existing root systems intact, and remove from wetland for disposal.

7. Limit pulling of tree stumps and grading activities to directly over trench; do not remove stumps or root systems from non-trenched portions of the ROW in wetlands.

8. Segregate and replace the top 1 foot of topsoil from the area disturbed by trenching, except in areas with standing water or saturated soils.

9. Limit construction equipment operating in wetland to that needed to dig trench, install pipe, backfill trench, and restore ROW.

10. Do not use dirt, rockfill, tree stumps, or brush riprap to stabilize ROW.

11. Utilize wide-track or balloon-tire construction equipment, or operate normal equipment off of timber pads, prefabricated equipment pads, or geotextile fabric overlain with gravel fill, if standing water or saturated soils are present.

12. Do not cut trees located outside of ROW to obtain timber for equipment pads, and do not utilize more than two layers of timber or equipment pads to stabilize the ROW.

13. Remove all timber pads, prefabricated equipment pads, and geotextile fabric overlain with gravel fill upon completion of construction.

14. Assemble pipeline in upland area and utilize "push-pull" or "float" technique to place pipe in trench whenever water and other site conditions allow.

D. TEMPORARY EROSION AND SEDIMENT CONTROL

1. Perform daily inspection, and repair as needed.

2. Install and maintain sediment filter devices at edge of all wetlands until ROW revegetation is complete.

3. Install permanent slope breakers at base of all slopes adjacent to wetlands.

APPENDIX D (cont'd)

E. REVEGETATION TECHNIQUES

1. Do not use fertilizer or lime, unless required by appropriate state permitting agency.

2. Restore topsoil to original horizon and temporarily revegetate disturbed areas with annual ryegrass at a rate of 40 lbs per acre, unless standing water is present.

3. Ensure that all disturbed areas permanently revegetate with native herbaceous and woody plant species.

4. Develop specific procedures, in coordination with the appropriate state agency, to prevent the invasion or spread of undesirable exotic vegetation (e.g., purple loosestrife and phragmites).

F. TRENCH DEWATERING

1. Dewater in such a manner that no silt laden water flows into wetland areas off of construction ROW.

G. ROW MAINTENANCE PRACTICES

1. Mowing (and other vegetation maintenance practices) of the permanent ROW is prohibited, except for the selective cutting of trees that are located within 15 feet of the pipeline and are greater than 15 feet in height.

III. HYDROSTATIC TESTING

A. TIMING

1. Hydrotest pipeline section prior to installation under stream or wetland.

B. INTAKE SOURCE AND RATE

1. Screen intake hose to prevent entrainment of fish.

2. Do not utilize state designated exceptional value waters, or streams designated as public water supplies, unless appropriate state and/or local permitting agencies grant permission.

3. Notify state water quality and fishery management agencies of intent to use specific sources at least 48 hours prior to testing activities.

4. Adequate flow rates shall be maintained to protect aquatic life, provide for all in-stream uses, and provide for downstream withdrawals of water by existing users.

5. Apply for state-issued withdrawal permit, as required.

C. DISCHARGE LOCATION, METHOD, RATE

1. Regulate discharge rate and utilize energy dissipation device(s) in order to prevent erosion of upland areas, streambottom scour, suspension of sediments, or excessive stream flow.

2. Discharge test water from existing pipelines, using velocity dispersion device, into haybale/silt fence containment structure.

3. Obtain NPDES or state-issued discharge permit, as required.

4. Sample test water during discharge in accordance with any NPDES or state-issued discharge permit requirements; provide a copy of the results to FERC.

APPENDIX E

WATER BODIES TRAVERSED BY THE PROPOSED IROQUOIS AND TENNESSEE PIPELINES

APPENDIX E

WATER BODIES TRAVERSED BY THE PROPOSED IROQUOIS AND TENNESSEE PIPELINES

Applicant State/Segment	Milepost	Water Body	State Water Quality Classification a/	Fishery Type b/	Width of Crossing (ft)
IROQUOIS/NY	0.00	St. Lawrence	A	C1	3,100
	3.20	Sucker Brook	C	C1	20
	5.20	Little Sucker Brook	D		
	5.80	Little Sucker Brook	D		
	10.55	Brandy Brook	D	C1	10
	14.55	Line Creek	D		10
	15.55	Grass River	B		100-200
	18.10	Grass River	B	C1	150
	18.85	Unnamed stream into Upper and Lower Lakes State Wildlife Management Area	no class..		
	19.55	Unnamed stream into Upper and Lower Lakes State Wildlife Management Area	D		
	21.50	Church Brook	D		
	25.05	Harrison Creek	D	Wm	
	27.85	Elm Creek	C	Cd-S	
	30.10	Tanner Creek (T) c/	D		
	33.85	Brandy Brook	D		
	35.25	Tanner Creek (T)	ND		
	35.50	Tanner Creek (T)	ND		
	36.35	Tanner Creek (T)	ND		
	37.25	Unnamed	ND		
	37.35	Unnamed	ND		
	38.05	Unnamed	ND		
	38.25	Unnamed	ND		
	38.55	Unnamed	ND		
	38.60	Unnamed	ND		
	38.85	Unnamed	ND		
	39.45	Unnamed	ND		
	40.10	Unnamed	ND		
	40.25	Unnamed	ND		
	40.60	Oswegatchie River (T)	D		
	41.35	Oswegatchie River	C	C1	200
	42.80	Pork Creek	D		10
	43.00	Pork Creek (T)	D		
	43.40	Pork Creek (T)	D		
	43.95	West Branch Oswegatchie River (T)	D		
	44.75	West Branch Oswegatchie River (T)	D		2
	45.10	West Branch Oswegatchie River (T)	C(T)		2
	45.30	West Branch Oswegatchie River (T)	C(T)		
	45.65	West Branch Oswegatchie River (T)	C(T)		
	46.55	Bennett Brook	C(T)		5
	48.25	West Branch Oswegatchie River	C		100
	49.10	West Branch Oswegatchie River (T)	C(T)		3
	50.30	Black Creek (T)	C(T)		3
	50.90	Black Creek	C(T)		2
	51.25	Clear Creek	C(T,S)	Cd-T	5

APPENDIX E (cont'd)

Applicant State/Segment	Milepost	Water Body	State Water Quality Classification a/	Fishery Type b/	Width of Crossing (ft)
IROQUOIS/NY	51.80	West Branch Oswegatchie River (T)	C(T)		
(cont'd)	52.50	West Branch Oswegatchie River (T)	D		
	53.55	West Branch Oswegatchie River (T)	D		
	54.50	West Branch Oswegatchie River (T)	D		
	60.95	Hogsback Creek (T)	D		
	61.40	Hogsback Creek	C(T)		
	61.95	Blanchard Creek (T)	D		
	63.00	Blanchard Creek (T)	D		
	63.30	Blanchard Creek (T)	D		
	63.70	Blanchard Creek	C(T)		
	65.05	Indian River	C(T)	Cd-T	2
	66.05	Black Ash Swamp (T)	D		
	66.25	Black Ash Swamp (T)	D		
	66.60	Weatherhead Creek	C(T)		
	66.95	Indian River (T)	C(T)		
	68.75	Pine Creek	C(T)		3
	70.70	Alder Creek	D		
	71.20	Indian River (T)	D		
	71.60	Indian River (T)	C(T)		
	72.10	Indian River (T)	C(T)		
	74.50	Indian River (T)	D		
	75.65	Balsam Creek	C(T)		5
	76.80	Beaver River	C(T)	C1	200
	78.25	Murmur Creek (T)	C(T,S)		
	79.55	Murmur Creek	C(T)	Cd-T	15
	80.75	Black Creek	C(T)	Cd-S	9.5
	81.25	Black Creek (T)	C(T,S)		1
	82.10	Black Creek (T)	D		
	83.70	Crystal Creek (T)	D		
	84.40	Crystal Creek	C(T)	Cd-T	25
	84.70	South Branch Creek	C(T)		
	87.00	Harvey Creek	C(T)		3
	88.85	Black River (T)	C(T)		6
	89.80	Independence River (T)	C(T,S)		7
	91.05	Independence River	C(T)	Cd-S	54
	92.10	Otter Creek	C(T)	Cd-S,T	20-40
	93.95	Black River (T)	C(T)	Cd-S,T	6
	94.75	Black River	C	C1	180
	95.05	Douglass Creek	C(T)		10
	96.00	Black River (T)	C(T)		2-5
	97.00	Black River (T)	C(T)		2-5
	98.25	Mill Creek	C(T)		4
	99.05	Black River (T)	C(T)		2
	103.15	Black River (T)	C(T)		3
	106.45	Sugar River	C(T)	Cd-S,T	40
	108.35	Mill Creek	D	Cd-T	15-20
	108.70	Black River Canal	D		
	111.35	West Kent Creek	C(T)	Cd-T	13
	112.10	Kent Creek (T)	C(T)		

APPENDIX E (cont'd)

Applicant State/Segment	Milepost	Water Body	State Water Quality Classification a/	Fishery Type b/	Width of Crossing (ft)
IROQUOIS/NY (cont'd)	112.40	Kent Creek (T)	C(T)		
	113.05	East Kent Creek	C(T,S)	Cd-T	15
	114.85	Black River Canal Feeder (T)	C(T)		
	115.30	Alder Pond (T)	C(T)		12
	115.60	Alder Creek	C(T,S)	Cd-S	
	116.25	Kayuta Lake (Black River) (T)	D		
	116.30	Kayuta Lake (Black River) (T)	D		
	116.65	Kayuta Lake (Black River) (T)	D		
	117.60	Black River (T)	D		
	118.00	Black River (T)	D		
	118.40	Black River (T)	D		
	118.85	Black River (T)	D		4
	122.55	Frank Jones Brook	C(T)		20
	123.10	Cady Brook	D	Cd-T	5
	124.70	Cady Brook (T)	D		
	125.60	West Canada Creek	C(T)	Cd-S	45
	125.65	West Canada Creek (T)	C(T)		6
	127.10	West Canada Creek (T)	D		
	127.45	West Canada Creek (T)	C(T)		4
	129.35	Mill Creek	C(T)		5
	129.70	West Canada Creek (T)	C(T,S)		3
	130.35	West Canada Creek (T)	D		
	130.65	West Canada Creek (T)	D		
	131.20	West Canada Creek (T)	D		
	131.45	West Canada Creek (T)	D		
	131.65	West Canada Creek (T)	D		
	131.75	West Canada Creek (T)	D		
	132.10	West Canada Creek (T)	D		
	132.55	West Canada Creek (T)	C		
	132.75	Cold Brook	C(T)		
	133.05	Cold Brook (T)	C(T)		
	133.25	Cold Brook (T)	C		
	133.35	Cold Brook (T)	C		
	135.60	Hurricane Brook (T)	no class.		
	136.20	Hurricane Brook	C(T,S)	Cd-S	
	136.55	Hurricane Brook (T)	C(T,S)	Cd-S	
	136.80	Factory Brook (T)	C(T,S)	Cd-T	
	137.10	Factory Brook (T)	D		
	137.60	Factory Brook	C(T,S)	Cd-T	5
	138.15	Big Bill Brook (T)	C(T)	Cd	4
	138.50	Big Bill Brook (T)	C(T)	Cd	6
	139.05	Big Bill Brook	C(T,S)	Cd-T	12
	139.10	Big Bill Brook	C(T,S)	Cd-T	10
	139.15	Big Bill Brook	C(T,S)	Cd-T	12
	140.10	Wolf Hollow Creek	C(T,S)	Cd-T	1
	143.70	Beaver Creek (T)	AA(T)	Cd	
	144.05	Beaver Creek (T)	AA		
	144.45	Ransom Creek (T)	D		
	145.05	Ransom Creek (T)	D		

APPENDIX E (cont'd)

Applicant State/Segment	Milepost	Water Body	State Water Quality Classification a/	Fishery Type b/	Width of Crossing (ft)
IROQUOIS/NY	145.60	Ransom Creek	C(T)	Cd	12
(cont'd)	146.25	Ransom Creek (T)	D		
	146.70	Ransom Creek (T)	D		
	148.25	Crum Creek (T)	no class.		
	150.15	Crum Creek	C(T)	Cd	7
	150.35	Crum Creek (T)	D		
	151.45	Crum Creek (T)	D		
	151.60	Mohawk River (T)	D		
	151.95	Mohawk River (T)	C		
	154.20	Mohawk River	C	C1/Wm	390
	154.45	Mohawk River (T)	D		
	154.50	Mohawk River (T)	D		
	154.70	Mohawk River (T)	D		
	154.85	Mohawk River (T)	D		
	155.65	Nowadaga Creek	C		40
	157.70	Nowadaga Creek (T)	D		
	158.35	Otsquago Creek (T)	D		
	159.20	Otsquago Creek (T)	D		
	161.30	Otsquago Creek	C(T)	Cd-S	
	162.35	Otsquago Creek (T)	D		
	162.80	Otsquago Creek (T)	D		
	163.35	Otsquago Creek (T)	D		
	164.00	Otsquago Creek (T)	D		
	165.35	Otsquago Creek (T)	D		
	166.00	Otsquago Creek (T)	D		
	166.60	Otsquago Creek (T)	D		
	169.75	Canajoharie Creek (T)	D		
	170.50	Canajoharie Creek (T)	D		
	170.80	Canajoharie Creek	C	Cd-S	
	175.60	Flat Creek	D		
	177.80	Flat Creek (T)	D		
	178.35	Flat Creek (T)	D		
	178.90	Flat Creek (T)	D		
	180.55	Flat Creek (T)	D		
	180.85	Flat Creek (T)	D		
	181.21	Fly Creek (Swamp) (T)	N/A		
	182.00	Fly Creek (Swamp (T)	N/A		
	182.50	Fly Creek (T)	D		
	182.80	Fly Creek (T)	D		
	183.55	Fly Creek (T)	D		
	185.95	Fly Creek (T)	D		
	186.15	Fly Creek (T)	D		
	187.50	Schoharie Creek	C	C1	
	190.80	Schoharie Creek (T)	D		
	192.25	Louse Kill	D		
	193.75	King Creek (T)	C(T)	Cd	
	194.25	King Creek (T)	D		
	195.70	Fox Creek (T)	D		
	195.95	Fox Creek (T)	D		

Applicant State/Segment	Milepost	Water Body	State Water Quality Classification a/	Fishery Type b/	Width of Crossing (ft)
IROQUOIS/NY	196.50	Fox Creek (T)	D		
(cont'd)	198.10	Fox Creek (T)	D		
	198.35	Fox Creek (T)	D		
	199.30	Fox Creek	C	Wm	
	200.30	Switz Kill (T)	D		
	200.70	Switz Kill (T)	D		
	201.35	Switz Kill (T)	D		
	201.90	Switz Kill (T)	D		
	202.00	Switz Kill (T)	D		
	202.65	Switz Kill (T)	D		
	202.70	Switz Kill (T)	D		
	203.45	Switz Kill (T)	D		
	203.95	Switz Kill	D	Cd	
	205.10	Switz Kill (T)	D		
	205.15	Switz Kill (T)	D		
	205.35	Switz Kill (T)	D		
	206.60	Eightmile Creek	C	Cd/Cl	5
	207.55	Basic Creek (T)	D		
	208.05	Basic Creek (T)	D		
	209.15	Basic Creek (T)	D		
	212.65	Wolf Fly Creek (T)	D		
	213.15	Basic Creek	C(T)	Cd-S	6-12
	213.60	Basic Creek (T)	D		
	214.10	Basic Creek (T)	D		
	214.70	Cob Creek (T)	D		
	215.25	Cob Creek (T)	D		
	215.55	Cob Creek (T)	D		15
	216.80	Cob Creek	D		
	216.95	Cob Creek (T)	D		
	217.30	Cob Creek (T)	D		
	217.65	Cob Creek (T)	D		
	218.25	Cob Creek (T)	D		
	224.40	Potic Creek	B(T)	Cd-S	15
	227.85	Hans Vosen Kill	D		1-3
	228.10	Hans Vosen Kill (T)	D		
	228.25	Hans Vosen Kill (T)	D		
	228.95	Murderers Creek (T)	no class.		
	231.60	Hudson River (T)	D		3
	231.90	Hudson River	A	Cl/Wm	2,500
	233.10	Hudson River (T)	D		25
	235.20	Hudson River (T)	D		
	235.80	Hudson River (T)	D		
	237.65	Klein Kill (T)	D		
	239.70	Mud Creek (T)	D		
	241.70	Klein Kill (T)	D		5-20
	243.00	Roeliff Jansen Kill (T)	C(T)	Cd	
	243.85	Roeliff Jansen Kill (T)	D		
	245.00	Roeliff Jansen Kill	--	Cd	30
	250.30	Roeliff Jansen Kill (T)	D		

APPENDIX E (cont'd)

Applicant State/Segment	Milepost	Water Body	State Water Quality Classification a/	Fishery Type b/	Width of Crossing (ft)
IROQUOIS/NY	252.00	Saw Kill (T)	C		
(cont'd)	252.45	Saw Kill (T)	C		
	253.60	Saw Kill (T)	C		
	255.40	Little Wappinger Creek (T)	D		
	255.50	Little Wappinger Creek (T)	D		
	257.95	Little Wappinger Creek	D	Cd	
	259.20	Little Wappinger Creek (T)	D		
	259.85	Little Wappinger Creek (T)	D		
	260.50	Little Wappinger Creek	no class.		
	261.80	Little Wappinger Creek (T)	--		
	262.45	Little Wappinger Creek (T)	B		
	262.50	Little Wappinger Creek (T)	B		
	265.25	Wappinger Creek (T)	B		
	265.45	Wappinger Creek	B(T)	Cd-S/Wm	40-60
	266.25	Wappinger Creek	B(T)	Cd-S/Wm	40-60
	266.40	Wappinger Creek	B(T)	Cd-S/Wm	40-60
	266.85	Wappinger Creek (T)	--		
	268.35	Wappinger Creek (T)	B		
	269.75	Wappinger Creek (T)	B		
	269.95	Wappinger Creek (T)	B		
	270.10	Wappinger Creek (T)	B		
	270.35	Wappinger Creek (T)	B		
	271.30	Sprout Creek (T)	C		
	272.20	Sprout Creek (T)	C(T)	Cd	1.3
	272.55	Sprout Creek	C(T)	Cd	1.3
	276.10	Clove Brook (T)	D	Cd	6
	277.05	Seeley Creek (T)	C		
	278.10	Seeley Creek (T)	C		
	279.90	Coppertown Brook	C(T)	Cd	1-10
	281.40	Swamp River (T)	C		
	281.70	Swamp River	C	C1/Wm	12-30
	284.20	Tenmile River	C(T)	Cd/C1	50
	284.75	Tenmile River (T)	C		84
	285.25	Tenmile River	C(T)	Cd/C1	50
	286.25	Deull Hollow Brook	C	Cd	4-12
IROQUOIS/CT	287.80	Wimisink Brook	A	Cd	
	288.90	Morrissey Brook (T)	A		
	289.15	Morrissey Brook	A	Cd-S	
	289.85	Morrissey Brook (T)	A		
	291.70	Bullymuck Brook	A	Cd	
	292.85	Rocky River	C/B		
	297.0	Still River (T)	C/B		
	297.50	Still River	C/B		30
	304.85	Unnamed marsh (T)	A		
	305.10	Unnamed marsh (T)	A		
	306.10	Unnamed marsh (T)	A		
	306.45	Pond Brook	A	Cd-S	
	308.75	Cavanaugh Pond (T)	A		

APPENDIX E (cont'd)

Applicant State/Segment	Milepost	Water Body	State Water Quality Classification a/	Fishery Type b/	Width of Crossing (ft)
IROQUOIS/CT (cont'd)	311.20	Pootatuck River	B/C	Cd-S	
	312.55	Pole Bridge Brook	A		
	312.70	Pole Bridge Brook	A		
	313.45	Housatonic River (T)	A		
	314.00	Housatonic River (T)	A		
	314.15	Housatonic River (T)	A		
	314.95	Housatonic River (T)	A		
	316.95	Halfway River	B/A		15
	318.40	Boys Halfway River	A		25
	318.85	Hurds Brook	A		
	319.35	Means Brook (T)	AA		
	319.40	Means Brook (T)	AA		
	•320.15	Means Brook (T)	AA		
	320.80	Means Brook (T)	AA		
	321.25	Means Brook (T)	AA		
	321.70	Means Brook (T)	AA		
	323.75	Shelton Reservoir (T)	AA		
	324.15	Shelton Reservoir (T)	AA		
	324.25	Shelton Reservoir (T)	AA		
	326.30	Farmill River (T)	A		
	326.65	Farmill River (T)	A		
	326.90	Farmill River (T)	A		
	327.20	Farmill River	Sc/SB	Cd-S	20
	329.25	Cemetery Pond Brook	A		
	329.50	Cemetery Pond Brook	A		
	329.60	Pumpkin Ground Brook	--		
	329.70	Pumpkin Ground Brook	--		
	329.80	Pumpkin Ground Brook	--		
	329.85	Pumpkin Ground Brook	--		
	330.40	Pecks Mill Pond (T)	A		
	330.85	Housatonic River	Sc/SB	Est	745
	332.60	Beaver Brook	A		
	334.15	Long Island Sound	SA	Est/M	26.3 mi.
	361.25	Crab Meadow Brook (T)	C		
	362.41	Crab Meadow Brook (T)	C		
TENNESSEE					
Schoharie/Albany Loop/ NY	249-2A + 0.54	Louise Kill	D		
	249-2A + 1.98	King Creek	C (TS)	Cd-T	
	249-2A + 2.44	King Creek	D		
	249-2A + 4.37	Fox Creek (T)	D		
	249-2A + 4.90	Fox Creek (T)	D		
	249-2A + 7.00	Beaverdam Creek (T)	D		
	249-2A + 7.42	Beaverdam Creek	C	Cd	
	249-2A + 7.69	Beaverdam Creek (T)	D		
	249-2A + 7.80	Beaverdam Creek (T)	D		
	249-2A + 8.48	Beaverdam Creek (T)	D		
	250-2 + 0.55	Fox Creek (T)	C (T)	Cd-S	

APPENDIX E (cont'd).

Applicant State/Segment	Milepost	Water Body	State Water Quality Classification a/	Fishery Type b/	Width of Crossing (ft)
TENNESSEE	250-2 + 1.35	Unnamed Pond	D		100
Schoharie/Albany Loop	250-2 + 1.98	Fox Creek (T)	D		20
NY (cont'd)	250-2 + 2.24	Fox Creek (T)	D		
	250-2 + 2.66	Fox Creek (T)	D		
	250-2 + 3.19	Fox Creek (T)	D		
	250-2 + 3.69	Unnamed Creek	D		
	250-2 + 4.94	Unnamed Creek	D		
	250-2 + 5.33	Onesquethaw Creek	D		
	250-2 + 6.00	Onesquethaw Creek (T)	D		
	250-2 + 6.12	Onesquethaw Creek (T)	D		
Columbia/Berkshire Loop	254 + 1.61	Green Brook	C (TS)	Cd-T	20
NY	254 + 3.41	Cotter Brook	D		
	254 + 7.50	Stony Kill (T)	D		
	254 + 7.93	Stony Kill (T)	D		
	255 + 2.10	Unnamed Creek	B	Cd	
	255 + 2.25	Unnamed Creek	B	Cd	
	255 + 3.34	Sleepy Hollow Brook	B	Cd	
	255 + 3.42	Fairfield Brook	B	Cd	
	256 + 1.59	Cone Brook (T)	B	Cd	
	256 + 2.29	Lenox Mountain Brook	B	Cd	
	256 + 4.84	Larrywaug Brook (Lake)	B	Cd	75
	256 + 6.60	Marsh Brook	B		
	256 + 7.42	Kampoosa Brook (T)	B		
Worcester Loop/MA	265 + 2.30	Casey Brook	B		
	265 + 7.08	Blackstone Canal	B		
	265 + 7.11	Blackstone River	B	Wm	70
	266 + 1.03	West River	B	Cd-S	150
	266 + 1.58	Warren Brook (T)	B	Cd	
	266 + 1.84	Warren Brook	B	Cd	
	266 + 3.16	Pratt Pond (T)	B	Cd	
Concord Lateral/NH	270B-105 + 10.65	Suncook River	B	Cd-S	250
	270B-105 + 12.90	Meetinghouse Brook	B		
	270B-105 + 14.36	Soucook River (T)	B	Cd-S	
	270B-105 + 14.92	Soucook River	B	Cd-S	50
Haverhill Lateral/MA	270B-302 + 0.12	Hawkes Brook	B	Cd	
	270B-302 + 0.31	Hawkes Brook	B	Cd	
	270B-302 + 0.95	Hawkes Brook (T)	B	Cd	
	270B-302 + 2.39	West Meadow Brook	B	Cd	
	270B-302 + 2.49	West Meadow Brook (T)	B	Cd	
	270B-302 + 3.12	Creek Brook	B	Cd	
	270B-302 + 4.17	Fishin Brook	A	Cd	
	270B-302 + 4.53	Fishin Brook	A	Cd	
	270B-302 + 4.88	Little River	B	Cd-S	

APPENDIX E (cont'd)

Applicant State/Segment	Milepost	Water Body	State Water Quality Classification a/	Fishery Type b/	Width of Crossing (ft)
Wallingford Lateral/ CT	345A - 201 + 0.32	Willow Brook	AA	Cd	
	345A - 201 + 1.56	Mill River	B/AA	Cd-S	
Lincoln Extension/RI	265E - 103 + 2.48	Woonasquatucket River (T)	B	Wm	
	265E - 103 + 3.44	Harris Brook (T)	B	Cd-S	

a/ See table 4.1.3-3 for a summary of state surface water classifications.

b/ Fishery types:

- Cd - Cold water
- S - Stocked
- T - Trout spawning
- Cl - Cool water
- Wm - Warm water
- Est - Estuarine
- M - Marine

c/ (T) following stream name indicates tributary

Source: Iroquois Resource Reports
Tennessee Resource Reports
NYDEC (Schiavone 1989, Elliot 1989)
CTDEP (Moulton 1989)

APPENDIX F

LIST OF PREPARERS

APPENDIX F

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APPENDIX G

EIS DISTRIBUTION LIST

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FEDERAL GOVERNMENT AGENCIES

Advisory Council on Historic Preservation
Center for Disease Control
Council on Environmental Quality
Department of Agriculture
Department of the Air Force
Department of Commerce
Department of Defense
Department of Energy
Department of Housing and Urban Development
Deparment of Health and Human Services
Department of the Interior
Department of Justice
Department of Labor
Department of State
Department of Transportation
Department of the Treasury
Environmental Protection Agency
Farm Credit Administration
Federal Aviation Administration
Federal Energy Regulatory Commission
Federal Highway Administration
Interstate Commerce Commission
National Marine Fisheries Service
Office of Finance and Management
Office of Program Analysis and Evaluation
Office of Program Initiatives
The White House
U.S. Soil Conservation Service
U.S. Army Corps of Engineers
U.S. Forest Service
U.S. Fish and Wildlife Service

CONGRESSIONAL REPRESENTATIVES

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Senator Bill Bradley (NJ)
Senator John Chafee (RI)
Representative William Clinger, Jr. (PA)
Representative Silvio O. Conte (MA)
Representative Jim Courter (NJ)
Senator Alfonse D'Amato (NY)
Senator Christopher Dodd (CT)

Congressional Reps (cont'd)

Representative Charles Douglas (NH)
Representative Thomas Downey (NY)
Representative Jim Florio (NJ)
Representative Dean Gallo (NJ)
Senator John Heinz (PA)
Representative Frank Horton (NY)
Senator Gordon Humphrey (NH)
Representative Nancy Johnson (CT)
Senator Edward Kennedy (MA)
Senator John Kerry (MA)
Senator Frank Lautenberg (NJ)
Senator Joseph Lieberman (CT)
Representative David O.B. Martin (NY)
Representative Nicholas Mavroules (MA)
Representative Bruce A. Morrison (CT)
Senator Daniel P. Moynihan (NY)
Represenative Robert Mrazek (NY)
Representative Richard Neal (MA)
Senator Claiborne Pell (RI)
Representative Thomas Ridge (PA)
Representative Marge Roukema (NJ)
Representative John G. Rowland (CT)
Senator Warren B. Rudman (NH)
Representative Christopher Shay (CT)
Representative Robert Smith (NH)
Representative Gerald B. H. Solomon (NY)
Senator Arlen Specter (PA)
Representative Gerry Studds (MA)

STATE GOVERNMENT AGENCIES

Connecticut	Governor William A. O'Neill
	Council on Environmental Quality
	Department of Agriculture
	Department of Environmental Protection
	Department of Public Utilities Control
	Facility Siting Council
	Historical Commission
	Office of Attorney General
	Office of Legislative Research
	Office of Policy and Management

State Gov't Agencies (cont'd)

Massachusetts	Governor Michael Dukakis Department of Environmental Management Department of Environmental Quality Engineering Department of Fisheries, Wildlife and the Environment Department of Public Health Department of Public Utilities Energy Facility Siting Council Executive Office of Communities and Development Executive Office of Environmental Affairs Historical Commission Massachusetts Water Resources Authority
New Hampshire	Governor Judd Gregg Council on Resources and Development Department of Agriculture Department of Environmental Services Department of Resources and Economic Development Department of Transportation Division of Historic Resources Energy Facility Siting Committee Fish and Game Department Public Utilities Commission Public Service Commission Water Resources Board
New Jersey	Governor James Florio Board of Public Utilities Department of Agriculture Department of Community Affairs Department of Environmental Protection Division of Local Government Services Endangered Non-game Species Program Green Acres and Recreation Program Natural Heritage Program Water Supply Authority
New York	Governor Mario Cuomo Adirondack Park Agency Department of Agriculture and Markets Department of Environmental Conservation Department of Health Department of Natural Resources Department of Public Service Environmental Protection Bureau

APPENDIX G (cont'd)

State Gov't Agencies (cont'd)

NY (cont'd)	Geological Survey (State Geologist) Office of Energy and Environmental Planning Office of Parks, Recreation & Historic Preservation Office of the Secretary of State Public Service Commission Soil Conservation Service State Clearinghouse, Division of Budget State Energy Office State Fish & Wildlife Management Board St. Lawrence-Ontario Commission
Pennsylvania	Governor Robert Casey Bureau of Air Quality Control Bureau of Historic Preservation Bureau of Water Quality Management Department of Agriculture Department of Environmental Resources Energy Office Fish Commission Game Commission Historical Preservation Commission Intergovernmental Council Office of Environmental Management Office of Policy and Planning Pennsylvania State Grange Public Utility Commission State Conservation Commission
Rhode Island	Governor Edward DiPrete Department of Environmental Management Department of Transportation Energy Facility Siting Board Historical Preservation Commission Public Utilities Commission State Historic Resources Commission Statewide Planning Program Water Resources Board

COUNTY GOVERNMENT AGENCIES

Massachusetts	Berkshire Essex Franklin Hamden Hampshire Worcester
New Hampshire	Merrimack
New Jersey	Sussex
New York	Albany Columbia Dutchess Greene Herkimer Lewis Montgomery Oneida Onondaga Ontario Otsego Rensselaer St. Lawrence Schenectady Schoharie Seneca
Pennsylvania	Forest Mercer
Rhode Island	Providence

LOCAL GOVERNMENT AGENCIES

Connecticut	Bridgewater Brookfield Cheshire Fairfield Hamden Milford Monroe New Milford

Local Gov't Agencies (cont'd)

CT (cont'd)	Newtown
	North Haven
	Shelton
	Sherman
	Stratford
	Wallingford
Massachusetts	Agawam
	Ashfield
	Auburn
	Belchertown
	Blackstone
	Cheshire
	Conway
	Dalton
	Deerfield
	East Brookfield
	Grafton
	Hancock
	Haverhill
	Hinsdale
	Hopedale
	Lanesborough
	Lee
	Leicester
	Leverett
	Mendon
	Methuen
	Millbury
	Millville
	North Brookfield
	Northbridge
	Pelham
	Plainfield
	Richmond
	Shutesbury
	South Deerfield
	Spencer
	Stockbridge
	Sunderland
	Sutton
	Tyringham
	Upton
	Uxbridge

Local Gov't Agencies (cont'd)

MA (cont'd)	Ware West Brookfield Windsor Whitinsville
New Hampshire	Allenstown Concord Pembroke Suncook
New Jersey	Sussex Wantage
New York	Athens Berne Bethlehem Booneville Canaan Canajoharie Canton Carlisle Charleston Chatham Clinton Columbia Coxsackie Croghan Clermont Danube Dekalb Diana Dolgeville Dover Duanesberg East Greenbush Edwards Esperance Fairfield Florida Glen Greenport Greenville Grieg Guilderland

Local Gov't Agencies (cont'd)

NY (cont'd)

Hermon
Hopewell
Huntington
Knox
Lafayette
La Grange
Leyden
Lisbon
Little Falls
Livingston
Lyonsdale
Manheim
Mendon
Milan
Nassau
New Baltimore
New Bremen
New Lebanon
Newport
New Scotland
North Greenbush
Norway
Phelps
Pitcairn
Pleasant Valley
Pompey
Princeton
Remsen
Richfield
Root
Rotterdam
Russia
Salisbury
Sand Lake
Schoharie
Seneca Falls
Smithtown
Stephentown
Steuben
Turin
Union Vale
Waddington
Waterloo
Watson

Local Gov't Agencies (cont'd)

NY (cont'd)	West Turin West Winfield Westerlo Winfield Wright
Pennsylvania	Cool Spring Howe Jackson Jefferson Jenks Kingsley Worth
Rhode Island	Lincoln Smithfield

LIBRARIES

Connecticut	Bristol Public Library, Bristol Brookfield Library, Brookfield Burham Library, Bridgewater Cheshire Library, Cheshire Cromwell Beldon Library, Cromwell Douglas Library, Hebron Hamden Library, Hamden Milford Public Library, Milford Monroe Public Library, Monroe Newtown Library, Newtown North Haven Library, North Haven Oliver Wolcott Library, Litchfield Oxford Public Library, Oxford Plum Memorial Library, Shelton Sherman Library, Sherman Stratford Library Assoc., Stratford Wallingford Public Library, Wallingford Wells-Turner Library, Glastonbury
Massachusetts	Agawam Public Library, Agawam Auburn Free Public Library, Auburn Bancroft Memorial Library, Hopedale Belding Memorial Library, Ashfield Blackstone Public Library, Blackstone

Libraries (cont'd)

MA (cont'd)	Brockton Public Library, Brockton Cheshire Public Library, Cheshire Clapp Memorial Library, Belchertown Dalton Public Library, Dalton Fall River Public Library, Fall River Field Memorial Library, Conway Grave Memorial Library, Sunderland Grafton Center Library, Grafton Haverhill Public LIbrary, Haverhill Lancaster Public Library, Lancaster Lanesborough Public Library, Lanesborough Lee Library Association, Lee Leicester Public Library, Leicester Lorna Rivers Library, Leverett Medway Public Library, Medway Merriam-Gilbert Library, West Brookfield Millbury Public Library, Millbury Millville Free Public Library, Millville Nevins Memorial Library, Methuen North Brookfield Library, North Brookfield Pelham Public Library, Pelham Pepperell Public Library, Pepperell Richard Susden Library, Spencer Richmond Free Public Library, Richmond Shutesbury Library, Shutesbury Stockbridge Library Association, Stockbridge Sutton Center Library, Sutton Taft Public Library, Mendon Taylor Library, Hancock Tilton Library, South Deerfield Tyringham Library, Tyringham Upton Town Library, Upton Uxbridge Public Library, Uxbridge Whitinsville Social Library, Whitinsville Windsor Public Library, Windsor Young Men's Library Association, Ashfield
New Hampshire	Concord Public Library, Concord Pembroke Public Library, Suncook
New Jersey	Sussex County Library, Newton
New York	Adrience Library, Poughkeepsie Barneveld Public Library, Barneveld

Libraries (cont'd)

NY (cont'd)

Beavers Falls Library, Beavers Falls
Berne Free Library, Berne
Bethlehem Public Library, Delmar
Canaan Public Library, Canaan
Canajoharie Library, Canajoharie
Canton Free Library, Canton
Chatham Public Library, Chatham
Clifton Springs Public Library, Clifton Springs
Clinton Literary Assoc., Clinton Corners
Cobleskill Public Library, Cobleskill
Croghan Free Library, Croghan
D. R. Evarts Library, Athens
Didymus Thomas Library, Remsen
Dolgeville/Manheim Public Library, Dolgeville
Dover Plains Library, Dover Plains
East Greenbush Public Library, Rensselaer
Erwin Library, Booneville
Floyd Memorial Library, Greenport
Fonda Library, Fonda
Fort Hunter Free Library, Fort Hunter
Frothingham Library, Fonda
Greenville Public Library, Greenville
Guilderland Free Library, Albany
Harrisville Free Library, Harrisville
Heermance Library, Coxsackie
Hepburn Library, Edwards
Hepburn Library, Hermon
Hepburn Library, Lisbon
Hepburn Library, Waddington
Huntington Library, Huntington
Joseph Hooper Library, New Lebanon
Kirby Library, Salisbury
Lafayette Public Library, Lafayette
LaGrange Library, Poughkeepsie
Livingston Free Library, Livingston
Lowville Free Library, Lowville
Manlius Library, Manlius
Mid York Library, Utica NY
Mynderse Library, Seneca Falls
Nassau Library, Nassau
Newport Free Library, Newport
North Greenbush Public Library, Wynantskill
Phelps Community Library, Phelps
Pleasant Valley Free Library, Pleasant Valley

Libraries (cont'd)

NY (cont'd)	Port Leyden Community Library, Port Leyden Red Hook Public Library, Red Hook Richfield Springs Village Library, Richfield Springs Sand Lake Public Library, West Sand Lake Schenectady County Public Library, Schenectady Smithtown Library, Commack Smithtown Library, Smithtown Stephentown Memorial Library, Stephentown Turin Library, Turin Voorheesville Library, Voorheesville Waterloo Library, Waterloo Wellar Library, Mohawk West Turin Library, Constableville West Winfield Library, West Winfield Wingate Library, Rotterdam Wood Library, Canandaigua
Pennsylvania	Greenville Public Library, Greenville Marienville Public Library, Marienville Tionesta Public Library, Tionesta
Rhode Island	East Smithfield Public Library, Smithfield Greenville Public Library, Smithfield Lincoln Library, Lincoln Lydia Essex Public Library, Tiverton Providence Public Library, Providence

MEDIA

Connecticut	Bridgeport Post, Bridgeport Bristol Press, Bristol Brookfield Journal, New Milford Cheshire Herald, Cheshire Citizen, Milford Danbury News Times, Danbury, Ct Fairfield County Advocate, Fairfield Hamden Chronicle, Hamden Litchfield County Times, New Milford New Haven Register, New Haven New Milford Times, New Milford Newtown Bee, Newtown Suburban News, Shelton The Advisor, North Haven

Media (cont'd)

CT (cont'd)	The Hartford Courant, Hartford Washington Eagle, New Milford Waterbuty Republican, Waterbury
Massachusetts	Agawam Advertiser News, Agawam Amherst Bulletin, Amherst Belchertown Centinel, Belchertown Berkshire Eagle, Pittsfield Blackstone Valley News Tribune, Whitinsville Daily Hampshire Gazette, Northampton Grafton News, North Grafton Haverhill Gazette, Haverhill Holyoke Transcript, Holyoke Lawrence Eagle Tribune, North Andover Milford Daily News, Milford Millbury Journal, Millbury Millbury & Sutton Journal, Millbury New Leader, Spencer North Adams Transcript, North Adams Springfield, Union, Springfield Telegram & Gazette, Worcester The Ware River News, Ware West County News, Shelbourne Falls
New Hampshire	Concord Monitor, Concord Manchester Union Leader, Concord
New Jersey	New Jersey Herald, Newton
New York	Adirondack Echo, Old Forge Altamont Enterprise, Altamont Booneville Herald, Booneville Catskill Daily Mail, Catskill Chatham Courier, Chatham Courier, Monroe Daily Freeman, Rhinebeck Daily Messenger, Canandaigua Daily Star, Oneida Echo, Canon Finger Lakes Times, Geneva Gazette, Schenectady Greenbush Area News, East Greenbush Greene County News, West Coxsackie Harlem Valley Times, Amenia

Media (cont'd)

NY (cont'd)	Herkimer Telegram, Herkimer Hudson Register Star, Hudson Independent, Hillsdale Journal Republican, Lowville Knickerbocker News, Albany Little Falls Evening Times, Little Falls Long Island Monthly, Freeport Mohawk Valley Democrat Weekly, Fonda Mountain Eagle, Middleburgh New York Times, New York Observer-Dispatch Press, Utica Park Newspapers, Ogdensberg Pine Plains Register Herald, Millbrook Schenectady Gazette, Amsterdam Smithtown News, Smithtown Southern Dutchess News, Wappingers Falls St. Lawrence Plaindealer, Canton The Long Islander, Huntington The Penny Wise, Tully The Recorder, Amsterdam The Reveille Publishing Co., Inc., Seneca Falls The Spotlight, Delmar The Syracuse Post Standard, Syracuse The Times Record, Troy Times Journal, Cobleskill Times-Union, Albany Watertown Daily Times, Lowville West Winfield Star, West Winfield
Pennsylvania	Forest Press, Tionesta Greenville Record-Argus, Greenville Oil City Derrick, Oil City Sharon Herald, Sharon
	Observer Publications, Greenville Evening Times, Pawtucket Woonsocket Call, Woonsocket

ORGANIZATIONS AND INDIVIDUALS

In addition to the above distribution list, private organizations and interested individuals have requested and received a copy of this EIS.

APPENDIX H

REFERENCES AND CONTACTS

APPENDIX H

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APPENDIX J

DATA FROM FIELD DELINEATION OF FEDERAL JURISDICTIONAL WETLANDS

Appendix

IGTS Wetlands Table

The attached table identifies the wetlands that will be crossed along the Iroquois pipeline route. All wetlands have been delineated using the 1989 uniform federal procedures. Those wetlands delineated during onsite surveys were assigned Wetland Identification numbers (e.g. W-1-1), as shown in column 7 of the table. Those wetlands delineated using offsite procedures lack Wetland Identification numbers.

A full report detailing the results of the wetlands surveys, including 1 inch = 500 feet scale maps depicting the wetland boundaries in relation to the pipeline route will be available for review at the following locations:

- Federal Energy Regulatory Commission
  Office of Pipeline and Producer Regulation
  825 North Capital Street, N.E.
  Washington, D.C. 20426

- U.S. Army Corps of Engineers
  - New York District
    26 Federal Plaza
    New York, New York 10278-0090

  - New England Division
    424 Trapelo Road
    Waltham, MA 02254-9149

  - Buffalo District
    1776 Niagara Street
    Buffalo, New York 14207

- New York State Department of Public Service
  3 Empire Street Plaza
  Albany, New York 12223

- Connecticut Siting Council
  136 Main Street, Suite 401
  New Britain, Connecticut 06051

- Plumb Memorial Library
  65 Wooster Street
  Shelton, Connecticut 06484

DELINEATION OF FEDERAL JURISDICTIONAL WETLANDS ALONG IGTS

LOCATION		FERC DEIS			RESULTS OF FIELD/OFFSITE DELINEATIONS *						
County	Town	Milepost (a)	Class (a)	Length (ft) (a)	Actual Field Milepost (c)	Wetland ID #	Field Class.	Crossing Width A (ft)	Final Crossing Width B (ft)	Potential Reduction (ft)	Soil Series
St. Lawrence	Waddington	0.00	L10WHh	1790							
St. Lawrence	Waddington	0.34	L20WHh	310							
St. Lawrence	Waddington	0.81	PFO1E	1630	0.81	W-1-1	PFO1E	625	625	0	Covington
St. Lawrence	Waddington				0.90	W-1-2	PFO/SS1E	1030	1030	0	Stockholm
St. Lawrence	Waddington				1.50	W-2-1	PSS1E	150	100	50	Malone
St. Lawrence	Waddington				2.40	W-2-2	PFO1E	125	70	55	Swanton
St. Lawrence	Waddington				2.90	W-2-3	PSS1E	150	100	50	Swanton
St. Lawrence	Waddington	3.20	R20WHh	50	3.20	W-3-1	PEM1E	50	50	0	Fluvaquent
St. Lawrence	Waddington	4.40	PEM5E	50	4.40	W-5-1	PSS/EM1E	400	250	150	Adjidaumo
St. Lawrence	Waddington				4.71	W-5-2	PEM/SS1E	35	25	10	Swanton
St. Lawrence	Waddington	5.21	PEM5E	150	5.21	W-6-1	PEM1E	80	80	0	Fluvaquent
St. Lawrence	Waddington	5.80	PSS1E	150	5.80	W-6-2	PEM1Ef	150	30	120	Fluvaquent
St. Lawrence	Waddington	5.86	PEM5E	50	5.86	W-6-3	PEM1Ef	20	20	0	Adjidaumo
St. Lawrence	Lisbon				7.40	W-8-1	PFO1E	200	200	0	Swanton
St. Lawrence	Lisbon				7.70	W-9-1	PFO1E	1200	95	1105	Deford
St. Lawrence	Lisbon	8.42	PFO1E	1160	8.42	W-9-2	PFO1E	190	190	0	Carbondale
St. Lawrence	Lisbon				9.15	W-9-3	PSS1E	25	25	0	Fluvaquent
St. Lawrence	Lisbon				9.90	W-10-1	PSS1E	190	100	90	Stockholm
St. Lawrence	Lisbon				10.20	W-10-2	PFO/SS1,4E	410	375	35	Munuscong
St. Lawrence	Lisbon	10.53	PSS1E	520	10.53	W-10-3	PSS/EM1E	440	320	120	Dora
St. Lawrence	Lisbon	10.76	PSS1E	370							
St. Lawrence	Lisbon	11.71	PFO1E	790							
St. Lawrence	Lisbon	12.06	PFO1E	330							
St. Lawrence	Lisbon	12.31	PSS1E	1350	12.31	W-13-4	PSS1E	220	220	0	Malone
St. Lawrence	Lisbon	12.70	PFO1E	730	12.70	W-13-5	PSS1E	125	125	0	Swanton
St. Lawrence	Lisbon				12.71	W-13-7	PEM5E	125	60	65	Swanton
St. Lawrence	Lisbon	12.84	PFO1E	1900							
St. Lawrence	Lisbon				13.19	W-13-9	PSS/EM1E	50	50	0	Guff
St. Lawrence	Lisbon				13.30	W-13-10	PSS1/EM5F	70	70	0	Adjidaumo
St. Lawrence	Lisbon	13.75	PSS1E	100	13.75	W-14-1	PSS/EM1E	100	0	100	Muskellunge
St. Lawrence	Lisbon	14.10	PFO1E	420	14.10	W-14-2	PSS1/EM1E	50	50	0	Swanton
St. Lawrence	Lisbon	14.45	PEM5Zb	730	14.45	W-15-1	PSS1/FO4/EM	1000	1000	0	Dora
St. Lawrence	Canton				15.30	W-15-2	PFO1E	975	975	0	Munuscong
St. Lawrence	Canton				15.60	W-15-3	PEM1E	90	90	0	Fluvaquent
St. Lawrence	Canton	15.70	PFO1E/MO-2	450	15.70		PFO1E	375	375	0	Fluvaquent
St. Lawrence	Canton				16.30	W-16-2	PFO1E	100	100	0	Malone
St. Lawrence	Canton			375	16.50	W-16-3	PFO1E	75	10	65	Naumburg
St. Lawrence	Canton	16.96	PFO1E	260	16.96	W-16-4	PSS1E	800	470	330	Swanton
St. Lawrence	Canton				17.15	W-17-1	PFO1E	180	180	0	Adjiduamo
St. Lawrence	Canton				17.75	W-17-2	PSS1E	190	0	190	Kingsbury

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St. Lawrence	Canton	17.90	PSS1	210	17.95	W-17-3	PSS/EM1E	190	115	75	Fluvaquent
St. Lawrence	Canton				18.10	W-18-1	PSS1E	200	0	200	Redwater
St. Lawrence	Canton				18.30	W-18-5	PEM5/SS1E	70	70	0	Fluvaquent
St. Lawrence	Canton				18.46	W-18-6	PSS1E	60	0	60	Fluvaquent
St. Lawrence	Canton	18.42	PEM5C	50	18.42	W-18-4	PEM1/SS1E	50	0	50	Munuscong
St. Lawrence	Canton	18.50	PFO1E	310	18.50	W-18-2	PSS/EM/FO1E	1200	1200	0	Dora
St. Lawrence	Canton				19.40	W-19-2	PSS1E	50	0	50	Adjiduamo
St. Lawrence	Canton				20.70	W-20-1	PEM5/SS1E	75	0	75	Covington
St. Lawrence	Canton				20.90	W-20-2	PEM5/SS1E	50	50	0	Muskellunge
St. Lawrence	Canton	21.40	POWZb/CT-15	1370	21.40	W-20-4	PEM5/SS1E	1000	1000	0	Adjiduamo
St. Lawrence	Canton				21.70	W-20-5	PEM5/SS1E	550	550	0	Adjiduamo
St. Lawrence	Canton	21.96	PEM5E	100	21.96	W-20-6	PEM5/SS1E	50	0	50	Adjiduamo
St. Lawrence	Canton	22.05	PEM5E	100	22.05	W-20-7	PEM5E	50	0	50	Adjiduamo
St. Lawrence	Canton	22.29	PEM5E	100	22.30	W-21-1	PEM5E	60	60	0	Adjiduamo
St. Lawrence	Canton	22.35	PEM5E	370	22.35	W-21-2	PEM5E	370	0	370	Adjiduamo
St. Lawrence	Canton				23.00	W-21-4	PEM1E	50	50	0	Adjiduamo
St. Lawrence	Canton				23.10	W-22-1	PEM1E	150	125	25	Adjiduamo
St. Lawrence	Canton				23.40	W-22-2	PEM1E	60	60	0	Adjiduamo
St. Lawrence	Canton	23.50	PEM5E	150	23.50	W-22-5	PEM5E	150	0	150	Adjiduamo
St. Lawrence	Canton				23.60	W-23-1	PEM1F	40	0	40	Muskellunge
St. Lawrence	Canton	23.85	PEM5E	1210							
St. Lawrence	Canton	24.16	PFO1E	150	24.16	W-23-2	PEM/SS1E	150	75	75	Adjiduamo
St. Lawrence	Canton				24.40	W-23-3	PEM1F	50	0	50	Adjiduamo
St. Lawrence	Canton	25.07	PFO1C	470	25.07	W-24-1	PFO1C	375	375	0	Adjiduamo
St. Lawrence	Canton				25.30	W-24-2	PSS1E	20	20	0	Fluvaquent
St. Lawrence	Canton	25.50	PFO1E	470	25.60	W-24-3	PFO/SS1E	100	0	100	Dora
St. Lawrence	Canton				25.90	W-25-1	PEM/SS1Hb	190	190	0	Adjiduamo
St. Lawrence	Canton				26.50	W-25-2	PEM1E	50	50	0	Fluvaquent
St. Lawrence	Canton				26.60	W-25-3	PFO4G	50	50	0	Fluvaquent
St. Lawrence	Herman	27.78	PEM5A	150							
St. Lawrence	Herman	27.83	R3OWH	50	27.83	W-26-1	PEM/SS1E	150	150	0	Adjiduamo
St. Lawrence	Herman	28.42	PEM5E	50							
St. Lawrence	Herman	28.65	PEM5A	470	28.65	W-27-1	PSS1E	280	100	180	Wegatchie
St. Lawrence	Herman				29.15	W-28-1	PSS1E	220	50	170	Hailsboro
St. Lawrence	Herman	29.99	PEM5E	100	29.99	W-29-1	PEM1E	50	50	0	Fluvaquent
St. Lawrence	Herman	30.10	PSS1/EM5E	100	30.10	W-29-2	PEM1E	50	50	0	Fluvaquent
St. Lawrence	Herman	30.19	PEM5E	150	30.19	W-29-3	PEM/SS1E	280	280	0	Fluvaquent
St. Lawrence	Herman	30.40	PEM5E	50							
St. Lawrence	Herman	32.50	PEM/FO1F	420	32.50	W-31-1	PEM/FO1F	150	150	0	Summerville
St. Lawrence	Herman	32.93	PFO/SS1EB	680	32.93	W-31-2	PSS1E	50	50	0	Adjiduamo
St. Lawrence	Herman				33.45	W-31-3	PFO/SS1E	150	75	75	Adjiduamo
St. Lawrence	Herman	33.83	PFO5/OWFB	370	33.83	W-31-4	PEM/FO4	20	20	0	Adj-Summerville
St. Lawrence	Herman				34.40	W-31-5	PSS1E	30	0	30	Wegatchie
St. Lawrence	Herman				34.48	W-31-6	PFO1E	35	0	35	Wegatchie
St. Lawrence	Herman				34.60	W-31-7	PFO1,4E	75	75	0	Wegatchie

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St. Lawrence	Herman				34.70	W-31-8	PSS1E	110	110	0	Adjiduamo
St. Lawrence	Herman	34.80	PSS1/EM5EB	150							
St. Lawrence	Herman				35.00	W-31-9	PSS/E1E	200	35	165	Adjiduamo
St. Lawrence	Herman	35.10	PSS1/EM5EB	630							
St. Lawrence	Herman				35.20	W-31-10	PSS1E	20	20	0	Fluvaquent
St. Lawrence	Herman				35.40	W-31-11	PSS1E	140	140	0	Fluvaquent
St. Lawrence	Herman				35.50	W-31-12	PFO1E	170	105	65	Adjiduamo
St. Lawrence	Herman				35.60	W-31-13	PEM1Fb	150	150	0	Fluvaquent
St. Lawrence	Herman				35.85	W-31-14	PSS1E	70	70	0	Adjiduamo
St. Lawrence	Herman	36.15	PEM5E	150							
St. Lawrence	Herman				36.20	W-32-30	PFO4/SS1E	230	0	230	Adjiduamo
St. Lawrence	Herman				36.30	W-32-31	PSS/EM1	60	60	0	Adjiduamo
St. Lawrence	Herman	36.33	PEM5E	210							
St. Lawrence	Herman				36.40	W-32-32	PSS1E	90	90	0	Adjiduamo
St. Lawrence	Herman	37.20	R30WH	50							
St. Lawrence	Herman				37.25	W-32-19	PFO1E	50	50	0	Borosaprists
St. Lawrence	Herman	37.64	PFO1E	310							
St. Lawrence	Herman	37.75	PFO1E	790	37.80	W-32-9	PFO1E	200	35	165	Borosaprists
St. Lawrence	Herman	38.00	PFO1E	420	38.00	W-32-10	PFO1E	350	175	175	Borosaprists
St. Lawrence	Herman	38.55	PFO5Fb	50	38.55	W-32-8	POW/EM5b	150	30	120	Borosaprists
St. Lawrence	Herman	38.59	PFO1E	150							
St. Lawrence	Herman	38.70	PFO1E	210							
St. Lawrence	Edwards	38.76	PFO1E	470	38.73	W-32-18	POWb	100	100	0	Borosaprists
St. Lawrence	Edwards				39.00	W-32-21	PFO1E	120	120	0	Borosaprists
St. Lawrence	Edwards	39.41	PFO1E/5Fb	100							
St. Lawrence	Edwards				39.45	W-32-22	PEM/SS1E	75	75	0	Borosaprists
St. Lawrence	Edwards				39.60	W-32-26	PFO1Hb	50	50	0	Borosaprists
St. Lawrence	Edwards	39.64	PFO1E	150							
St. Lawrence	Edwards				39.95	W-32-24	PFO1G	200	200	0	Borosaprist
St. Lawrence	Edwards				40.05	W-32-35	PFO1E	115	115	0	Borosaprist
St. Lawrence	Edwards				40.40	W-32-37	PFO1E	60	60	0	Borosaprist
St. Lawrence	Edwards				40.50	W-32-34	PFO1E	200	200	0	Borosaprist
St. Lawrence	Edwards				40.80	W-32-50	PFO4/SS1E	65	65	0	Borosaprist
St. Lawrence	Edwards				41.10	W-32-25	PFO1E	500	200	300	Fluvaquent
St. Lawrence	Edwards				41.40	W-33-4	PSS/FO1F	120	120	0	Fluvaquent
St. Lawrence	Edwards				41.50	W-33-2	PEM/SS1Ed	1000	1000	0	Fluvaquent
St. Lawrence	Edwards				41.60	W-33-1	PSS/FO1F	350	350	0	Fluvaquent
St. Lawrence	Edwards				42.50	W-34-1	PEM1E	50	0	50	Wegatchie
St. Lawrence	Edwards	42.77	R3OWH	50							
St. Lawrence	Edwards	43.08	PSS1/EM5C	150	43.08	W-34-2	PEM/SS1B	300	0	300	Fluvaquent
St. Lawrence	Edwards	43.25	PSS1/EM5C	310							
St. Lawrence	Edwards	43.40	PFO/SS1E	470	43.40	W-36-2	PSS/FO1,3	1600	0	1600	Roundabout
St. Lawrence	Edwards				43.41	W-35-2	PEM1E	50	50	0	Fluvaquent
St. Lawrence	Edwards				43.50	W-35-3	PSS1E	110	110	0	Wegatchie
St. Lawrence	Edwards				43.58	W-35-4	PFO/EM1E	300	300	0	Wegatchie

St. Lawrence	Edwards				43.61	W-35-5	PEM1E	150	150	0	Wegatchie
St. Lawrence	Edwards				43.70	W-36-1	PEM1E	75	75	0	Roundabout
St. Lawrence	Edwards	44.06	PSS1C	730	44.15	W-36-3	PSS1C	500	500	0	Naumburg
St. Lawrence	Edwards				44.85	W-36-4	PSS/FO1Gb	975	975	0	Naumburg
St. Lawrence	Edwards				45.60	W-36-6	PSS1G	40	40	0	Fluvaquent
St. Lawrence	Edwards	46.50	PSS1/FO5EB	420	46.50	W-37-1	PSS/EM1GB	250	250	0	Borosaprist
St. Lawrence	Pitcairn	48.00	PFO4B	210	48.00	W-37-2	PFO4F	75	75	0	Fluvaquent
St. Lawrence	Pitcairn	48.15	PSS1E	50	48.15	W-37-3	PSS/FO1G	120	120	0	Fluvaquent
St. Lawrence	Pitcairn										
St. Lawrence	Pitcairn	49.10	PSS1/EM5E	100	49.10	W-39-1	PEM/SS1	50	50	0	Fluvaquent
St. Lawrence	Pitcairn				49.45	W-39-2	PEM5E	40	40	0	Fluvaquent
St. Lawrence	Pitcairn	50.31	PFO1A	50	50.31	W-39-3	PFO1E	60	60	0	Fluvaquent
St. Lawrence	Pitcairn	50.90	PSS1/EM5E	150	51.10	W-39-4	PSS/EM5E	100	100	0	Fluvaquent
St. Lawrence	Pitcairn	51.30	PSS1/EM5E	370	51.30	W-39-5	PSS1/EM5	200	125	75	Fluvaquent
St. Lawrence	Pitcairn				51.40	W-39-6	PEME	25	25	0	Fluvaquent
St. Lawrence	Pitcairn	51.80	PFO/SS1A	50	51.80	W-40-1	PSS1	40	40	0	Fluvaquent
St. Lawrence	Pitcairn	52.51	PEM5A	50							
St. Lawrence	Pitcairn	52.61	PFO4B	950							
Lewis	Diana				53.10	W-43-1	PFO1,4B	30	30	0	Walpole
Lewis	Diana				53.15	W-44-1	PSS1E	200	175	25	Palms
Lewis	Diana	53.55	PSS1E	150	53.55	W-44-2	PSS1E	150	150	0	Palms
Lewis	Diana	54.01	PFO/SS1E	470	54.01	W-45-1	PSS/FO1E	100	100	0	Palms
Lewis	Diana	54.46	PSS1/EM5E	150	54.46	W-45-2	PEM/SS1E	260	260	0	Scarboro
Lewis	Diana				54.60	W-45-3	PSS1E	170	170	0	Scarboro
Lewis	Diana				54.90	W-46-1	PSS1E	800	340	460	Palms
Lewis	Diana				55.10	W-46-2	PFO1E	55	55	0	Westland
Lewis	Diana				55.15	W-46-3	PEM/SS1,2E	210	210	0	Westland
Lewis	Diana	55.21	PSS1A	50	55.21	W-47-1	PFO/EM1	500	235	265	Westland
Lewis	Diana	55.30	PFO1E	470	55.30	W-47-2	PFO4/SS1	250	170	80	Westland
Lewis	Diana	55.80	PSS1E	370	55.80	W-47-3	PFO/SS1,4	500	400	100	Palms
Lewis	Diana				56.21	W-47-4	PFO1,4E	370	370	0	Palms
Lewis	Diana				56.50	W-47-6	PEM5E	180	180	0	Swanton
Lewis	Diana	57.10	PFO4B	790	57.10	W-48-1	PFO4B	475	475	0	Palms
Lewis	Diana	57.55	PFO1E	470	57.55	W-49-1	PFO/SS1,4	600	600	0	Palms
Lewis	Diana	58.98	PSS1E	470	58.98	W-49-2	PSS1E	300	0	300	Scarboro
Lewis	Diana	60.25	PFO1E	100							
Lewis	Diana	60.36	PFO1E	950	60.46	W-50-1	PFO1,4E	100	100	0	Scarboro
Lewis	Diana	60.94	PSS1E	420	60.94	W-50-2	PSS	120	120	0	Scarboro
Lewis	Diana	61.31	PFO1E	370	61.31	W-50-4	PFO1,4	100	100	0	Palms
Lewis	Diana	61.65	PFO1E	150	61.65	W-50-5	PSS/FO	150	150	0	Scarboro
Lewis	Diana				62.40	W-50-6	PEM/SS1	50	0	50	Scarboro
Lewis	Diana				62.50	W-50-7	PSS	400	0	400	Scarboro
Lewis	Diana				63.30	W-51-1	PSS/EM1	75	75	0	Scarboro
Lewis	Diana	63.36	PFO4B	470							
Lewis	Diana	63.59	PSS1E	520	63.59	W-52-1	PSS/EM1F	200	200	0	Palms

Lewis	Diana	64.19	PSS1E	260	64.19	W-52-2	PSS1E	150	150	0	Fluvaquent
Lewis	Diana				65.05	W-53-10	PEM/SS1	15	15	0	Saco
Lewis	Diana	65.05	PSS1/EM5E	420	65.10	W-53-1	PEM/SS1	300	300	0	Saco
Lewis	Diana				65.20	W-53-2	PSS/FO1	80	80	0	Saco
Lewis	Diana				65.60	W-53-3	PFO1,4	45	0	45	Palms
Lewis	Diana				65.61	W-53-4	PFO1,4E	75	0	75	Palms
Lewis	Diana				65.80	W-53-5	PFO1,4E	100	75	25	Palms
Lewis	Diana	66.02	R30WH	50	66.05	W-53-6	PFO/SS1	100	25	75	Palms
Lewis	Diana	66.21	R30WH	50	66.20	W-53-7	PFO1,4	70	0	70	Palms
Lewis	Diana	66.49	PEM5Eb	730	66.49	W-53-8	PEM1	200	200	0	Marsh
Lewis	Croghan	66.85	PSS1/EM5E	50							
Lewis	Croghan	66.86	PFO4/6B	580							
Lewis	Croghan				66.90	W-53-9	PSS1	60	0	60	Whately
Lewis	Croghan				66.95	W-54-4	PSS1F	140	140	0	Palms
Lewis	Croghan				67.15	W-54-5	PFO1F	100	100	0	Palms
Lewis	Croghan				67.20	W-54-6	PFO1E	120	0	120	Fluvaquent
Lewis	Croghan				67.30	W-54-7	PFO1E	115	0	115	Ridgebury
Lewis	Croghan	67.36	PFO1E	100							
Lewis	Croghan	67.49	PFO1E	50							
Lewis	Croghan	68.45	PFO1E	210	68.45	W-54-1	PFO1E	70	20	50	Ridgebury
Lewis	Croghan	68.74	PFO1E	150	68.74	W-54-2	PFO1/EM	60	60	0	Ridgebury
Lewis	Croghan				69.10	W-55-1	PFO1/EM	110	110	0	Ridgebury
Lewis	Croghan	69.66	PFO1E	100							
Lewis	Croghan				70.50	W-55-2	PFO/EM1	30	30	0	Ridgebury
Lewis	Croghan				71.40	W-55-3	PFO/SS1	510	300	210	Whately
Lewis	Croghan	71.55	PSS1/EM5E	310	71.55	W-55-4	PEM	60	60	0	Whately
Lewis	Croghan				72.10	W-56-1	PFO4	250	250	0	Palms
Lewis	Croghan				73.25	W-56-2	PEM1	50	50	0	Whately
Lewis	Croghan				73.30	W-56-3	PFO4	100	0	100	Whately
Lewis	Croghan				73.60	W-56-5	PFO4E	50	50	0	Fluvaquent
Lewis	Croghan	73.70	PFO1	470	73.70	W-56-4	PFO1,4F	300	35	265	Saugatuck
Lewis	Croghan				74.90	W-57-1	PSS/FO4E	300	100	200	Ridgebury
Lewis	Croghan				75.60	W-57-2	PSS1E	35	35	0	Ridgebury
Lewis	Croghan				76.30	W-58-7	PSS/FO1,4E	160	160	0	Whitman
Lewis	Croghan				76.35	W-58-8	PSS1E	70	70	0	Ridgebury
Lewis	Croghan				76.40	W-58-9	PSS1E	120	120	0	Fluvaquent
Lewis	Croghan				76.60		PSS/FO1	250	250	0	Ridgebury
Lewis	Croghan				77.40	W-58-1	PSS1E	360	0	360	Ridgebury
Lewis	Croghan				77.45	W-58-2	PSS/FO1	150	0	150	Ridgebury
Lewis	Croghan				77.50	W-58-3	PSS1	150	0	150	Ridgebury
Lewis	Croghan				77.52	W-58-6	PEM1E	40	40	0	Fluvaquent
Lewis	Croghan				77.58	W-58-5	PSS1E	175	0	175	Ridgebury
Lewis	Croghan				77.60	W-58-4	PEM1	100	0	100	Ridgebury
Lewis	Croghan				77.80	W-59-1	PEM1E	150	0	150	
Lewis	Croghan				78.10		PSS1	125	125	0	Ridgebury

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Lewis	Croghan				78.30		PFO/SS1	300	200	100	Rumney
Lewis	Croghan				78.90	W-60-1	PSS1E	75	75	0	Swanton
Lewis	New Bremen				80.20	W-61-1	PEM1E	75	75	0	Swanton
Lewis	New Bremen				81.40	W-62-1	PSS1E	100	100	0	Saugatuck
Lewis	New Bremen				81.90	W-63-1	PSS1E	150	150	0	Ridgebury
Lewis	New Bremen				83.50	W-64-1	PSS/FO1,4E	200	200	0	Ridgebury
Lewis	New Bremen				83.60	W-64-2	PSS1E	190	190	0	Ridgebury
Lewis	New Bremen				83.70	W-65-2	PSS1E	100	100	0	Ridgebury
Lewis	New Bremen	83.75	PSS1	150							
Lewis	New Bremen				84.40		PSS1	100	100	0	Palms
Lewis	Watson	87.00	PSS1	50	87.00	W-68-1	PSS1E	23	23	0	Ridgebury
Lewis	Watson	88.10	PFO1	50							
Lewis	Watson				88.60	W-69-1	PFO1,4	70	50	20	Rumney
Lewis	Watson				89.30		PFO1	100	100	0	Rumney
Lewis	Watson				89.60		PFO1,4	250	250	0	Saugatuck
Lewis	Watson	89.80	PFO1	210	89.80		PFO1	150	150	0	Saugatuck
Lewis	Watson				90.10		PFO1	300	300	0	Ridgebury
Lewis	Greig	91.05	ROWH	260							
Lewis	Greig				91.80		PFO1	400	300	100	Ridgebury
Lewis	Greig	92.07	ROWH	210							
Lewis	Greig				92.60		PFO1	250	0	250	Ridgebury
Lewis	Greig				92.80		PEM1E	250	0	250	Scarboro
Lewis	Greig	93.40	ROWH	100	93.20	W-75-1	PSS1E	75	75	0	Walpole
Lewis	Greig	93.53	PSS1	890	93.40	W-75-2	PSS1E	200	50	150	Walpole
Lewis	Greig				93.53	W-75-3	PEM1E	25	15	10	Walpole
Lewis	Greig				93.90	W-75-4	PSS1E	60	60	0	Walpole
Lewis	Greig	94.15	PSS1	50							
Lewis	Greig	94.45	PFO1	630	94.45	W-76-1	PSS/FO1H	50	50	0	Sloan
Lewis	Greig	94.57	PSS1	840	94.57	W-76-2	PEM1	825	825	0	Sloan
Lewis	Greig	94.73	ROWH	260							
Lewis	Turin	94.78	PSS1	310	94.78	W-77-1	PSS/EM1	325	275	50	Sloan
Lewis	Turin				94.80	W-77-2	PFO1E	100	100	0	Sloan
Lewis	Turin	95.02	PSS1	50							
Lewis	Turin				95.25	W-78-1	PEM/SSIE	75	75	0	Walpole
Lewis	Turin				95.97	W-79-1	PSS1E	1100	1100	0	Westland
Lewis	Turin				96.15	W-79-5	PFO1E	2675	2675	0	Wstl, Alluv
Lewis	Turin	97.12	PFO1	50	97.12	W-79-3	PFO1E	100	0	100	Westland
Lewis	Turin	97.70	PSS1	50	97.70	W-79-4	PSS1	50	0	50	Westland
Lewis	West Turin	99.07	PSS1	50							
Lewis	West Turin	99.87	PSS1	210							
Lewis	West Turin				100.45	W-82-9	PSSIE	100	100	0	Lyons
Lewis	West Turin				100.60	W-82-7	PSSIE	175	175	0	Lyons
Lewis	Leyden				100.80	W-82-8	PEM/SSIE	80	80	0	Junius
Lewis	Leyden	100.90	PSS1	50	100.90	W-82-6	PSS1E	65	50	15	Alluvial land
Lewis	Leyden	101.31	PSS1	50							

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Lewis	Leyden	102.01	PSS1	100	102.01	W-83-2	PSS1E	1275	300	975	Rhinebeck
Lewis	Leyden				102.30	W-84-1	PSS1E	30	30	0	Rhinebeck
Lewis	Leyden				102.53	W-84-2	PSS/FO1E	600	600	0	Rhinebeck
Lewis	Leyden				105.67	W-86-1	PSS1E	120	50	70	Kendaia
Lewis	Leyden	106.43	PFO/SS1	150							
Lewis	Leyden	106.46	ROW1	150							
Lewis	Leyden				106.56		PSS/FO1	650	250	400	Biddeford
Lewis	Leyden				106.82		PSS/EM1	100	100	0	Sloan
Oneida	Boonville				107.70	W-89-1	PSS/EMIE	64	64	0	Fluvaquent
Oneida	Boonville	108.28	PFO1	260	108.28	W-90-1	PSS1F	215	215	0	Fluvaquent
Oneida	Boonville				109.65	W-91-1	PFO4E	450	0	450	Naumburg
Oneida	Boonville	110.85	PFO1	2790	110.85	W-93-1	PFO4E	250	100	150	Dawson
Oneida	Boonville				111.30		PSS1	50	50	0	Fluvaquent
Oneida	Boonville				111.73		PSS1	50	50	0	Malone
Oneida	Boonville	112.90	PSS1	210	112.90		PSS1	725	550	175	Naumburg
Oneida	Boonville	112.99	PFO/SS1	370							
Oneida	Boonville	113.31	PFO/SS1	370	113.31		PEM/SS1	100	50	50	Naumburg
Oneida	Boonville	114.80	PSS1	420	114.80		PFO4,1	1250	1100	150	Naumburg
Oneida	Boonville	115.30	PFO1	50	115.30		PFO1	100	100	0	Naumburg
Oneida	Boonville				115.45		PSS1	50	50	0	Fluvaquent
Oneida	Boonville				116.22		PFO/SS1	75	75	0	Naumburg
Oneida	Boonville	116.65	PSS1	210	116.65		PSS1	50	50	0	Fluvaquent
Oneida	Boonville	116.80	PFO1	310	116.80		PFO1	50	50	0	Greenwood
Oneida	Remsen	117.49	PSS1	950	117.49	W-99-1	PFO1,4	950	950	0	Malone
Oneida	Remsen	117.75	PSS1	1370							
Oneida	Remsen				118.00	W-99-2	PFO1E	150	150	0	Malone
Oneida	Remsen				118.10	W-100-4	PSSIE	135	65	70	Fluvaquent
Oneida	Remsen	118.78	PSS1	210	118.78	W-100-1	PSS1/FO4E	200	50	150	Fluvaquent
Oneida	Remsen				119.00	W-100-2	PSS1E	150	0	150	Dawson
Oneida	Remsen				119.10	W-100-3	PEM1E	75	50	25	Malone
Oneida	Remsen	119.56	PFO1	1100	119.56	W-101-1	PFO1,4	650	375	275	Dawson
Oneida	Remsen										
Oneida	Remsen				120.50	W-101-5	PSS1E	60	25	35	Naumburg
Oneida	Remsen				120.80	W-101-6	PFO1E	350	350	0	Naumburg
Oneida	Remsen				120.95	W-102-1	PSS1E	140	140	0	Malone
Oneida	Remsen	121.06	PFO1	1260	121.06	W-102-2	PFO4E	125	125	0	Tughill
Oneida	Remsen				121.20	W-102-3	PSS1E	100	100	0	Tughill
Oneida	Remsen	121.33	PFO1	1580	121.33	W-102-4	PSS1/FO4E	220	220	0	Tughill
Oneida	Remsen				123.13		PFO1	75	75	0	Dawson
Oneida	Remsen	123.37	PFO1	370							
Oneida	Remsen				124.10	W-104-1	PFO4,1E	550	550	0	Dawson
Oneida	Remsen	124.20	PSS1	210	124.20	W-104-1	PSS1E	400	400	0	Dawson
Oneida	Trenton	124.76	PFO1	520	124.76		PSS1/FO4E	1400	1400	0	Dawson
Oneida	Trenton				125.37	W-106-1	PEM/SS1E	200	100	100	Lamson
Oneida	Trenton				125.41	W-106-2	PSS/FO1E	450	150	300	Lamson

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Oneida	Trenton				125.48	W-106-3	PSS/FO1E	85	85	0	Fluvaquent
Oneida	Trenton				125.55	W-106-4	PSS/FO1E	40	40	0	Fluvaquent
Herkimer	Russia				126.62		PSS/FO1	150	150	0	Sun
Herkimer	Russia	127.08	PFO1	100	127.08		PFO1,2	100	75	25	Mosherville
Herkimer	Russia				127.25		PFO1	50	50	0	Sun
Herkimer	Russia				127.43		PFO1	50	50	0	Sun
Herkimer	Russia				128.23		PFO1	200	200	0	Sun
Herkimer	Russia				128.55		PSS1	325	0	325	Sun
Herkimer	Russia	129.33	PFO1	260	129.33		PFO4	300	225	75	Alluvial land
Herkimer	Russia				129.68		PFO1	50	50	0	Alluvial land
Herkimer	Russia				130.38		PEM1	50	50	0	Mosherville
Herkimer	Russia	130.67	PFO1	100	130.67		PFO1,4	100	100	0	Mosherville
Herkimer	Russia	131.26	PSS1	210	131.26	W-111-5	PEM/SS1E	40	40	0	Ilion
Herkimer	Russia				131.50	W-111-6	PEM1E	30	30	0	Manheim
Herkimer	Russia				132.00	W-112-1	PEM1E	65	65	0	Alluvial land
Herkimer	Newport				135.00	W-114-6	PFO1,4E	165	100	65	Fredon
Herkimer	Norway				135.80	W-114-2	PFO1,4E	325	325	0	Halsey
Herkimer	Norway				136.55	W-114-4	PSS1E	200	200	0	Alluvial land
Herkimer	Norway	136.84	PFO1	260	136.84	W-115-1	PFO4F	250	100	150	Manheim
Herkimer	Norway				136.95	W-115-2	PEM1E	50	0	50	Ilion
Herkimer	Norway	137.60	PFO1	50							
Herkimer	Norway				138.13	W-116-2	PSS1E	250	100	150	Alluvial land
Herkimer	Norway				138.25	W-116-3	PEM1E	50	50	0	Appleton
Herkimer	Norway	139.21	PFO1	420	139.21	W-117-2	PSS1E	90	90	0	Alluvial land
Herkimer	Norway				139.80	W-118-1	PEM/SS1E	55	55	0	Ilion
Herkimer	Norway				139.98	W-118-2	PFO1E	27	27	0	Ilion
Herkimer	Norway	140.02	PFO1	370	140.02	W-118-3	PFO1E	37	37	0	Manheim
Herkimer	Fairfield				142.62		PEM/SS1	450	0	450	Ilion
Herkimer	Fairfield	143.66	PEM1	370	143.66	W-121-2	PSS1E	175	100	75	Ilion
Herkimer	Fairfield	144.06	PFO1	50							
Herkimer	Fairfield	144.09	PFO1	370							
Herkimer	Fairfield				144.35	W-122-1	PEM1E	50	50	0	Lamson
Herkimer	Fairfield	144.40	PSS1	260	144.40	W-122-2	PEM1E	75	75	0	Ilion
Herkimer	Fairfield	145.05	PSS1	310	145.05	W-123-1	PSS1E	385	300	85	Ilion
Herkimer	Salisbury	145.57	PSS1	370	145.57	W-123-2	PEM1E	100	100	0	Alluvial land
Herkimer	Salis/Manh.	146.10	PSS1	370	146.10	W-124-1	PSS/EM1E	825	500	325	Alluvial land
Herkimer	Manheim				146.30	W-124-2	PSS1E	200	75	125	Alluvial land
Herkimer	Manheim				147.00	W-125-1	PEM1E	48	48	0	Ilion
Herkimer	Manheim				150.38		PSS/EM1	200	200	0	Alluvial land
Herkimer	Manheim				151.42		PFO/SS1	275	50	225	Alluvial land
Herkimer	Manheim				151.56		PSS/FO1	50	0	50	Ilion
Herkimer	Manheim				152.84	W-130-1	PEM1E	900	600	300	Wayland
Herkimer	Manheim				153.12	W-130-2	PEM1E	65	65	0	Wayland
Herkimer	Manheim				153.30	W-130-3	PEM1E	65	0	65	Cohoctah
Herkimer	Manheim				153.35	W-130-4	PEM/FO1E	1250	0	1250	Cohoctah

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Herkimer	Manheim				153.75	W-130-5	PSS1E	700	0	700	Cohoctah
Herkimer	Manh/Danu	154.22	ROWH	520							
Herkimer	Danube	154.31	PSS1/EM	630	154.31	W-130-6	PFO1E	175	175	0	Cut & fill land
Herkimer	Danube				154.35	W-130-6	PEM/FO1E	550	550	0	Cohoctah
Herkimer	Danube				154.38	W-130-6	PEM1G	175	175	0	Cohoctah
Herkimer	Danube	155.55	ROWH	50							
Herkimer	Danube				155.60	W-131-1	PEM1E	50	50	0	Alluvial land
Herkimer	Danube				155.80	W-132-1	PEM/FO1E	60	60	0	Alluvial land
Herkimer	Danube				157.25	W-133-1	PEM1E	250	0	250	Ilion
Montgomery	Minden	161.30	PFO1	310	161.30		PSS1	50	50	0	Fluvaquent
Montgomery	Minden	162.35	PSS1	50							
Montgomery	Minden				162.40	W-137-2	PFO1E	235	235	0	Ilion
Montgomery	Minden				162.80	W-137-1	PEM/FO1E	50	50	0	Alluvial land
Montgomery	Minden	164.00	PSS1	50							
Montgomery	Minden	165.30	PEM	150							
Montgomery	Minden	165.35	PSS1	50							
Montgomery	Canajoharie	166.00	PSS1	50	166.00		PSS/EM1	175	100	75	Ilion
Montgomery	Canajoharie				167.50	W-140-1	PEM/FO1E	2000	0	2000	Ilion
Montgomery	Canajoharie				169.90		PSS/EM1	100	100	0	Madalin
Montgomery	Canajoharie				170.80		PFO1	150	150	0	Fluvaquent
Montgomery	Canajoharie				171.30	W-144-2	PSS/FO1E	70	70	0	Ilion
Montgomery	Root				174.30	W-145-1	PSS/FO1,3	250	60	190	Ilion
Montgomery	Root	174.55	PFO1	210							
Montgomery	Root	175.65	PFO1	50							
Montgomery	Root				177.84	W-148-1	PSS1E	40	40	0	Alluvial land
Montgomery	Root				177.90	W-148-2	PSS1E	45	0	45	Ilion
Montgomery	Root				178.35	W-148-3	PSS1E	33	33	0	Fluvaquent
Montgomery	Root				178.85		PSS1	100	50	50	Fluvaquent
Montgomery	Root				180.00		PSS1	150	150	0	Ilion
Montgomery	Root				180.30		PSS1	50	0	50	Ilion
Montgomery	Charleston	180.52	PSS1	260	180.52		PFO1	75	75	0	Ilion
Montgomery	Charleston				180.85		PSS/FO1	50	50	0	Ilion
Montgomery	Charleston				181.15		PFO1	50	50	0	Alluvial land
Montgomery	Charleston				182.00		PSS1	50	50	0	Ilion
Montgomery	Charleston	182.49	PFO/SS1	260	182.49		PSS1	175	175	0	Fonda
Montgomery	Charleston				182.80		PFO/SS1	400	50	350	Ilion
Schoharie	Carlisle	183.60	PSS1	210	183.60	W-151-1	PFO/SS1E	225	130	95	Madalin
Schoharie	Carlisle	183.64	PFO1	680							
Schoharie	Esperance	185.95	PFO1	50							
Schoharie	Esperance				187.70	W-154-1	PEM1E	30	0	30	Fluvaquent
Schoharie	Esperance				187.95	W-154-2	PSS/FO1E	500	400	100	Chippewa
Schoharie	Esperance	187.45	ROWH	420							
Schenectady	Duanesburg				190.70		PSS/EM1E	150	100	50	Ilion
Schoharie	Schoharie				191.75	W-158-1	PEM/SS1E	50	0	50	Ilion
Schoharie	Wright	193.75	PF01	50							

Schoharie	Wright				194.13	W160-1	PEM/SS1E	35	35	0	Darien
Schoharie	Wright				194.38	W161-1	PEM1G	75	75	0	Darien
Schoharie	Wright				195.30	W161-2	PSS/FO1E	70	0	70	Madalin
Schoharie	Wright				195.47	W161-3	PEM1E	120	120	0	Madalin
Schoharie	Wright	195.91	PFO1	210							
Schoharie	Wright				196.13	W162-2	PEM1E	20	0	20	Ilion & Lyons
Schoharie	Wright				196.38	W163-3	PEM1E	55	55	0	Ilion & Lyons
Schoharie	Wright				196.56	W163-2	PSS/FO1E	80	40	40	Ilion&Lyons
Albany	Knox				197.13	W164-1	PSS/FO1E	75	75	0	Burdett
Albany	Knox				197.83	W165-3	PSS1E	25	25	0	Ilion
Albany	Knox	198.05	PSS1	260	198.05	W165-2	PEM1EF	300	150	150	Birdsall
Albany	Knox				198.36	W165-1	PSS1E	15	15	0	Ilion
Albany	Berne	199.33	PSS1	50	199.33		PFO1E	170	170	0	Raynham
Albany	Berne	199.57	PSS1	50							
Albany	Berne	199.60	PSS1	1050	199.60		PFO1H	650	0	650	Raynham
Albany	Berne				200.15	W168-2	PEM1E	130	0	130	Nunda
Albany	Berne				200.39	W168-1	PEM/SS1E	210	100	110	Wayland
Albany	Berne				201.90	W169-5	PEM1E	500	500	0	Wayland
Albany	Berne				203.02	W169-4	PEM1E	25	25	0	Aluvial Loamy
Albany	Berne				203.10	W169-3	PSS1E	110	50	60	Aluvial Loamy
Albany	Berne				203.25	W169-2	PSS/EM1E	230	230	0	Aluvial Loamy
Albany	Berne	203.90	PFO/SS1	310							
Albany	Berne				204.92	W171-1	PEM/SS1E	50	50	0	Ilion
Albany	Westerlo				205.85	W172-3	PFO/SS1E	100	0	100	Tuller
Albany	Westerlo				205.91	W172-2	PSS/FO1E	80	20	60	Tuller
Albany	Westerlo				206.15	W172-1	PSS1E	450	450	0	Tuller
Albany	Westerlo				206.38	W173-3	PSS/EM1E	340	340	0	Tuller
Albany	Westerlo				206.59	W173-1	PSS/EM1E	40	40	0	Tuller
Albany	Westerlo				206.63	W173-2	PSS1E	55	0	55	Tuller
Albany	Westerlo				206.82	W174-5	PSS/FO1E	40	40	0	Fluvaquent
Albany	Westerlo				207.06	W174-4	PSS1E	250	50	200	Lordstown
Albany	Westerlo				207.38	W174-3	PSS1E	60	0	60	Lordstown
Albany	Westerlo				207.40	W174-2	PSS1E	10	0	10	Lordstown
Albany	Westerlo	207.52	PSS1	150	207.52	W174-1	PFO1H	85	85	0	Tuller
Albany	Westerlo				208.30	W175-2	PSS/FO1E	45	25	20	Chautaugua
Albany	Westerlo				209.15		PFO1H	50	50	0	Birdsall
Albany	Westerlo				209.47	W176-1	PEM1E	65	65	0	Burdett
Albany	Westerlo				209.89	W176-4	PFO1,3H	430	30	400	Tuller
Albany	Westerlo				210.30	W176-3	PSS1E	190	190	0	Tuller
Albany	Westerlo				211.09	W176-2	PSS1E	80	80	0	Angola
Albany	Westerlo	211.60	PSS1	310	211.60	W177-1	PSS1E	550	0	550	Angola
Albany	Westerlo				211.77	W177-2	PEM/SS1E	65	0	65	Arnot
Albany	Westerlo	212.37	PFO1	210	212.37	W178-3	PSS1E	50	30	20	Angola
Albany	Westerlo	213.15	PFO1	50							
Albany	Westerlo	213.59	PFO1	630	213.59	W179-1	PFO1E	300	300	0	Tuller

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Albany	Westerlo				214.85	W180-1	PEM1E	50	50	0	Burdett
Greene	Greenville				215.81		PSS1E	90	40	50	Arnot
Greene	Greenville				215.97		PEM/SS1E	100	10	90	Lordstown
Greene	Greenville				216.36	W182-4	PSS1E/EM1E	150	150	0	Arnot
Greene	Greenville	216.80	PFO1	50							
Greene	Greenville				217.09	W182-5	PEM1E	25	0	25	Fluvaquent
Greene	Greenville				217.28	W182-2	PSS1E	70	0	70	Tuller
Greene	Greenville				217.42	W182-1	PEM1E	25	0	25	Tuller
Greene	Greenville				217.62	W183-2	PEM1E	120	120	0	Tuller
Greene	Greenville	218.25	PF01	50							
Greene	Greenville				218.65	W184-2	PFO1E	75	75	0	Lyons
Greene	Greenville				218.72	W184-1	PFO1E	35	0	35	Lyons
Greene	N. Baltimore	219.03	PFO1	210	218.95	W185-1	PSS1E	100	0	100	Valois
Greene	Coxsackie				220.47	W185-3	PSS/FO1E	25	0	25	Arnot/Lordstown
Greene	Coxsackie				220.60	W185-2	PEM1E	70	0	70	Arnot/Lordstown
Greene	Coxsackie				221.91	W186-1	PFO1E	60	0	60	Carlisle
Greene	Coxsackie	222.25	PFO1	730							
Greene	Coxsackie				222.53	W187-2	PEM/FO1E	75	75	0	Arnot
Greene	Coxsackie				222.60	W187-1	PFO3E	300	0	300	Arnot
Greene	Coxsackie	223.50	PFO1	370							
Greene	Coxsackie				223.98	W188-1	PSS1E	90	0	90	Arnot
Greene	Coxsackie				224.38	W189-1	PSS1E	25	25	0	Fluvaquent
Greene	Coxsackie	224.45	PFO1	50							
Greene	Coxsackie				224.47	W189-2	PFO/SS1E	60	60	0	Fluvaquent
Greene	Coxsackie				224.52	W189-3	PSS1E	30	30	0	Arnot
Greene	Coxsackie				224.68	W189-4	PFO/SS1E	70	70	0	Arnot
Greene	Coxsackie				225.26	W190-2	PSS1E	120	0	120	Madalin
Greene	Athens	225.55	PSS1/EM	210							
Greene	Athens				225.57		PEM/SS1E	110	110	0	Madalin
Greene	Athens				225.81	W191-8	PFO4E	15	15	0	Fluvaquent
Greene	Athens				225.85	W190-3	PSS1E	75	75	0	Volusia
Greene	Athens				226.55	W191-7	PSS/FO1E	45	0	45	Madalin
Greene	Athens				226.73	W191-6	PSS1E	110	110	0	Madalin
Greene	Athens				226.84	W191-5	PSS1E	15	0	15	Tuller
Greene	Athens				226.88	W191-4	PEM/SS/FO1H	85	0	85	Tuller
Greene	Athens	226.76	PFO1	790	226.90	W191-1	PSS1E	75	75	0	Tuller
Greene	Athens				226.94	W191-3	PEM/SS1E	70	70	0	Farmington
Greene	Athens				226.96	W191-2	PSS1E	25	25	0	Farmington
Greene	Athens				227.58	W193-1	PFO1E	60	0	60	Rinebeck
Greene	Athens	227.85	PFO1	260	227.88	W193-2	PSS/FO1E	100	100	0	Rinebeck
Greene	Athens				227.91	W193-3	PSS1E	31	21	10	Wayland
Greene	Athens				227.94	W193-4	PSS1E	120	120	0	Wayland
Greene	Athens				228.23	W194-3	PSS1E	45	45	0	Madalin
Greene	Athens				228.64	W194-1	PSS1E	30	30	0	Canandaigua
Greene	Athens	228.99	PSS1	730	228.99	W195-1	PEM/SS1E	155	155	0	Rhinebeck

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Greene	Athens	229.64	PFO/SS1	1050	229.64	W196-9	PEM1E	800	800	0	Madalin
Greene	Athens				229.91	W196-8	PSS/FO1E	125	125	0	Rhinebeck
Greene	Athens				230.08	W196-2	PFO1E	75	75	0	Valois
Greene	Athens				230.15	W196-3	PSS1E	40	40	0	Fluvaquent
Greene	Athens				230.27	W196-4	PEM1E	40	40	0	Fluvaquent
Greene	Athens				230.49	W196-5	PFO/SS1E	120	50	70	Madalin
Greene	Athens				230.55	W196-6	PFO1E	110	50	60	Madalin
Greene	Athens				231.15	W196-7	PFO/SS1E	45	45	0	Rhinebeck
Greene	Athens	231.55	PFO1	260	231.55	W197-1	PSS/FO1E	260	120	140	Medisaprist
Greene	Athens	231.63	PSS1/EM	1790	231.63	W197-2	PFO/SS1J/EM	1650	1650	0	Medisaprist
Greene	Athens	231.95	ROWH	2640							
Columbia	Greensport	232.98	PSS1	730	232.98	W199-1	PEM/FO1G	650	650	0	Limerick
Columbia	Greensport	233.20	PSS1	1050							
Columbia	Greensport				233.60	W199-2	PEM1E	450	0	450	Canandaigua
Columbia	Greensport				233.96	W199-3	PEM1E	70	35	35	Fluvaquent
Columbia	Greensport	235.20	PFO1	50	235.20		PFO1	50	0	50	Niagara
Columbia	Livingston	236.92	PFO1	2790	236.86		PFO1	800	800	0	Raynham
Columbia	Livingston				238.28	W203-1	PFO1E	380	200	180	Canandaigua
Columbia	Livingston				238.55	W203-2	PFO1E	125	125	0	Canandaigua
Columbia	Livingston	238.89	PSS1	370							
Columbia	Livingston	238.97	PFO1	310							
Columbia	Livingston				239.02		PSS/FO1E	850	850	0	Alden
Columbia	Livingston				239.43	W204-2	PFO1E	240	100	140	Alden
Columbia	Livingston				239.53	W205-1	PEM1E	10	10	0	Alden
Columbia	Livingston	240.63	PFO1	1050	240.64	W206-1	PFO1,4H	600	0	600	Canandaigua
Columbia	Livingston	243.00	PFO1	150	243.00		PFO1E	100	100	0	Fluvaquent
Columbia	Livingston				244.42		PEM/SS1E	400	0	400	Fluvaquent
Columbia	Livingston	245.00	PFO1	210	244.96		PFO1	100	100	0	Fluvaquent
Dutchess	Milan	247.90	PFO1	310	247.90	W214-1	PFO1E	45	0	45	Fluvaquent
Dutchess	Milan				248.21	W214-2	PSS/FO1E	55	55	0	Wayland
Dutchess	Milan				251.16	W217-2	PFO1E	80	80	0	Nassau
Dutchess	Milan				251.76	W217-3	PEM1E	60	60	0	Stissing
Dutchess	Milan				251.81	W217-1	PSS1E	240	240	0	Stissing
Dutchess	Milan				251.93	W218-1	PSS/EM1E	225	225	0	Stissing
Dutchess	Milan				252.37	W218-2	PSS1E	110	20	90	Fluvaquent
Dutchess	Milan				253.09	W218-3	PFO1E	40	40	0	Stissing
Dutchess	Milan				254.32	W220-2	PSS/EM1E	15	15	0	Nassua
Dutchess	Milan				254.88	W220-1	PEM/SS/FO1E	150	0	150	Stissing
Dutchess	Milan	255.47	PFO1	50	255.47	W221-1					Fluvaquent
Dutchess	Milan	256.00	PSS1	1050							
Dutchess	Clinton	257.60	PFO1	150	257.64		PFO1E	80	80	0	Wayland
Dutchess	Milan				257.64	W222-2	PFO/SS1E	380	380	0	Wayland
Dutchess	Clinton	257.82	PFO1	1260	257.82		PFO1E	400	400	0	Wayland
Dutchess	Clinton				258.84		PFO1E	200	0	200	Stattsburg
Dutchess	Clinton				259.15		PSS1E	130	0	130	Alluvial

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Dutchess	Clinton				260.58		PFO1E	65	30	35	Fluvaquent
Dutchess	Clinton	261.50	PFO1	310							
Dutchess	Clinton	261.75	PFO1	520							
Dutchess	Clinton				261.80	W227-3	PFO1E	35	0	35	Muck
Dutchess	Clinton				261.88	W227-1	PFO1/EM1/SS	1430	400	1030	Muck
Dutchess	Clinton	262.50	PFO1	470							
Dutchess	Pleasant Vly	265.45	PFO1	100	265.42		PFO1	100	100	0	Fluvaquent
Dutchess	Pleasant Vly	266.25	PFO1	50	266.25		PFO1	50	50	0	Fluvaquent
Dutchess	Pleasant Vly	266.38	PFO1	50	266.38		PFO1	50	50	0	Fluvaquent
Dutchess	Pleasant Vly	267.12	PSS1	100	267.12		PSS1E	250	0	250	Fluvaquent
Dutchess	Pleasant Vly				269.31		PFO1E	50	50	0	Fluvaquent
Dutchess	Pleasant Vly	269.69	PFO1	370							
Dutchess	Pleasant Vly				269.73	W233-7	PFO1E	180	180	0	Fluvaquent
Dutchess	Pleasant Vly	269.90	PFO1	840							
Dutchess	Pleasant Vly	270.09	PSS1	210							
Dutchess	Pleasant Vly				270.10	W233-6	PFO/SS1H	800	800	0	Fluvaquent
Dutchess	Pleasant Vly				270.58	W233-1	PSS/FO1E	200	200	0	Fluvaquent
Dutchess	LaGrange				270.96	W233-4	PFO1E	25	25	0	Muck
Dutchess	LaGrange				271.04	W233-2	PFO/EM1H	50	50	0	Fluvaquent
Dutchess	LaGrange				271.12	W233-3	PFO1,4H	10	10	0	Muck
Dutchess	LaGrange				271.29	W233-5	PFO1,4H	235	0	235	Muck
Dutchess	LaGrange				271.66		PFO1	450	450	0	Fluvaquent
Dutchess	LaGrange				271.95		PFO1	100	100	0	Saco
Dutchess	LaGrange				272.20		PFO1	100	100	0	Saco
Dutchess	Union Vale	275.75	PFO1	260	275.75		PFO1	250	250	0	Saco
Dutchess	Union Vale	276.99	PFO/SS1	370	276.99		PFO1	450	450	0	Saco
Dutchess	Dover	279.87	PFO1	50							
Dutchess	Dover				281.70		PSS1	50	0	50	Wayland
Dutchess	Dover				281.90		PFO1	100	100	0	Lyons
Dutchess	Dover				282.40		PFO1	400	400	0	Lyons
Dutchess	Dover	284.22	ROWH	50							
Dutchess	Dover	285.25	ROWH	50							
Dutchess	Dover				285.60		PSS1	150	150	0	Fluvaquent
Dutchess	Dover	286.30	PFO1	50	286.30		PFO1	50	50	0	Fluvaquent
Dutchess	Dover	286.58	PSS1	370	286.58		PSS1	350	350	0	Wayland
Fairfield	Sherman				286.85		PFO1E	350	150	200	Ridg/Leics/Whit
Fairfield	Sherman	287.90	PEME	400	287.55		PEME	1300	1300	0	Raypol/Saco
Litchfield	New Milford				288.50		PFO1	1200	1200	0	Leicester/Whitman
Litchfield	New Milford				288.75		PFO1	300	300	0	Leicester
Litchfield	New Milford				289.05	W60-26/32	PFO/SS	50	50	0	Massena
Litchfield	New Milford				289.09	W60-20/25	PSS	30	30	0	Massena
Litchfield	New Milford				289.13	W60-16/19	PEM	20	20	0	Massena
Litchfield	New Milford	289.15	PSS1/EME	50							
Litchfield	New Milford				289.40		PSS1/EME	50	50	0	non hydric
Litchfield	New Milford				289.48		PFO/SS1E	50	50	0	non hydric

Litchfield	New Milford				289.54	W61-4/6	PFO/SS	20	20	0	Limerick
Litchfield	New Milford	289.87	PFO1E	50							
Litchfield	New Milford				290.05		PFO1	100	50	50	Ridgebury
Litchfield	New Milford				290.11	W62-1/8	PFO1E	60	60	0	Massena
Litchfield	New Milford				290.45		PFO1	150	100	50	Leic/Ridg/Whit
Litchfield	New Milford				290.55		PFO1	300	100	200	Leic/Ridg/Whit
Litchfield	New Milford				290.72	W62-9/19	PFO1E	60	60	0	Massena
Litchfield	New Milford				290.75	W62-23/31	PFO1E	70	70	0	Massena
Litchfield	New Milford	291.66	PFO/SS1E	50	291.50		PFO1	300	300	0	Limerick
Litchfield	New Milford	292.95	PFO1E	50	292.97		PFO1E	50	50	0	non hydric
Litchfield	New Milford				294.87		PEME	250	0	250	Raynham
Litchfield	New Milford				295.00		PFO1	300	300	0	Raynham
Litchfield	New Milford	297.01	PEME	50	297.00		PFO1	250	250	0	Alluvial Land
Litchfield	New Milford				297.16		Golf Course	0	0	0	Raynham(drained)
Litchfield	New Milford	297.27	POWH	50	297.27		POWH	0	0	0	Water hazard
Litchfield	New Milford				297.30		Golf Course	0	0	0	Raynham(drained)
Litchfield	New Milford	297.51	R2OWH	420	297.44		R2OWH	50	50	0	Still River
Litchfield	New Milford				297.50		PFO/SS	100	100	0	Saco
Litchfield	New Milford	297.69	POWH	100							
Litchfield	New Milford				297.80		PEME	50	0	50	Wareham
Litchfield	New Milford				297.95		PEME	100	0	100	Wareham
Litchfield	New Milford				298.05		PEME	250	250	0	Wareham
Litchfield	New Milford				298.45		PEME/PFO	2700	2100	600	Wareham
Litchfield	New Milford	298.47	POWH	210							
Litchfield	New Milford	298.68	POWH	210							
Fairfield	Brookfield				299.05		PFO/SS	200	200	0	Walpole
Fairfield	Brookfield				299.10	W63-327/338	PFO/SS	50	50	0	Fredon
Fairfield	Brookfield				299.20		PEM/SS	400	100	300	Walpole
Fairfield	Brookfield				299.40	W63-290	PEM/SS	80	80	0	Massena/Aquents
Fairfield	Brookfield				299.45	W63-279/289	PEM/SS	50	50	0	Pootatuck
Fairfield	Brookfield				300.00		PSS/EM	2300	2300	0	Walpole
Fairfield	Brookfield				300.50		PSS/EM	700	700	0	Raypol
Fairfield	Brookfield				300.53	W63-1/13	PFO/SS	150	150	0	Fredon
Fairfield	Brookfield				300.58	W63-14/39	PSS/EM/OW	500	500	0	Fredon/Fluvaquents
Fairfield	Brookfield				300.67		PSS/EM	300	300	0	Raypol
Fairfield	Brookfield				300.71	W63-40/49	PFO/SS	20	20	0	Fluvaquents
Fairfield	Brookfield				300.73	W63-50/64	PEM/SS	200	200	0	Fredon
Fairfield	Brookfield				300.87	W63-65/85	PSS/EM	250	250	0	Aquents/Fluvaquents
Fairfield	Brookfield				300.98	W63-86/90	PEM/SS	100	100	0	Aquents
Fairfield	Brookfield				301.10		PFO1	1700	1700	0	Walpole
Fairfield	Brookfield				301.13	W63-339/377	PFO1	100	100	0	Massena
Fairfield	Brookfield				301.22	W63-378	PFO1	1200	1200	0	Fredon/Sun
Fairfield	Brookfield				301.46	W63-137/145	R45B1,4	10	10	0	Nonhydric
Fairfield	Brookfield				301.53	W63-129/136	R45B1,4	20	20	0	Nonhydric
Fairfield	Brookfield	301.56	PFO1E	50	301.54		PFO1	450	450	0	Raypol

Fairfield	Brookfield				301.59	W63-120/128	R45B1,4	5	5	0	Nonhydric
Fairfield	Brookfield				301.66		PFO1	1300	1300	0	Raypol
Fairfield	Brookfield				301.72	W-63-99/119	PFO1	250	250	0	Aquents/Rippo
Fairfield	Brookfield				301.85	W63-420/450	PFO1	350	150	200	Aquents/Rippo
Fairfield	Brookfield	302.11	PFO1E	50							
Fairfield	Brookfield	302.41	PFO1E	520							
Fairfield	Brookfield				302.33		PFO1	1550	1550	0	Raypol
Fairfield	Brookfield	302.51	PSS1F	260							
Fairfield	Brookfield				302.80		PSS/EM	250	250	0	Walpole
Fairfield	Brookfield				304.07	W63-152/173	PSS	40	40	0	Rippowana
Fairfield	Brookfield				304.25	W63-146/151	PFLAX	650	650	0	Aquents
Fairfield	Brookfield				304.60	W63-206/215	PFO1	250	250	0	Palms
Fairfield	Brookfield				304.62		PFO1	400	400	0	Ridg/Leic/Whit
Fairfield	Brookfield	304.86	PFO1E	50	304.72		PFO1	75	75	0	Ridg/Leic/Whit
Fairfield	Brookfield				304.86	W63-174/199	PFO1	780	0	780	Woodbridge
Fairfield	Brookfield	305.09	PFO1E	50	305.10		PFO1	1000	200	800	Ridgebury
Fairfield	Brookfield				305.15	W63-216/233	PFO1	40	40	0	Pootatuck
Fairfield	Brookfield	305.26	PFO1E	520							
Fairfield	Brookfield	305.40	POWH	260							
Fairfield	Brookfield				305.45		PEME	50	50	0	non hydric
Fairfield	Brookfield	305.60	POWH	50							
Fairfield	Newtown	306.16	PEME	50	306.07		PEME	1100	1100	0	Ridgebury
Fairfield	Newtown	306.18	PEME	630	306.32		PEME	150	150	0	Ridgebury
Fairfield	Newtown	306.30	PFO1E	420	306.42		PFO/EM	600	400	200	Scarboro
Fairfield	Newtown	306.48	R2OWH	50							
Fairfield	Newtown	306.68	PSS1/EM	150							
Fairfield	Newtown				306.82		PFO/SS	150	150	0	Ridg/Leic/Whit
Fairfield	Newtown				307.00		PFO1	300	300	0	Scarboro
Fairfield	Newtown	307.19	POWH	100							
Fairfield	Newtown				307.22		PFO1	800	800	0	Scarboro/Adrian
Fairfield	Newtown	308.11	PSS1/EME	50	308.11		PFO1	50	50	0	non hydric
Fairfield	Newtown	308.20	PEME	100							
Fairfield	Newtown				308.47		PFO1E	50	50	0	non hydric
Fairfield	Newtown	308.48	PSS1/EME	100							
Fairfield	Newtown	308.68	PSS1/EME	150							
Fairfield	Newtown				308.69		PFO1	650	650	0	Scarboro
Fairfield	Newtown				310.22		PFO1	150	150	0	Leicester
Fairfield	Newtown				310.50		PFO1	250	250	0	Leicester
Fairfield	Newtown	311.19	R2OWH	50	311.16		R2OWH	250	200	50	Saco/Scarboro
Fairfield	Newtown	311.33	POWH	100							
Fairfield	Newtown	311.44	PEME	50							
Fairfield	Newtown	312.54	PFO1E	50	312.54		PFO1E	150	150	0	Scarboro
Fairfield	Newtown	312.72	PSS1/EME	50							
Fairfield	Newtown	312.76	PEME	100							
Fairfield	Newtown				312.95		PFO1	200	200	0	Ridg/Leic/Whit

DELINEATION OF FEDERAL JURISDICTIONAL WETLANDS ALONG IGTS

Fairfield	Newtown	313.08	PSS1E	260	313.08		PFO1	150	150	0	Ridg/Leic/Whit
Fairfield	Newtown	313.40	PFO1E	50	313.40		PFO1	700	0	700	Ridg/Leic/Whit
Fairfield	Newtown	313.98	PFO1E	50	314.00		PFO1	500	500	0	Ridg/Leic/Whit
Fairfield	Newtown	314.17	PSS1E	50							
Fairfield	Newtown	314.96	PFO1E	50	314.95		PFO1	150	150	0	Ridg/Leic/Whit
Fairfield	Newtown	315.05	PFO1E	50							
Fairfield	Newtown	315.16	PFO1E	50	315.15		PFO1	250	150	100	Ridg/Leic/Whit
Fairfield	Newtown	315.50	PFO1E	210							
Fairfield	Newtown				316.10		PFO1E	200	200	0	Ridg/Leic/Whit
Fairfield	Newtown				316.32		PFO1E	100	100	0	Ridg/Leic/Whit
Fairfield	Newtown	316.93	R3OWH	50	316.95		R3OWH	50	50	0	
Fairfield	Monroe				317.65		PFO1E	250	250	0	Ridg/Leic/Whit
Fairfield	Monroe	318.22	PFO1E	100	318.40		PFO1E	100	50	50	non hydric
Fairfield	Monroe	318.30	PFO4E	50	318.50		PFO1	50	50	0	non hydric
Fairfield	Monroe	318.85	PFO1E	50	318.85		PFO1E	50	50	0	non hydric
Fairfield	Monroe	318.97	PFO1E	50	318.97		PFO1E	50	50	0	non hydric
Fairfield	Monroe	319.29	PFO1E	630	319.28		PFO1E	3050	3050	0	Rayp/Ridg/Adrian
Fairfield	Shelton	319.60	PFO1E	580	319.80		PFO1E	400	400	0	Rayp/Ridg/Adrian
Fairfield	Shelton	320.03	PFO1E	2210	319.96		PFO1E	3900	3900	0	Rd/Lc/Wh/Sc/Ad
Fairfield	Shelton	320.26	PFO1/EME	50							
Fairfield	Shelton	320.76	PSS1/EME	50	320.73		PFO1E	50	50	0	non hydric
Fairfield	Shelton				321.15		PFO/SS/EM	250	250	0	Scarboro/Walpole
Fairfield	Shelton				321.42		PFO1	100	100	0	Ridg/Leic/Whit
Fairfield	Shelton	321.66	PFO1E	50	321.65		PFO1	50	50	0	non hydric
Fairfield	Shelton	321.81	PFO1E	50	321.85		PFO1/SS	150	150	0	Ridg/Leic/Whit
Fairfield	Shelton	322.07	PFO1E	50	322.07		PFO/SS	200	200	0	Ridg/Leic/Whit
Fairfield	Shelton	322.14	PFO1E	50	322.13		PFO1E	50	50	0	non hydric
Fairfield	Shelton	322.56	PSS1	50	322.55		PSS/EM	600	250	350	Ridg/Leic/Whit
Fairfield	Shelton	323.14	PFO1E	150	323.15		PFO1	100	100	0	Ridg/Leic/Whit
Fairfield	Shelton				323.65		PFO1	150	150	0	Ridg/Leic/Whit
Fairfield	Shelton	323.76	PFO1E	50	323.70		PFO1/SS	250	250	0	Ridg/Leic/Whit
Fairfield	Shelton				324.00		PFO/SS1E	100	100	0	non hydric
Fairfield	Shelton	324.10	PSS1F	150	324.10		PFO1	100	100	0	Ridg/Leic/Whit
Fairfield	Shelton	324.25	PSS1/EME	50	324.25		PFO1	150	0	150	Ridg/Leic/Whit
Fairfield	Shelton	324.42	PFO1E	50							
Fairfield	Shelton	324.53	PFO1E	210	324.47		PFO1	1100	1100	0	Adrian/Carlisle
Fairfield	Shelton				324.65		PFO1	400	400	0	Ridg/Leic/Whit
Fairfield	Shelton	324.83	PFO1E	100							
Fairfield	Shelton				324.95		PSS/EM	50	0	50	Adrian
Fairfield	Shelton	324.87	PFO1E	520							
Fairfield	Shelton	325.20	PFO1E	100	325.15		PFO1	200	200	0	Ridg/Leic/Whit
Fairfield	Shelton	325.35	PFO1E	50	325.30		PFO1	50	50	0	non hydric
Fairfield	Shelton	325.40	PFO1E	1050	325.36		PFO1	150	150	0	Ridg/Leic/Whit
Fairfield	Shelton				325.62		PFO1	100	50	50	Ridg/Leic/Whit
Fairfield	Shelton	325.77	PFO1E	50							

DELINEATION OF FEDERAL JURISDICTIONAL WETLANDS ALONG IGTS

Fairfield	Shelton	326.27	PEME	50	326.24		PFO1	100	100	0	Ridg/Leic/Whit
Fairfield	Shelton				326.52		PFO/EM	100	100	0	Ridg/Leic/Whit
Fairfield	Shelton	326.84	PFO1E	50	326.86		PFO1	50	50	0	non hydric
Fairfield	Shelton	327.29	R3OWH	50	327.25		R3OWH	50	50	0	non hydric
Fairfield	Stratford				328.00		PFO1	300	300	0	Carlisle
Fairfield	Stratford				328.27		PFO/SS	300	0	300	Carlisle
Fairfield	Stratford	328.39	PFO1E	150	328.38		PFO1E	75	75	0	non hydric
Fairfield	Stratford	328.49	PFO1E	470	328.50		PFO/SS/EM	600	600	0	Carlisle
Fairfield	Stratford				329.00		PFO	50	0	50	Adrian
Fairfield	Stratford	329.15	PFO/SS1E	300	329.15		PFO	100	100	0	Adrian
Fairfield	Stratford	329.48	PFO/SS1E	50							
Fairfield	Stratford	329.60	PFO1E	50	329.40		PFO1E	50	50	0	non hydric
Fairfield	Stratford	329.70	PFO1E	50	329.70		PFO1E	300	250	50	Ridg/Leic/Whit
Fairfield	Stratford	329.85	PSS1E	260							
Fairfield	Stratford				329.92		PFO	200	200	0	Leicester
Fairfield	Stratford				330.30		PSS/EM/FO	250	100	150	Ridg/Leic/Whit/Ad
Fairfield	Stratford				330.50		PFO	100	100	0	Ridg/Leic/Whit
Fairfield	Stratford	330.52	PFO1E	50	330.60		PFO/SS	200	200	0	Ridg/Leic/Whit
Fairfield	Stratford	330.91	E1OWL3	730	330.92		E1OWL3	700	700	0	Housatonic River
New Haven	Milford				331.90		PFO	1900	1900	0	Raypol
New Haven	Milford				331.00	W68-1	PFLAX	550	550	0	Aquic
New Haven	Milford	332.10	PFO1E	50							
New Haven	Milford				332.50		PSS/EM	200	0	200	Raypol (filled)
New Haven	Milford	332.62	PFO4ex	50	332.60		PFO/SS	200	0	200	Adrian/Palms
New Haven	Milford	332.64	PSS1/5F	1050							
New Haven	Milford	333.55	PSS5/OWH	100	333.52		PSS/OW	150	150	0	Walpole
New Haven	Milford	333.99	PEMEx	470							
New Haven	Milford	334.19	E2BBP	100							
New Haven	Milford	334.21	E2FLN	520							
Suffolk	Huntington	360.15	[redacted]2FLM	790							
Suffolk	Huntington	360.30	E2FLN	580							
Suffolk	Huntington	360.41	E2BBP	100	360.41		E2BBP	100	100	0	Beaches
Suffolk	Huntington	360.50	PEM1F	630	360.50		PEME	0	0	0	Tidal Marsh
Suffolk	Huntington	360.62	E1OWLx	950							
Suffolk	Huntington	360.80	PEMWF/POWZ	520							
Suffolk	Huntington	361.25	PFO/SS1A	730	361.23	WLI1-1	PFO/SS	800	800	0	Berryland
Suffolk	Huntington	361.39	PEM5E	370	361.39	WLI1-2	PEME	400	400	0	Berryland
Suffolk	Smithtown	365.37	PFLAx	370							
Suffolk	Smithtown	365.75	PFLAx	630							
Total				114075				152843	113883	38960	

Key to Wetlands Table

Crossing Width A-

The amount of wetland crossed as determined using Federal procedures (onsite and/or offsite).

Crossing Width B-

The amount of wetland crossed as determined above taking into account minor alignment refinements to avoid or minimize wetland crossings.

* Wetlands without wetland ID# were delineated using offisite procedures.

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